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Nancy A. Pachana  
*Editor*

# Encyclopedia of Geropsychology

 Springer

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# Encyclopedia of Geropsychology

With 148 Figures and 100 Tables

 Springer

*Editor*

Nancy A. Pachana  
The University of Queensland  
Brisbane, QLD, Australia

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## Foreword: The Frontiers of Geropsychology

In *Undaunted Courage*, the late historian, Stephen Ambrose (1996) chronicled the challenges faced by Meriwether Lewis as he set out on the Lewis and Clark expedition. He and his band of explorers were emissaries of President Thomas Jefferson, seeking a northwest passage and exploring the western territories of a young nation. Throughout the expedition, Lewis sent scouts back to President Jefferson, reporting on the landscape and the flora and fauna of the young nation's largely unknown territory.

In many ways, the entries of this comprehensive encyclopedia are like Lewis's scouts reports, only the territory being described is at once universal and immediately personal: the psychology of aging. Although concerns about aging and the latter part of the life span can be traced to the ancient Greeks (Abeles 2015), G. Stanley Hall's (1922) *Senescence: The Last Half of Life* marked psychology's formal acknowledgment of the relevance of later life for psychology and psychology's relevance for understanding that portion of the lifespan. In the almost one hundred years since Hall's publication, the field of geropsychology has expanded tremendously in breadth and depth.

When someone asks "What does psychology have to do with aging?" there are simple and complex answers. The simple answer: "Lots!"

Paul Baltes (1987, 1997; Baltes et al. 2007) outlined a more complex answer. He suggested that psychological models of adult development and aging had to account for four key elements: multidirectionality; plasticity; the historical context; and multiple causation. Baltes reminded us that aging includes both growth and decline (a lesson highlighted in Freund et al. (2016) entry). He also highlighted that compensatory skills can be learned to accommodate changing abilities. (Kuhn and Lindenberger (2016) would later differentiate plasticity from flexibility, a differentiation found in Wahl and Wettstein's (2016) contribution to this encyclopedia.) Baltes's emphasis on the historical context was a reminder of the influence of cohort and historical moments on individuals and societies, a theme echoed in Kennison, et al.'s (2016) entry. Finally, by highlighting multiple causation, Baltes focused our attention on the interaction between and among influences that shape the development and expression of psychological functioning, including biological and psychological elements (again, reflected in Riffin and Loeckenhoff's (2016) entry).

Editor Nancy Pachana is to be commended for the range of talented scholars and important topics she has assembled in this encyclopedia; both

are impressive. Together, hundreds of scholars have shared their expertise to report on the state of the art in geropsychology in the early twenty-first century. Along the way, they have demonstrated range of methods (observational and experimental), design (longitudinal, cross-sectional, cohort-sequential), and measurement strategies (intensive, repeated measures; single time surveys; etc.) Highlighting both inter- and intra-individual differences in rates and processes of aging, they have expanded Baltes's outline and helped us answer three important questions: *How do psychological processes affect aging? How does aging affect psychological processes? How do the contexts of individuals affect the interaction of aging and psychological processes?*

Throughout the encyclopedia, various psychological processes are highlighted for their impact on the processes of aging: for example, resilience (Staudinger and Greve 2016); the positivity effect (Reed and Carstensen 2016); social cognition (von Hippel et al. 2016); and social exchange (Wan and Antonucci 2016).

Conversely, some have focused on the impact of aging processes on psychological and social functions: for example, cognition (Schaie and Willis 2016); executive function (Karbach and Unger 2016); attention (Ruthruff and Lien 2016); memory (Zimprich and Kurtz 2016); decision-making (Mata 2016); personality (Helmes 2016; Diehl and Brother 2016); sexuality (Connaughton and McCabe 2016); and sexual orientation (Kimmel 2016).

At the same time, the contributors have focused on the impact of various contexts on the interplay of aging and psychological functioning: for example, social policy (Lum and Wong 2016); advocacy (DiGilio and Elmore 2016); technology (Lane et al. 2016); and work and retirement (Desmette and Fraccaroli 2016).

This encyclopedia will be a resource for many audiences: students of geropsychology who seek an introduction to the methods and findings of the field; teachers and scholars who seek insightful summaries of the complex literatures encompassed by geropsychology; and clinicians who are involved in translational research and service, extending the implications of basic research paradigms into the lives of aging adults, their families, and their communities.

The encyclopedia's "scholar scouts" of the territory of aging, who include the very capable associate editors of this text, have given us detailed reports on both the process and substance of exploring the territory. They allow us to understand aging in new ways and to see new prospects and new challenges in a territory we thought we knew. They also remind us of how far we have come in understanding the very human experience of aging. Savor the journey.

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Michael A. Smyer  
Professor of Psychology  
Bucknell University

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## Preface

Geropsychology is a relatively young field which spans a range of topic areas covering a subject of perennial interest to researchers, practitioners, and lay persons – namely, the psychology of later life. This book aims to thoroughly cover the main subtopics within the field of geropsychology, including historical and theoretical perspectives, clinical and applied geropsychology, cognitive and experimental geropsychology, geriatric neuropsychology and neuroscience, social geropsychology, health perspectives in geropsychology, work and retirement in later life, and longitudinal aging and centenarian studies.

The aim is to cover all aspects of geropsychology in a comprehensive way, with an international perspective and attention paid to both established and emerging topics in the field. The illustrations and high quality of the images, as well as the breadth of topics covered, will be key to its success.

In recent years, several advances in theory, measurement, and application across these many areas within geropsychology, coupled with innovations in domains ranging from genetics to social media and the Internet, have dramatically expanded the field. Simultaneously, the aging of the population in the developing and the developed world has enlivened interest in geropsychology. I hope that this book serves as a timely addition to the growing body of literature on this topic.

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Nancy A. Pachana



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The *Encyclopedia of Geropsychology* has been a truly international collaborative effort. I would like to thank all of the wonderful researchers across the globe who contributed entries to this work, my subsection editors for their diligence and creativity, the patience and support of all of the staff at Springer, the encouragement of my colleagues, friends, and family, and the love and support of my husband Tim.



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## About the Editor



**Nancy A. Pachana**

School of Psychology  
The University of Queensland  
Brisbane, Queensland, Australia

**Dr. Nancy A. Pachana** is a clinical geropsychologist, neuropsychologist, and professor in the School of Psychology at The University of Queensland and is codirector of the UQ Ageing Mind Initiative, providing a focal point for clinical, translational aging-related research at UQ. She has an international reputation in the area of geriatric mental health, particularly with her research on late-life anxiety disorders. She is codeveloper of the Geriatric Anxiety Inventory, a published brief self-report inventory in wide clinical and research use globally, translated into over two dozen languages. She has published over 200 peer-reviewed articles, book chapters, and books on various topics in the field of aging and has been awarded more than \$20 million in competitive research funding, primarily in the areas of dementia and mental health in later life. Her research is well cited and she maintains a clear international focus in her collaborations and research interests, which include anxiety in later life, psychological interventions for those with Parkinson's disease, nursing home interventions, driving safety and dementia, teaching and learning in psychogeriatrics, and mental health policy and aging.

Nancy was elected a Fellow of the Academy of Social Sciences in Australia in 2014. She is also a Fellow of the Australian Psychological Society and is the recipient of numerous prizes and awards, including an Australian Davos Connection Future Summit Leadership Award, for leadership on aging issues in Australia. She serves on the editorial boards of several journals, including the *Journals of Gerontology: Psychological Science*, one of the top two journals in the world for publication of research in the science of the psychology of aging. Originally from the United States, Nancy was awarded her A.B. from Princeton University in 1987, her Ph.D. from Case Western Reserve University in 1992, and completed postdoctoral fellowships at the Neuropsychiatric Institute at UCLA, Los Angeles, and the Palo Alto Veterans Medical Center, Palo Alto, California. She is an avid bird watcher and photographer and an intrepid traveller.



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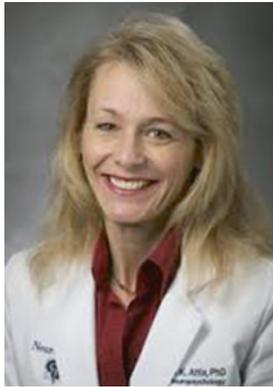
## Section Editors



**Christopher Hertzog** School of Psychology, Georgia Institute of Technology, Atlanta, USA



**Marcia G. Ory** Health Promotion and Community Health Sciences, School of Public Health, Texas A&M Health Science Center Texas, Texas, USA



**Deborah Attix** Duke Clinical Neuropsychology Service, Department of Psychiatry and Behavioral Sciences, Department of Neurology, Duke University Medical Center, Durham, USA



**Bob G. Knight** School of Psychology and Counseling, University of Southern Queensland, Toowoomba, Queensland, Australia



**Óscar Ribeiro** Institute of Biomedical Sciences Abel Salazar of the University of Porto (UNIFAI & CINTESIS), University of Aveiro, Department of Education and Psychology, Higher Institute of Social Service of Porto, Porto, Portugal



**Mônica Yassuda** Gerontology and Neurology Departments, University of São Paulo, São Paulo, Brazil



**Daniela S. Jopp** University of Lausanne, Institute of Psychology, Géopolis, Lausanne, Switzerland



**Hannes Zacher** School of Management, Queensland University of Technology, Brisbane, Queensland, Australia



**Catherine Haslam** School of Psychology, The University of Queensland, Queensland, Australia



**Helene Fung** Chinese University of Hong Kong, Shatin, Hong Kong



**Fiona Alpass** School of Psychology, Massey University, Palmerston North, New Zealand



**Sherry Ann Beaudreau** Psychiatry Service, Sierra Pacific Mental Illness Research Education and Clinical Center (MIRECC), VA Palo Alto Health Care System, Palo Alto, CA, USA

Department of Psychiatry and Behavioral Sciences, Stanford University School of Medicine, Stanford, CA, USA

School of Psychology, University of Queensland, Brisbane, Australia



**Matthias Kliegel** Department of Psychology, University of Geneva, Geneva, Switzerland

Center for the Interdisciplinary Study of Gerontology and Vulnerability, University of Geneva, Geneva, Switzerland

Swiss National Center of Competences in Research LIVES—Overcoming vulnerability: life course perspectives, University of Lausanne Géopolis building, Lausanne, Switzerland



**Chris Stephens** School of Psychology, Massey University, Palmerston North, New Zealand



**Hans-Werner Wahl** Department of Psychological Aging Research, University of Heidelberg, Hauptstrasse, Heidelberg, Germany



**Colette Browning** RDNS Institute, Victoria, Australia

---

## Contributors

**Marja Aartsen** NOVA Norwegian Social Research, Oslo and Akershus University College, Oslo, Norway

**Phillip L. Ackerman** School of Psychology, Georgia Institute of Technology, Atlanta, GA, USA

**Stéphane Adam** Psychology of Aging Unit, University of Liège, Liège, Belgium

**Janne Adolf** Max Planck Institute for Human Development, Berlin, Germany

**Rosa Marina Afonso** Department of Psychology and Education, University of Beira Interior, Covilhã, Portugal

UNIFAI-ICBAS and CINTESIS, University of Porto, Porto, Portugal

**Kozma Ahacic** Centre for Epidemiology and Community Medicine, Health Care Services, Stockholm County Council, Stockholm, Sweden

Department of Public Health Sciences, Karolinska Institutet, Stockholm, Sweden

**Andrew J. Ahrendt** University of Nevada, Reno, NV, USA

**Julia Alber** Center for Health Behavior Research, Perelman School of Medicine, University of Pennsylvania, Philadelphia, PA, USA

**Carolyn Aldwin** Center for Healthy Aging Research, Oregon State University, Corvallis, OR, USA

**Jason C. Allaire** Department of Psychology, North Carolina State University, Raleigh-Durham, NC, USA

**Mathias Allemand** Department of Psychology and University Research Priority Program “Dynamics of Healthy Aging,” University of Zurich, Zurich, Switzerland

**Joanne Allen** School of Psychology, Massey University, Palmerston North, New Zealand

**Rebecca S. Allen** The University of Alabama, Tuscaloosa, AL, USA

**Philip A. Allen** Adult Development and Aging Psychology, The University of Akron, Akron, OH, USA

**Fiona Alpass** School of Psychology, Massey University, Palmerston North, New Zealand

**Lori J. P. Altmann** Department of Speech, Language, and Hearing Sciences, University of Florida, Gainesville, FL, USA

**Karen Andersen-Ranberg** Epidemiology, Biostatistics and Biodemography, Institute of Public Health, University of Southern Denmark, Odense C, Denmark

**Kaarin J. Anstey** Centre for Research on Ageing Health and Wellbeing, Research School of Population Health, The Australian National University, Canberra, ACT, Australia

**Toni C. Antonucci** University of Michigan, Ann Arbor, MI, USA

**Ivan Aprahamian** University of São Paulo, São Paulo, SP, Brazil  
Jundiaí Faculty of Medicine, Jundiaí, Brazil

**Yasumichi Arai** Center for Supercentenarian Research, Keio University School of Medicine, Tokyo, Japan

**Lia Araújo** UNIFAI and CINTESIS, ICBAS – University of Porto, Porto, Portugal  
Portugal and Polytechnic Institute, ESEV and CI&DETS, Viseu, Portugal

**Neal M. Ashkanasy** UQ Business School, The University of Queensland, Brisbane, QLD, Australia

**Martin Asperholm** Division of Psychology, Department of Clinical Neuroscience, Karolinska Institutet, Stockholm, Sweden

**Catherine R. Ayers** Department of Psychiatry, University of California, San Diego School of Medicine, San Diego, CA, USA

Research Service, VA San Diego Healthcare System, San Diego, CA, USA

**Christian Bakker** Department of Primary and Community Care: Center for Family Medicine, Geriatric Care and Public Health, Radboud University Medical Center, Nijmegen, The Netherlands

Florence, Mariahoeve, Center for Specialized Care in Young-Onset Dementia, Den Haag, The Netherlands

Radboud Alzheimer Center Nijmegen, Radboud University Medical Center, Nijmegen, The Netherlands

**P. Matthijs Bal** School of Management, University of Bath, Bath, UK

**Andrés Losada Baltar** Department of Psychology, Universidad Rey Juan Carlos, Madrid, Spain

**James Banks** Institute for Fiscal Studies, London, UK  
School of Social Sciences, University of Manchester, Manchester, UK

**Fiona Kate Barlow** School of Applied Psychology and Menzies Health Institute Queensland, Griffith University, Brisbane, QLD, Australia

**Magdalena Bathen** Kassel, Germany

**Sarah Bauermeister** School of Psychology, Faculty of Medicine and Health, University of Leeds, Leeds, UK

**Christine Beanland** Royal District Nursing Service (RDNS) Institute, Melbourne, VIC, Australia

**Sherry A. Beaudreau** Department of Psychiatry and Behavioral Sciences, Stanford University School of Medicine, Stanford, CA, USA

Sierra Pacific Mental Illness Research Education and Clinical Center, VA Palo Alto Health Care System, Palo Alto, CA, USA

School of Psychology, The University of Queensland, Brisbane, QLD, Australia

**Terry A. Beehr** Central Michigan University, Mount Pleasant, MI, USA

**Margaret E. Beier** Department of Psychology, Rice University, Houston, TX, USA

**Raoul Bell** Heinrich Heine University Düsseldorf, Düsseldorf, Germany

**Sylvie Belleville** Psychology Department, Research Centre, Institut Universitaire de Gériatrie de Montréal, Montréal, QC, Canada

**Vern L. Bengtson** School of Social Work and Edward R. Roybal Institute on Aging, University of Southern California, Los Angeles, CA, USA

**Kate M. Bennett** Department of Psychological Sciences, University of Liverpool, Liverpool, UK

**Karianne Berg** Norwegian University of Science and Technology, Trondheim, Norway

**Marilena Bertolino** Department of Psychology, University de Nice Sophia Antipolis, Nice, France

**Maxime Bertoux** Norwich Medical School, University of East Anglia, Norfolk, UK

Department of Clinical Neurosciences, University of Cambridge, Cambridge, UK

**Sunil S. Bhar** Department of Psychological Sciences, Swinburne University of Technology H99, Hawthorn, VIC, Australia

**Allison A. M. Bielak** Department of Human Development and Family Studies, Colorado State University, Fort Collins, CO, USA

**Simon Biggs** School of Social and Political Sciences, University of Melbourne, Melbourne, VIC, Australia

---

Magdalena Bathen: deceased.

**Erin D. Bigler** Department of Psychology and Neuroscience Center, Brigham Young University, Provo, UT, USA

Department of Psychiatry, University of Utah, Salt Lake City, UT, USA

**Kira S. Birditt** Institute for Social Research, University of Michigan, Ann Arbor, MI, USA

**Alex J. Bishop** Human Development and Family Science Department, Oklahoma State University, Stillwater, OK, USA

**Patrizia S. Bisiacchi** Department of General Psychology, University of Padova, Padova, Italy

**Pär Bjälkebring** Department of Psychology, University of Gothenburg, Gothenburg, Sweden

**Kathrin Boerner** Department of Gerontology, John W. McCormack Graduate School of Policy and Global Studies, University of Massachusetts Boston, Boston, MA, USA

**Walter R. Boot** Institute for Successful Longevity, Department of Psychology, Florida State University, Tallahassee, FL, USA

**Sarah Borish** University of California, San Francisco, San Francisco, CA, USA

**Axel Börsch-Supan** Munich Center for the Economics of Aging, Max-Planck-Institute for Social Law and Social Policy, Munich, Germany

**Tom Borza** Centre for Old Age Psychiatric Research, Innlandet Hospital Trust, Oslo, Norway

**Nicholas T. Bott** Sierra Pacific Mental Illness Research, Education, and Clinical Centers (MIRECC), VA Palo Alto Health Care System, Palo Alto, CA, USA

Pacific Graduate School of Psychology–Stanford PsyD Consortium, Stanford, CA, USA

**Catherine E. Bowen** Wittgenstein Centre for Demography and Global Human Capital (IIASA, VID/ÖAW, WU), Vienna Institute of Demography/Austrian Academy of Sciences, Vienna, Austria

**S. K. Bradshaw** Heart of England Foundation Trust, Birmingham, UK

**Caitlin Brandenburg** The University of Queensland, St Lucia, Brisbane, QLD, Australia

**Daniela Brandão** UNIFAI and CINTESIS, ICBAS – University of Porto, Porto, Portugal

**Jochen Brandtstädter** Department of Psychology, University of Trier, Trier, Germany

**Tina Braun** Life-Span Developmental Psychology Laboratory, University of Leipzig, Leipzig, Germany

**Mary Breheny** School of Public Health, Massey University, Palmerston North, New Zealand

**Dawn Brooker** University of Worcester Association for Dementia Studies, Institute of Health and Society, University of Worcester, Worcester, UK

**Allyson Brothers** Department of Human Development and Family Studies, Colorado State University, Fort Collins, CO, USA

**Colette J. Browning** Royal District Nursing Service, St Kilda, VIC, Australia

International Primary Health Care Research Institute, Shenzhen, China

Monash University, Melbourne, VIC, Australia

**Halina Bruce** Department of Psychology, Center for Research in Human Development, Concordia University, Montréal, QC, Canada

**Hannah Brunet** University of California, San Francisco, San Francisco, CA, USA

**Axel Buchner** Heinrich Heine University Düsseldorf, Düsseldorf, Germany

**Romola S. Bucks** School of Psychology, University of Western Australia, Crawley, WA, Australia

**Gina Bufton** School of Psychology, J. S. Coon Building, MC0170, Georgia Institute of Technology, Atlanta, GA, USA

**Adam Bulley** School of Psychology, The University of Queensland, St Lucia, QLD, Australia

**David Bunce** School of Psychology, Faculty of Medicine and Health, University of Leeds, Leeds, UK

**Céline N. Bürki** University Center for Medicine of Aging, Felix Platter-Hospital, Basel, Switzerland

Department of Radiology, University of Basel Hospital, Basel, Switzerland

**Anne Burmeister** Leuphana University of Lüneburg, Lüneburg, Germany

**Katherine Burn** Department of Medicine - Royal Melbourne Hospital, The University of Melbourne, Parkville, VIC, Australia

**Richard A. Burns** Centre for Research on Ageing Health and Wellbeing, Research School of Population Health, The Australian National University, Canberra, ACT, Australia

**Nicola W. Burton** School of Human Movement and Nutrition Sciences, The University of Queensland, St Lucia, Brisbane, QLD, Australia

**Alissa M. Butts** Mayo Clinic, Rochester, MN, USA

Department of Psychiatry and Psychology, Division of Neurocognitive Disorders, Mayo Clinic, Rochester, MN, USA

**Lisa Calvano** West Chester University of Pennsylvania, West Chester, PA, USA

**Julieta Camino** Faculty of Medicine and Health Sciences, University of East Anglia, Norwich, UK

**Katherine Campbell** Clinical Psychologist, Department of Psychiatry, The University of Melbourne, Parkville, VIC, Australia

**M. Teresa Cardador** School of Labor and Employment Relations, University of Illinois, Urbana-Champaign, IL, USA

**Keisha D. Carden** The University of Alabama, Tuscaloosa, AL, USA

**Brian D. Carpenter** Department of Psychology, Washington University, St. Louis, MO, USA

**Laura L. Carstensen** Department of Psychology, Stanford University, Stanford, CA, USA

**Maria Teresa Carthery-Goulart** Center of Mathematics, Computing and Cognition (CMCC), Federal University of ABC (UFABC), São Bernardo do Campo, São Paulo, Brazil

Cognitive and Behavioral Neurology Unit, Hospital das Clínicas, School of Medicine, University of São Paulo (HCFMUSP), São Paulo, São Paulo, Brazil

**Lindsey A. Cary** Department of Psychology, University of Toronto, Toronto, ON, Canada

**Erin L. Cassidy-Eagle** Research and Evaluation, ETR, Scotts Valley, CA, USA

Department of Psychiatry and Behavioral Sciences, Stanford University School of Medicine, Stanford, CA, USA

**Casey Cavanagh** Department of Psychology, West Virginia University, Morgantown, WV, USA

**Jane H. Cerhan** Department of Psychiatry and Psychology, Division of Neurocognitive Disorders, Mayo Clinic, Rochester, MN, USA

**Eric Cerino** School of Social and Behavioral Health Sciences, College of Public Health and Human Sciences, Oregon State University, Corvallis, OR, USA

**Veronique S. Chachay** School of Human Movement and Nutrition Sciences, School of Medicine, The University of Queensland, Brisbane, QLD, Australia

Faculty of Health and Behavioural Sciences, The University of Queensland, Brisbane, QLD, Australia

**Dorey S. Chaffee** Department of Psychology, Colorado State University, Fort Collins, CO, USA

**Michael C. H. Chan** Department of Psychology, Chinese University of Hong Kong, Hong Kong, China

- Anna Chapman** RDNS Institute, Melbourne, VIC, Australia  
School of Primary Health Care, Monash University, Melbourne, VIC, Australia
- Neena L. Chappell** Centre on Aging and Department of Sociology, University of Victoria, Victoria, BC, Canada
- Susan T. Charles** Department of Psychology and Social Behavior, University of California, Irvine, CA, USA
- Neil Charness** Institute for Successful Longevity, Department of Psychology, Florida State University, Tallahassee, FL, USA
- Alison L. Chasteen** Department of Psychology, University of Toronto, Toronto, ON, Canada
- Xinxin Chen** Institute of Social Science Survey, Peking University, Beijing, China
- Sheung-Tak Cheng** Department of Health and Physical Education, The Education University of Hong Kong, Hong Kong, China  
Department of Clinical Psychology, Norwich Medical School, University of East Anglia, Norwich, UK
- Monique M. Cherrier** Department of Psychiatry and Behavioral Sciences, University of Washington School of Medicine, Seattle, WA, USA
- Karen Siu-Lan Cheung** Sau Po Centre on Ageing and Department of Social Work and Social Administration, The University of Hong Kong, Hong Kong, China
- Adrienne K. Chong** University of Nevada, Reno, NV, USA
- Kysa M. Christie** Boston VA Healthcare System, Boston, MA, USA
- Christina Chrysohoou** 1st Cardiology Clinic University of Athens, Athens, Greece  
Research Institute for Longevity and Prevention of Geriatric Diseases, Athens, Greece
- Lindy Clemson** Ageing, Work and Health Research Unit, Faculty of Health Sciences, The University of Sydney, Lidcombe, NSW, Australia
- Jeanette N. Cleveland** Department of Psychology, College of Natural Sciences, Colorado State University, Fort Collins, CO, USA
- Simon Cloutier** Psychology Department, Research Centre, Institut Universitaire de Gériatrie de Montréal, Montréal, QC, Canada
- Giorgia Cona** Department of Neuroscience, University of Padova, Padova, Italy
- Casey Conaboy** Palo Alto University, Palo Alto, CA, USA
- Catherine Connaughton** Institute for Health and Ageing, Australian Catholic University, Melbourne, VIC, Australia

**Kaitrin Conniff** Palo Alto University, Palo Alto, CA, USA

Veterans Affairs Palo Alto Health Care System, Palo Alto, CA, USA

**Sarah E. Cook** Duke University, Durham, NC, USA

**Joel Cooper** Princeton University, Princeton, NJ, USA

**Ashley D. Cooper** Central Michigan University, Mount Pleasant, MI, USA

**Laura Coopersmith** Palo Alto University, Palo Alto, CA, USA

**Nick Corriveau-Lecavalier** Psychology Department, Research Centre,  
Institut Universitaire de Gériatrie de Montréal, Montréal, QC, Canada

**John Crawford** Centre for Healthy Brain Ageing, University of New South  
Wales, Sydney, NSW, Australia

**Dimity A. Crisp** Faculty of Health, University of Canberra, Canberra, ACT,  
Australia

**Tegan Cruwys** School of Psychology, The University of Queensland,  
Brisbane, QLD, Australia

**Robert A. Cummins** Deakin University, Melbourne, VIC, Australia

**Sara J. Czaja** University of Miami Miller School of Medicine, Miami, FL, USA

**Catriona Daly** Centre for Healthy Brain Ageing, University of New South  
Wales, Sydney, NSW, Australia

**Marleen Damman** Netherlands Interdisciplinary Demographic Institute  
(NIDI-KNAW), The Hague, The Netherlands

University Medical Center Groningen, University of Groningen, Groningen,  
The Netherlands

**Tanya Dash** Centre de recherche, Institut universitaire de gériatrie de Mon-  
tréal, Montréal, QC, Canada

École d'orthophonie et d'audiologie, Faculté de médecine, Université de  
Montréal, QC, Canada

**Judith Davey** Institute for Governance and Policy Studies, Victoria Univer-  
sity of Wellington, Wellington, New Zealand

**Danielle K. Davis** University of Florida, Gainesville, FL, USA

**Liesbeth De Donder** Vrije Universiteit Brussel/University College Ghent,  
Brussels, Belgium

**Kiki M. M. De Jonge** University of Groningen, Groningen, The Netherlands

**Margarida Pedroso de Lima** Faculty of Psychology and Educational Sci-  
ences, University of Coimbra, Coimbra, Portugal

**Jonas Jardim de Paula** Faculdade de Ciências Médicas de Minas Gerais,  
Intituto Nacional de Ciência e Tecnologia em Medicina Molecular, Federal  
University of Minas Gerais, Belo Horizonte, Minas Gerais, Brazil

**Ans De Vos** Antwerp Management School, Antwerp, Belgium

University of Antwerp, Antwerp, Belgium

**Marjolein E. de Vugt** School for Mental Health and Neuroscience, Alzheimer Center Limburg, Maastricht University Medical Center, Maastricht, The Netherlands

**Nico De Witte** Vrije Universiteit Brussel/University College Ghent, Brussels, Belgium

University College, Ghent, Belgium

**Christina Degen** Section of Geriatric Psychiatry, Heidelberg University, Heidelberg, Germany

**Serhiy Dekhtyar** Division of Psychology, Department of Clinical Neuroscience, Karolinska Institutet, Stockholm, Sweden

**Marguerite DeLiema** Stanford Center on Longevity, Stanford University, Stanford, CA, USA

**Julia A. M. Delius** Center for Lifespan Psychology, Max Planck Institute for Human Development, Berlin, Germany

**Jürgen Deller** Institute of Strategic HR Management Research and Development (SMARD), Leuphana University of Lüneburg, Lüneburg, Germany

**Natalie L. Denburg** Department of Neurology, University of Iowa Carver College of Medicine, Iowa, IA, USA

**Christian J. Lalive d'Épinay** Faculty of Sciences of the Society, CIGEV, University of Geneva, Geneva, Switzerland

**Donatienne Desmette** Institute of Research in Psychological Sciences, Université catholique de Louvain, Louvain-la-Neuve, Belgium

**Manfred Diehl** Department of Human Development and Family Studies, Colorado State University, Fort Collins, CO, USA

**Deborah A. DiGilio** American Psychological Association, Washington, DC, USA

**Josie Dixon** London School of Economics and Political Science, London, UK

**Friederike Doerwald** Department of Psychology, University of Groningen, Groningen, The Netherlands

**Marisa E. Domino** Gillings School of Global Public Health, University of North Carolina at Chapel Hill, Chapel Hill, NC, USA

**William H. Dow** School of Public Health, University of California, Berkeley, CA, USA

**Colleen Doyle** Australian Catholic University and Villa Maria Catholic Homes, Melbourne, VIC, Australia

National Ageing Research Institute, Melbourne, VIC, Australia

**Mary E. Dozier** San Diego State University/University of California, San Diego Joint Doctoral Program in Clinical Psychology, San Diego, CA, USA  
Research Service, VA San Diego Healthcare System, San Diego, CA, USA

**Brian Draper** School of Psychiatry, University of NSW, Sydney, NSW, Australia

Academic Department of Old Age Psychiatry, Prince of Wales Hospital, Randwick, NSW, Australia

**Natália Duarte** UNIFAI and CINTESIS, ICBAS – University of Porto, Porto, Portugal

**Patrick Dulin** Department of Psychology, University of Alaska, Anchorage, AK, USA

**Sandra Düzel** Center for Lifespan Psychology, Max Planck Institute for Human Development, Berlin, Germany

**Kaitlyn Dykes** Sidney Kimmel Medical College, Thomas Jefferson University, Philadelphia, PA, USA

**Catherine Earl** Federation Business School, Federation University Australia, Churchill, VIC, Australia

**Joanne K. Earl** Flinders School of Business, Flinders University, Adelaide, SA, Australia

**Barry Edelstein** Department of Psychology, West Virginia University, Morgantown, WV, USA

**Rohan A. Elliott** Monash University Centre for Medicine Use and Safety, Melbourne, VIC, Australia

Austin Health Pharmacy Department, Melbourne, VIC, Australia

**Michelle L. Ellis** School of Aging Studies, University of South Florida, Tampa, FL, USA

**Diane Elmore** Policy Program, UCLA-Duke University National Center for Child Traumatic Stress, Washington, DC, USA

**Tammy English** Washington University in St. Louis, St. Louis, MO, USA

**Alexandra Ernst** LEAD CNRS UMR 5022, Université de Bourgogne, Dijon, France

University of Burgundy, Dijon, France

**J. Kaci Fairchild** Sierra Pacific Mental Illness Research Education and Clinical Center, VA Palo Alto Health Care System, Stanford University School of Medicine, Palo Alto, CA, USA

**Yang Fang** Department of Psychology, The Chinese University of Hong Kong, Hong Kong, China

**Thomas J. Farrer** Department of Psychiatry and Behavioral Sciences, Duke University Medical Center, Durham, NC, USA

**Ulrike Fasbender** Department of Business and Management, Oxford Brookes University, Oxford, UK

**Joanne Feeney** The Irish Longitudinal Study on Ageing, Department of Medical Gerontology, Trinity College Dublin, Dublin, Ireland  
Centre for Public Health, Queen's University Belfast, Belfast, Northern Ireland, United Kingdom

**Lei Feng** Department of Psychological Medicine, Yong Loo Lin School of Medicine, National University of Singapore, Singapore, Singapore

**Qiushi Feng** Department of Sociology, National University of Singapore, Singapore, Singapore

**Daniela Figueiredo** School of Health Sciences, University of Aveiro, Aveiro, Portugal

Center for Health Technology and Services Research (CINTESIS.UA), Aveiro, Portugal

**Karen Fingerman** Human Development and Family Sciences, Population Research Center, The College of Liberal Arts, University of Texas-Austin, Austin, TX, USA

**Gwenith G. Fisher** Department of Psychology, Colorado State University, Fort Collins, CO, USA

**Jane E. Fisher** Department of Psychology/298, University of Nevada, Reno, NV, USA

**Amy Fiske** Department of Psychology, West Virginia University, Morgantown, WV, USA

**Emma Flanagan** Norwich Medical School, University of East Anglia, Norfolk, UK

**Matt Flynn** Centre for Research into the Older Workforce (CROW), Newcastle University, Newcastle upon Tyne, UK

**Kitty-Rose Foley** Department of Developmental Disability Neuropsychiatry, School of Psychiatry, University of New South Wales, Sydney, NSW, Australia

Cooperative Research Centre for Living with Autism (Autism CRC), Long Pocket, Brisbane, QLD, Australia

**Evgenia Folts** Department of Pediatrics, University of Iowa Carver College of Medicine, Iowa, IA, USA

**Simon Forstmeier** Faculty II – Department of Education Studies and Psychology, Developmental Psychology, University of Siegen, Siegen, Germany

**Franco Fraccaroli** Department of Psychology and Cognitive Science, University of Trento, Trento, Italy

**Susan Freiberg** Institute for Work and Health of the German Social Accident Insurance, Dresden, Germany

**Alexandra M. Freund** Department of Psychology, University of Zurich, Zurich, Switzerland

University Research Priority Program Dynamics of Healthy Aging, University of Zurich, Zurich, Switzerland

**Helene H. Fung** Department of Psychology, The Chinese University of Hong Kong, Hong Kong, China

**Rebecca Funken** Institute of Strategic HR Management, Leuphana University of Lüneburg, Lüneburg, Germany

**Trude Furunes** Norwegian School of Hotel Management, University of Stavanger, Stavanger, Norway

**Alyssa A. Gamlado** School of Aging Studies, University of South Florida, Tampa, FL, USA

**Christina Garrison-Diehn** Geriatric Research, Education, and Clinical Center, VA Palo Alto Health Care System, Palo Alto, CA, USA

Department of Psychiatry and Behavioral Science, Stanford University School of Medicine, Stanford, CA, USA

**Daniela Garten** Department of Politics and Public Administration, University of Konstanz, Konstanz, Germany

**Joseph E. Gaugler** School of Nursing, University of Minnesota, Minneapolis, MN, USA

**Zvi D. Gellis** School of Social Policy and Practice, Center for Mental Health and Aging, University of Pennsylvania, Philadelphia, PA, USA

**Debby L. Gerritsen** Department of Primary and Community Care: Center for Family Medicine, Geriatric Care and Public Health, Radboud University Medical Center, Nijmegen, The Netherlands

Radboud Alzheimer Center Nijmegen, Radboud University Medical Center, Nijmegen, The Netherlands

**Denis Gerstorf** Institute of Psychology, Humboldt University, Berlin, Germany

**Michael M. Gielnik** Institute of Strategic HR Management, Leuphana University of Lüneburg, Lüneburg, Germany

**Jacqueline M. Gilberto** Department of Psychology, Rice University, Houston, TX, USA

**Karen Glanz** Perelman School of Medicine, University of Pennsylvania, Philadelphia, PA, USA

**Lisa H. Glassman** VA San Diego Healthcare System, San Diego, CA, USA  
University of California, San Diego, San Diego, CA, USA

**Judith Glück** Department of Psychology, Alpen-Adria-Universität Klagenfurt, Klagenfurt, Austria

**Rowena Gomez** Pacific Graduate School of Psychology, Palo Alto University, Palo Alto, CA, USA

**Yasuyuki Gondo** Department of Clinical Thanatology and Geriatric Behavioral Science, Osaka University Graduate School of Human Sciences, Suita, Japan

**Xianmin Gong** Department of Psychology, The Chinese University of Hong Kong, Hong Kong, China

**B. Heath Gordon** Mental Health, G.V. (Sonny) Montgomery Veterans Affairs Medical Center, Jackson, MS, USA

**Christine E. Gould** Department of Psychiatry and Behavioral Sciences, Stanford University School of Medicine, Stanford, CA, USA

Geriatric Research, Education, and Clinical Center (GRECC), VA Palo Alto Health Care System, Palo Alto, CA, USA

**Alan J. Gow** Department of Psychology, Heriot-Watt University, Edinburgh, UK

**Jeffrey J. Gregg** Durham Veterans Affairs Medical Center, Durham, NC, USA

**Julie Gretler** Palo Alto University, Palo Alto, CA, USA

**Werner Greve** Hildesheim University, Hildesheim, Germany

**Catherine Grotz** Psychology of Aging Unit, University of Liège, Liège, Belgium

**Danan Gu** United Nations Population Division, New York, NY, USA

**Angela H. Gutchess** Brandeis University, Waltham, MA, USA

**Thomas Hadjistavropoulos** Department of Psychology and Centre on Aging and Health, University of Regina, Regina, SK, Canada

**Joachim Hallmayer** Department of Psychiatry and Behavioral Sciences, Stanford University School of Medicine, Stanford University, Stanford, CA, USA

Sierra Pacific Mental Illness Research Education and Clinical Center (MIRECC), VA Palo Alto Health Care System, Palo Alto, CA, USA

**Madison E. Hanscom** Department of Psychology, College of Natural Sciences, Colorado State University, Fort Collins, CO, USA

**Nathan Hantke** Sierra Pacific Mental Illness Research, Education, and Clinical Centers (MIRECC), VA Palo Alto Health Care System, Palo Alto, CA, USA

Department of Psychiatry and Behavioral Sciences, Stanford University School of Medicine, Stanford, CA, USA

**Lynn Hasher** Department of Psychology, University of Toronto, Toronto, ON, USA

Rotman Research Institute, Baycrest, Toronto, ON, USA

**Hideki Hashimoto** Department of Health and Social Behavior, The University of Tokyo School of Public Health, Bunkyo, Tokyo, Japan

**S. Alexander Haslam** School of Psychology, The University of Queensland, Brisbane, QLD, Australia

**Catherine Haslam** School of Psychology, The University of Queensland, Brisbane, QLD, Australia

**Louise C. Hawkey** Academic Research Centers, NORC at the University of Chicago, Chicago, IL, USA

**Tyler Haydell** Stanford University, Stanford, CA, USA

**Becky I. Haynes** School of Psychology, Faculty of Medicine and Health, University of Leeds, Leeds, UK

**Jutta Heckhausen** Department of Psychology and Social Behavior, School of Social Ecology, University of California, Irvine, CA, USA

**Chyrisse Heine** College of Science Health and Engineering, Department of Community and Clinical Allied Health, School of Allied Health, La Trobe University, Melbourne, VIC, Australia

**Edward Helmes** Department of Psychology, James Cook University, Townsville, QLD, Australia

**Gert-Jan Hendriks** Pro Persona Institute for Integrated Mental Health Care, Centre for Anxiety Disorders “Overwaal,” Nijmegen, The Netherlands

Radboud University Nijmegen, Behavioural Science Institute, Nijmegen, The Netherlands

Radboud University Medical Centre, Department of Psychiatry, Nijmegen, The Netherlands

**Julie D. Henry** School of Psychology, The University of Queensland, Brisbane, QLD, Australia

**Noreen Heraty** Kemmy Business School, University of Limerick, Limerick, Ireland

**Agneta Herlitz** Division of Psychology, Department of Clinical Neuroscience, Karolinska Institutet, Stockholm, Sweden

**Guido Hertel** Department of Psychology, University of Münster, Münster, Germany

**Christopher Hertzog** School of Psychology, Georgia Institute of Technology, Atlanta, GA, USA

**Thomas M. Hess** Department of Psychology, North Carolina State University, Raleigh, NC, USA

**Stephanie Hicks** Psychology Department, Fordham University, Bronx, NY, USA

**Patrick L. Hill** Department of Psychology, Carleton University, Ottawa, ON, Canada

**Thomas Hinault** Aix-Marseille Université and CNRS, Marseille, France

**Gregory A. Hinrichsen** Department of Geriatrics and Palliative Medicine, Icahn School of Medicine at Mount Sinai, New York, NY, USA

**Courtney von Hippel** School of Psychology, The University of Queensland, Brisbane, QLD, Australia

**William von Hippel** School of Psychology, The University of Queensland, Brisbane, QLD, Australia

**Nobuyoshi Hirose** Center for Supercentenarian Research, Keio University School of Medicine, Tokyo, Japan

**Andreas Hirschi** Institute of Psychology, University of Bern, Bern, Switzerland

**Rayna Hirst** Palo Alto University, Palo Alto, CA, USA

**Henry C. Y. Ho** School of Public Health, University of Hong Kong, Hong Kong, China

**Lieve Hoeyberghs** University College, Ghent, Belgium

**Joanna Hong** Department of Psychology and Social Behavior, University of California, Irvine, CA, USA

**Karen Hooker** School of Social and Behavioral Health Sciences, College of Public Health and Human Sciences, Oregon State University, Corvallis, OR, USA

**Christiane A. Hoppmann** Department of Psychology, University of British Columbia, Vancouver, BC, Canada

**Michael Hornberger** Norwich Medical School, University of East Anglia, Norfolk, UK

**Lena-Alyeska M. Huebner** Department of Psychology, College of Natural Sciences, Colorado State University, Fort Collins, CO, USA

**J. W. Terri Huh** VA Palo Alto Health Care System, Palo Alto, CA, USA

Stanford University School of Medicine, Stanford, CA, USA

**Martijn Huisman** NOVA Norwegian Social Research, Oslo and Akershus University College, Oslo, Norway

EMGO Institute for Health and Care Research, VU University Medical Center, Amsterdam, The Netherlands

Department of Epidemiology and Biostatistics, VU University Medical Center, Amsterdam, The Netherlands

Department of Psychiatry, VU University Medical Center, Amsterdam, The Netherlands

**Mary Lee Hummert** Communication Studies Department, University of Kansas, Lawrence, KS, USA

**Ye In (Jane) Hwang** Department of Developmental Disability Neuropsychiatry, School of Psychiatry, University of New South Wales, Sydney, NSW, Australia

Cooperative Research Centre for Living with Autism (Autism CRC), Long Pocket, Brisbane, QLD, Australia

**Maria Iankilevitch** Department of Psychology, University of Toronto, Toronto, ON, Canada

**Kazunori Ikebe** Department of Prosthodontics, Gerodontology and Oral Rehabilitation, Osaka University Graduate School of Dentistry, Suita, Japan

**Hiroki Inagaki** Research Team for Promoting Independence of the Elderly, Tokyo Metropolitan Institute of Gerontology, Tokyo, Japan

**Jennifer Inauen** Department of Psychology, Columbia University, New York, NY, USA

**Derek M. Isaacowitz** Department of Psychology, Northeastern University, Boston, MA, USA

**Yoshiko Lily Ishioka** Tokyo Metropolitan Institute of Gerontology, Tokyo, Japan

Graduate School of Science and Technology, Keio University, Yokohama, Japan

**Tatsuro Ishizaki** Tokyo Metropolitan Geriatric Hospital and Institute of Gerontology, Tokyo, Japan

**Shelly L. Jackson** Institute of Law, Psychiatry and Public Policy, University of Virginia, Charlottesville, VA, USA

**Lori E. James** Psychology Department, University of Colorado, Colorado Springs, CO, USA

**Soong-Nang Jang** Red Cross College of Nursing, Chung-Ang University, Seoul, South Korea

**Jolanda Jetten** School of Psychology, The University of Queensland, Brisbane, QLD, Australia

**Garima Jhingon** Pacific Graduate School of Psychology, Palo Alto University, Palo Alto, CA, USA

**Da Jiang** Department of Psychology, Chinese University of Hong Kong, Hong Kong, China

**Yves Joannette** Centre de recherche, Institut universitaire de gériatrie de Montréal, Montréal, QC, Canada

**Boo Johansson** Department of Psychology, University of Gothenburg, Gothenburg, Sweden

**Mary Ann Johnson** Department of Foods and Nutrition, University of Georgia, Athens, GA, USA

**Claire S. Johnston** Institute of Psychology, University of Bern, Bern, Switzerland

**Daniela S. Jopp** Institute of Psychology, University of Lausanne, Lausanne, Switzerland

Swiss Centre of Competence in Research LIVES, Overcoming Vulnerability: Life Course Perspectives, Lausanne, Switzerland

**Josh Jordan** Department of Psychiatry and Behavioral Sciences, Stanford University School of Medicine, Stanford University, Stanford, CA, USA

California School of Professional Psychology, Alliant International University, Alhambra, CA, USA

**Bruce Judd** Australian School of Architecture and Design, Built Environment, University of New South Wales, Sydney, NSW, Australia

**Seojung Jung** Fordham University, New York, NY, USA

**Franziska Jungmann** Institute for Work, Organizational and Social Psychology, University of Technology, Dresden, Dresden, Germany

**Elise K. Kalokerinos** Department of Psychology and Educational Sciences, KU Leuven, Leuven, Flemish Brabant, Belgium

**Kei Kamide** Department of Health Science and Department of Geriatric Medicine and Nephrology, Osaka University, Graduate School of Medicine, Suita, Japan

**Ruth Kanfer** School of Psychology, J. S. Coon Building, MC0170, Georgia Institute of Technology, Atlanta, GA, USA

**Julia Karbach** Goethe-University Frankfurt, Frankfurt, Germany

**Michele J. Karel** Mental Health Services, Department of Veterans Affairs  
Central Office, Washington, DC, USA

**Julia E. Kasl-Godley** Palo Alto VA Health Care System, Palo Alto, CA,  
USA

**Joseph S. Kay** Department of Psychology and Social Behavior, School of  
Social Ecology, University of California, Irvine, CA, USA

**Hal Kendig** Australian National University, Canberra, ACT, Australia

**Robert F. Kennison** Department of Psychology, California State University,  
Los Angeles, CA, USA

**Rose Anne Kenny** The Irish Longitudinal Study on Ageing, Department of  
Medical Gerontology, Trinity College Dublin, Dublin, Ireland

Mercer's Institute for Successful Ageing, St. James' Hospital, Dublin, Ireland

**Ngairé Kerse** Department of General Practice and Primary Health Care,  
School of Population Health, The University of Auckland, Auckland, New  
Zealand

**Eva-Marie Kessler** MSB Medical School Berlin Hochschule für Gesundheit  
und Medizin Calandrellistrasse, , Berlin, Germany

**Kim M. Kiely** Centre for Research on Ageing Health and Wellbeing,  
Research School of Population Health, The Australian National University,  
Canberra, ACT, Australia

**Douglas C. Kimmel** City College, City University of New York, New York,  
NY, USA

**David B. King** IRMACS Centre, Simon Fraser University, Burnaby, BC,  
Canada

**Susan Kirkland** Departments of Community Health and Epidemiology and  
Medicine, Dalhousie University, Dalhousie, NS, Canada

**Douglas A. Kleiber** University of Georgia College of Education, Athens,  
GA, USA

**Matthias Kliegel** Department of Psychology, University of Geneva, Geneve  
4, Switzerland

Center for Interdisciplinary Study of Gerontology and Vulnerability (CIGEV),  
University of Geneva, Carouge, Switzerland

**Andrzej Klimczuk** Warsaw School of Economics, Warsaw, Poland

**Michaela Knecht** Department of Psychology, University of Zurich, Zurich,  
Switzerland

University Research Priority Program Dynamics of Healthy Aging, University  
of Zurich, Zurich, Switzerland

**Jamie E. Knight** Department of Psychology, University of Victoria, Victoria, BC, Canada

**Dorien Kooij** Department of Human Resource Studies, Tilburg University, Tilburg, Netherlands

**Raymond T. C. M. Koopmans** Department of Primary and Community Care: Center for Family Medicine, Geriatric Care and Public Health, Radboud University Medical Center, Nijmegen, The Netherlands

Radboud Alzheimer Center Nijmegen, Radboud University Medical Center, Nijmegen, The Netherlands

Joachim en Anna, Center for specialized geriatric care, Nijmegen, The Netherlands

**Anna E. Kornadt** Department of Psychology, Bielefeld University, Bielefeld, Germany

**Pavel Kozik** Department of Psychology, University of British Columbia, Vancouver, BC, Canada

**Abigail Kramer** Sierra Pacific Mental Illness Research, Education, and Clinical Centers (MIRECC), VA Palo Alto Health Care System, Palo Alto, CA, USA

Pacific Graduate School of Psychology, Palo Alto University, Palo Alto, CA, USA

**Joel Kramer** University of California, San Francisco, San Francisco, CA, USA

**Ralf T. Krampe** Brain and Cognition, University of Leuven, Leuven, Belgium

**Jutta Kray** Saarland University, Saarbrücken, Germany

Department of Psychology, Saarland University, Saarbrücken, Saarland, Germany

**Kamini Krishnan** Mayo Clinic, Rochester, MN, USA

**Andreas Kruse** Institute of Gerontology, University of Heidelberg, Heidelberg, Germany

**Alexis Kuerbis** Silberman School of Social Work, Hunter College of the City University of New York, New York, NY, USA

**Florian Kunze** Department of Politics and Public Administration, University of Konstanz, Konstanz, Germany

**Ute Kunzmann** Life-Span Developmental Psychology Laboratory, University of Leipzig, Leipzig, Germany

**Tanja Kurtz** University of Mainz, Mainz, Germany

**Dawn La** Palo Alto University/Pacific Graduate School of Psychology, Palo Alto, CA, USA

Sierra Pacific Mental Illness, Research Education and Clinical Centers at the Veterans Affairs Palo Alto Health Care System, Palo Alto, CA, USA

**Geoffrey Lane** Psychology Service, VA Palo Alto Healthcare System – Livermore Division, Livermore, CA, USA

**Douglas Warren Lane** Geriatrics and Extended Care Service, VA Puget Sound Healthcare System, Seattle, WA, USA

Department of Psychiatry, University of Washington, Seattle, WA, USA

**Frieder R. Lang** Institute of Psychogerontology, Friedrich-Alexander-University of Erlangen-Nürnberg, Nürnberg, Germany

**José Miguel Latorre Postigo** Department of Psychology, Faculty of Medicine, University of Castilla-La Mancha, Albacete, Spain

**Bobo Hi-Po Lau** Faculty of Social Sciences, The University of Hong Kong, Hong Kong, China

**Gary D. Laver** Psychology and Child Development Department, Cal Poly, San Luis Obispo, CA, USA

**Jennifer C. Lay** The University of British Columbia, Vancouver, BC, Canada

**George Lazaros** 1st Cardiology Clinic University of Athens, Athens, Greece  
Research Institute for Longevity and Prevention of Geriatric Diseases, Athens, Greece

**Malloy-Diniz Leandro Fernandes** Department of Mental Health, Instituto Nacional de Ciência e Tecnologia em Medicina Molecular, Federal University of Minas Gerais, Belo Horizonte, Minas Gerais, Brazil

**Shinduk Lee** Texas A&M Health Science Center, School of Public Health, College Station, TX, USA

**Yunhwan Lee** Department of Preventive Medicine and Public Health, Ajou University School of Medicine, Suwon, Republic of Korea

Institute on Aging, Ajou University Medical Center, Suwon, Republic of Korea

**Cik Yin Lee** Royal District Nursing Service (RDNS) Institute, Melbourne, VIC, Australia

Centre for Medicine Use and Safety, Monash University, Melbourne, VIC, Australia

**Patrick Lemaire** Aix-Marseille Université and CNRS, Marseille, France

**Shu-Chen Li** Department of Psychology Chair of Lifespan Developmental Neuroscience, TU Dresden, Dresden, Germany

Center for Lifespan Psychology, Max Planck Institute for Human Development, Berlin, Germany

**Karen Z.H. Li** Department of Psychology, Center for Research in Human Development, Concordia University, Montréal, QC, Canada

**Tianyuan Li** Department of Psychological Studies and Centre for Psychosocial Health, Hong Kong Institute of Education, Tai Po, New Territories, Hong Kong, China

**Mei-Ching Lien** School of Psychological Science, Oregon State University, Corvallis, OR, USA

**Ulman Lindenberger** Center for Lifespan Psychology, Max Planck Institute for Human Development, Berlin, Germany

**Victoria Liou-Johnson** University of California, San Francisco, CA, USA  
Sierra Pacific Mental Illness Research Education and Clinical Center, VA Palo Alto Health Care System, Palo Alto, CA, USA

**Shuang Liu** School of Communication and Arts, The University of Queensland, Brisbane, QLD, Australia

**Kimberly M. Livingstone** Department of Psychology, Northeastern University, Boston, MA, USA

**Vanessa M. Loaiza** University of Essex, Colchester, United Kingdom

**Ada Lo** The University of Queensland, St Lucia, QLD, Australia

**Corinna E. Löckenhoff** Department of Human Development, Cornell University, Ithaca, NY, USA

**Peggy Lockhart** Iowa State University, Ames, IA, USA

**Alexandra Lopes** Institute of Sociology, University of Porto, Porto, Portugal

**Andrés Losada-Baltar** Department of Psychology, Facultad de Ciencias de la Salud, Universidad Rey Juan Carlos, Madrid, Spain

**Katie Louwagie** School of Nursing, University of Minnesota, Minneapolis, MN, USA

**Martin Lövdén** Aging Research Center, Karolinska Institutet and Stockholm University, Stockholm, Sweden

**Judy Lowthian** School of Public Health and Preventive Medicine, Monash University, Melbourne, VIC, Australia

**Minjie Lu** Department of Psychology, The Chinese University of Hong Kong, Hong Kong, China

**John A. Lucas** Department of Psychiatry and Psychology, Mayo Clinic, Jacksonville, FL, USA

**Terry Lum** The University of Hong Kong, Hong Kong, China

**Angela Lunde** Mayo Clinic, Rochester, MN, USA

**Mary A. Luszcz** Flinders University, Adelaide, SA, Australia

**David Madden** Brain Imaging and Analysis Center, Duke University Medical Center, Durham, NC, USA

**Justin Marcus** Ozyegin University, Istanbul, Turkey

**Jennifer Margrett** Iowa State University, Ames, IA, USA

**Rodrigo Mariño** Oral Health Cooperative Research Centre, Melbourne Dental School, University of Melbourne, Melbourne, VIC, Australia

**María Márquez-González** Department of Biological and Health Psychology, Universidad Autónoma de Madrid, Madrid, Spain

**Donel M. Martin** Black Dog Institute, School of Psychiatry, University of New South Wales, Sydney, NSW, Australia

**Peter Martin** Iowa State University, Ames, IA, USA

**Yukie Masui** Tokyo Metropolitan Geriatric Hospital and Institute of Gerontology, Tokyo, Japan

**Rui Mata** University of Basel, Basel, Switzerland

**Karen A. Mather** Centre for Healthy Brain Ageing, University of New South Wales, Sydney, NSW, Australia

**Katey Matthews** CMIST, School of Social Sciences, University of Manchester, Manchester, UK

**Susanne Mayr** Heinrich Heine University Düsseldorf, Düsseldorf, Germany  
University of Passau, Passau, Germany

**Marita McCabe** Institute for Health and Ageing, Australian Catholic University, Melbourne, VIC, Australia

**Jean McCarthy** Kemmy Business School, University of Limerick, Limerick, Ireland

**Shawn M. McClintock** Division of Psychology, Department of Psychiatry, UT Southwestern Medical Center, Dallas, TX, USA

Division of Brain Stimulation and Neurophysiology, Department of Psychiatry and Behavioral Sciences, Duke University School of Medicine, Durham, NC, USA

**Michael Thomas McGann** School of Social and Political Sciences, University of Melbourne, Melbourne, VIC, Australia

**Judy McGregor** AUT University, Auckland, New Zealand

**Bernard McKenna** The University of Queensland, Brisbane, QLD, Australia

**Christopher McLoughlin** Federation Business School, Federation University Australia, Churchill, VIC, Australia

**Verena H. Menec** University of Manitoba, Winnipeg, MB, Canada

**Claudia Meyer** RDNS Institute, St Kilda, VIC, Australia

Centre for Health Communication and Participation, School of Psychology and Public Health, LaTrobe University, VIC, Australia

**Lisa Mieskowski** University of Alabama, Tuscaloosa, AL, USA

**Victoria Michalowski** Department of Psychology, University of British Columbia, Vancouver, BC, Canada

**Joany K. Millenaar** School for Mental Health and Neuroscience, Alzheimer Center Limburg, Maastricht University Medical Center, Maastricht, The Netherlands

**Brent Mills** Palo Alto University, Palo Alto, CA, USA

Veterans Affairs Palo Alto Health Care System, Palo Alto, CA, USA

Sierra Pacific Mental Illness Research Education and Clinical Center, VA Palo Alto Health Care System, Palo Alto, CA, USA

**Beyon Miloyan** Department of Mental Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, USA

**Encida Mioshi** Faculty of Medicine and Health Sciences, University of East Anglia, Norwich, UK

**Leander K. Mitchell** School of Psychology, The University of Queensland, Brisbane, QLD, Australia

**Sepideh Modrek** School of Medicine, Stanford University, Palo Alto, CA, USA

**Scott D. Moffat** Georgia Institute of Technology, Atlanta, GA, USA

**Darya Moghimi** Department of Psychology, University of Groningen, Groningen, The Netherlands

**Victor Molinari** School of Aging Studies, University of South Florida, Tampa, FL, USA

**Terri G. Monk** Department of Anesthesiology and Perioperative Medicine, University of Missouri-Columbia, Columbia, MO, USA

**Alison A. Moore** Division of Geriatric Medicine, David Geffen School of Medicine at UCLA, Los Angeles, CA, USA

**Caitlin S. Moore** Ryan Dolby Brain Health Center, California Pacific Medical Center Neurosciences Institute, San Francisco, CA, USA

**H. C. Moorey** Heart of England Foundation Trust, Birmingham, UK

**Lafaiete Guimarães Moreira** Universidade Fundação Mineira de Educação e Cultura - FUMEC, Belo Horizonte, Minas Gerais, Brazil

**Georgina Moreno** Department of Psychology, New York University, New York, NY, USA

**Mike Morgan** Oral Health Cooperative Research Centre, Melbourne Dental School, University of Melbourne, Melbourne, VIC, Australia

**Steven Morrison** School of Physical Therapy and Athletic Training, Old Dominion University, Norfolk, VA, USA

**Moyra E. Morthby** Centre for Research on Ageing, Health and Wellbeing, The Australian National University, Canberra, ACT, Australia

**Thomas A. Morton** Psychology, College of life and Environmental Sciences, University of Exeter, Exeter, UK

**Chris J.A. Moulin** LEAD CNRS UMR 5022, Université de Bourgogne, Dijon, France

University of Burgundy, Dijon, France

**Christopher Moulin** Laboratoire de Psychologie and Neurocognition (LPNC), CNRS-UMR 5105, University Grenoble Alpes, Grenoble, France

**Julia Muenchhoff** Centre for Healthy Brain Ageing, University of New South Wales, Sydney, NSW, Australia

**Andreas Müller** Institute for Occupational and Social Medicine, Medical Faculty, Düsseldorf University, Düsseldorf, Germany

**Jo Munro** Ageing, Work and Health Research Unit, Faculty of Health Sciences, The University of Sydney, Lidcombe, NSW, Australia

**Alexa M. Muratore** Sydney, NSW, Australia

**Marama Muru-Lanning** James Henare Research Centre, The University of Auckland, Auckland, New Zealand

**Reidar J. Mykletun** Molde University College, Molde, Norway

**Noemi Nagy** Institute of Psychology, University of Bern, Bern, Switzerland

**Christopher M. Napolitano** Department of Psychology, University of Zurich, Zurich, Switzerland

**Paul Nash** Centre for Innovative Ageing, Swansea University, Wales, UK

**James Nazroo** School of Social Sciences, University of Manchester, Manchester, UK

**Holly Nelson-Becker** Loyola University School of Social Work, Chicago, IL, USA

**Karl M. Newell** The University of Georgia, Athens, GA, USA

**Nicky J. Newton** Wilfrid Laurier University, Waterloo, ON, Canada

**MyNhi Nguyen** School of Psychology, The University of Queensland, Brisbane, QLD, Australia

**Victoria Nieborowska** Department of Psychology, Center for Research in Human Development, Concordia University, Montréal, QC, Canada

**Jonna Nilsson** Aging Research Center, Karolinska Institutet and Stockholm University, Stockholm, Sweden

**Ina Nitschke** Clinic for Gerodontology and Special Care Dentistry, University of Zurich, Zurich, Switzerland

**J. Farley Norman** Department of Psychological Sciences, Ogden College of Science and Engineering, Western Kentucky University, Bowling Green, KY, USA

**Thomas A. Norton** School of Psychology, The University of Queensland, Brisbane, QLD, Australia

**Nanna Notthoff** Institute of Psychology, Humboldt University, Berlin, Germany

**Klaus Oberauer** University of Zurich, Zurich, Switzerland

**Claire O'Callaghan** Behavioral and Clinical Neurosciences Institute, University of Cambridge, Cambridge, UK

**Michael P. O'Driscoll** School of Psychology, University of Waikato, Hamilton, New Zealand

**Ruth O'Hara** Department of Psychiatry and Behavioral Sciences, Stanford University School of Medicine, Stanford, CA, USA

Sierra Pacific Mental Illness Research Education and Clinical Center, VA Palo Alto Health Care System, Palo Alto, CA, USA

School of Psychology, The University of Queensland, Brisbane, QLD, Australia

**Michelle Olaithe** School of Psychology, University of Western Australia, Crawley, WA, Australia

**Norm O'Rourke** Department of Public Health, Ben-Gurion University of the Negev, Be'er Sheva, Israel

**Marcia G. Ory** Health Promotion and Community Health Sciences, Texas A&M Health Science Center and School of Public Health, College Station, TX, USA

**Nancy A. Pachana** School of Psychology, The University of Queensland, Brisbane, QLD, Australia

**Laura E. Paige** Brandeis University, Waltham, MA, USA

**Nicole E. Pardo** Remind Technologies Inc., Houston, TX, USA

**Sang Chul Park** Department of New Biology, DGIST, Daegu, South Korea

**Stacey L. Parker** School of Psychology, The University of Queensland, Brisbane, QLD, Australia

**Mario A. Parra** Department of Psychology, Centre for Cognitive Ageing and Cognitive Epidemiology, and Human Cognitive Neuroscience, The University of Edinburgh, Edinburgh, UK

Department of Psychology, Heriot–Watt University, Edinburgh, UK

Alzheimer Scotland Dementia Research Centre, The University of Edinburgh, Edinburgh, UK

UDP–INECO Foundation Core on Neuroscience (UIFCoN), Diego Portales University, Santiago, Chile

**Constança Paúl** UNIFAI and CINTESIS, ICBAS – University of Porto, Porto, Portugal

**Yaritza D. Perez-Hooks** Princeton University, Princeton, NJ, USA

**Giovanni Mario Pes** Department of Clinical and Experimental Medicine, University of Sassari, Sassari, Sardinia, Italy

National Institute of Biostructures and Biosystems, University of Sassari, Sassari, Italy

**Andrew J. Petkus** Department of Psychology, University of Southern California, Los Angeles, CA, USA

**Louise H. Phillips** University of Aberdeen, Aberdeen, UK

**I. Philp** Heart of England Foundation Trust, Birmingham, UK

**Andrea M. Piccinin** Department of Psychology, University of Victoria, Victoria, BC, Canada

**Christos Pitsavos** 1st Cardiology Clinic University of Athens, Athens, Greece  
Research Institute for Longevity and Prevention of Geriatric Diseases, Athens, Greece

**Leonard W. Poon** University of Georgia, Athens, GA, USA

**Lauren E. Popham** Greenwald & Associates, Washington, DC, USA

**Michel Poulain** IACCHOS Institute of Analysis of Change in Contemporary and Historical Societies, Université catholique de Louvain, Louvain–La–Neuve, Belgium

Estonian Institute for Population Studies, Tallinn University, Tallinn, Estonia

**Emma E. Poulsen** School of Psychology, The University of Queensland, Brisbane, QLD, Australia

**Catherine C. Price** Department of Clinical and Health Psychology, University of Florida, Gainesville, FL, USA

Department of Anesthesiology, University of Florida, Gainesville, FL, USA

**Elizabeth C. Price** Department of Psychology, West Virginia University, Morgantown, WV, USA

**Janice C. Probst** Arnold School of Public Health, University of South Carolina, Columbia, SC, USA

**Jeffrey Proulx** Department of Neurology, School of Medicine, Oregon Health and Science University, Portland, OR, USA

**Amy C. Pytlovany** Department of Psychology, Portland State University, Portland, OR, USA

**Sara Honn Qualls** Gerontology Center, University of Colorado, Colorado Springs, Colorado Springs, CO, USA

**Patrick Rabbitt** Department of Experimental Psychology, University of Oxford, Oxford, UK

**Wiebke Rahmlow** Department of Psychiatry and Psychotherapy, University of Leipzig, Leipzig, Germany

**Parminder Raina** Department of Clinical Epidemiology and Biostatistics, McMaster University, Hamilton, ON, Canada

**Peter Rammelsberg** Department of Prosthodontics, University Hospital Heidelberg, Heidelberg, Germany

**G. Kevin Randall** Human Sciences Extension and Outreach, Partnerships in Prevention Science Institute, Iowa State University, Ames, IA, USA

**Signe Hoei Rasmussen** Epidemiology, Biostatistics and Biodemography, Institute of Public Health, University of Southern Denmark, Odense C, Denmark

**Philippe Rast** Department of Psychology, University of Victoria, Victoria, BC, Canada

**Andrew E. Reed** Department of Psychology, Stanford University, Stanford, CA, USA

**Gwyneth Rees** Department of Surgery, Centre for Eye Research Australia, Royal Victorian Eye and Ear Hospital, Ophthalmology, University of Melbourne, Melbourne, VIC, Australia

**Laura Simpson Reeves** Institute for Social Science Research, The University of Queensland, Brisbane, QLD, Australia

**Barbara Resnick** University of Maryland School of Nursing, Baltimore, MD, USA

**Nancy Reyes** Department of Psychology, California State University, Los Angeles, CA, USA

**Stephen Rhodes** Department of Psychology, Centre for Cognitive Ageing and Cognitive Epidemiology, and Human Cognitive Neuroscience, The University of Edinburgh, Edinburgh, UK

**Oscar Ribeiro** UNIFAI and CINTESIS, ICBAS – University of Porto, Porto, Portugal

Higher Institute of Social Service (ISSSP), Porto, Portugal

University of Aveiro, Aveiro, Portugal

**Eric F. Rietzschel** University of Groningen, Groningen, The Netherlands

**Catherine A. Riffin** Department of Human Development, Cornell University, Ithaca, NY, USA

**Gail Roberts** Australian Catholic University and Villa Maria Catholic Homes, Melbourne, VIC, Australia

**Jean-Marie Robine** INSERM & EPHE, Paris and Montpellier, France

**Gail A. Robinson** Neuropsychology Research Unit, School of Psychology, The University of Queensland, Brisbane, QLD, Australia

Neuropsychology, Department of Neurology, Royal Brisbane and Women's Hospital, Brisbane, QLD, Australia

**Natália Pessoa Rocha** Laboratório Interdisciplinar de Investigação Médica, Faculdade de Medicina, Universidade Federal de Minas Gerais, Belo Horizonte, MG, Brazil

**Maree Roche** School of Psychology, University of Waikato, Hamilton, New Zealand

**Rachel Rodriguez** VA Palo Alto Health Care System, Palo Alto, CA, USA

**Jan Philipp Röer** Heinrich Heine University Düsseldorf, Düsseldorf, Germany

**Nina T. Rogers** Department of Epidemiology and Public Health, University College London, London, UK

**Alexia Rohde** The University of Queensland, St Lucia, Brisbane, QLD, Australia

**Anna Rolleston** Te Kupenga Hauora Māori, Faculty of Medical and Health Sciences, The University of Auckland, Auckland, New Zealand

**David Rooney** Macquarie University, Sydney, NSW, Australia

**Tanya Rose** The University of Queensland, St Lucia, Brisbane, QLD, Australia

**Luis Rosero-Bixby** University of California, Berkeley, CA, USA

University of Costa Rica, San José, San José, Costa Rica

**Kathrin Rosing** Psychology of Entrepreneurial Behavior, Institute of Psychology, University of Kassel, Kassel, Germany

**Christoph Rott** Institute of Gerontology, Heidelberg University, Heidelberg, Germany

**Olivier Rouaud** LEAD CNRS UMR 5022, Université de Bourgogne, Dijon, France

University of Burgundy, Dijon, France

CMRR Dijon, Dijon, France

**Cort W. Rudolph** Saint Louis University, Saint Louis, MO, USA

**Clair Rummel** VA Puget Sound Health Care System – Seattle Division, Seattle, WA, USA

**Eric Ruthruff** Department of Psychology, University of New Mexico, Albuquerque, NM, USA

**Paul Sacco** University of Maryland School of Social Work, Baltimore, MD, USA

**Perminder Sachdev** Centre for Healthy Brain Ageing, University of New South Wales, Sydney, NSW, Australia

**Marian Saeed** Department of Surgery, Centre for Eye Research Australia, Royal Victorian Eye and Ear Hospital, Ophthalmology, University of Melbourne, Melbourne, VIC, Australia

**Rinat Saifouline** Faculty of Business Administration, University of Applied Sciences, Dresden, Germany

**Erin Sakai** VA Palo Alto Health Care System, Palo Alto, CA, USA

**Karen L. Salekin** The University of Alabama, Tuscaloosa, AL, USA

**Manisha Salinas** Department of Health Promotion and Behavior, College of Public Health, The University of Georgia, Athens, GA, USA

**Viktoriya Samarina** Barrow Neurological Institute, Phoenix, AZ, USA

**Kimberly Sangster** Loyola University School of Social Work, Chicago, IL, USA

**Kristen Sarkinen** School of Nursing, University of Minnesota, Minneapolis, MN, USA

**Christine Sattler** Department of Industrial and Organizational Psychology, Institute of Psychology, Heidelberg University, Heidelberg, Germany

**K. Warner Schaie** Department of Psychiatry and Behavioral Sciences, University of Washington, Seattle, WA, USA

**Susanne Scheibe** Department of Psychology, University of Groningen, Groningen, The Netherlands

**Oliver K. Schilling** Department of Psychological Ageing Research, Institute of Psychology, Ruprecht-Karls-Universität, Heidelberg, Germany

**Hannah Schmitt** Saarland University, Saarbrücken, Germany

**Antje Schmitt** Department of Business Psychology, Economics and Management and Institute of Psychology, University of Kassel, Kassel, Germany

**Eric Schmitt** Institute of Gerontology, University of Heidelberg, Heidelberg, Germany

**Katharina M. Schnitzspahn** School of Psychology, University of Aberdeen, Aberdeen, UK

**Jos Schols** Maastricht University, Maastricht, The Netherlands

**Urte Scholz** Department of Psychology, University of Zurich, Zurich, Switzerland

**Peter Schönknecht** Department of Psychiatry and Psychotherapy, University of Leipzig, Leipzig, Germany

**Johannes Schröder** Section of Geriatric Psychiatry, Heidelberg University, Heidelberg, Germany

Institute of Gerontology, Heidelberg University, Heidelberg, Germany

**Anika Schulz** Department of Psychology, University of Groningen, Groningen, Netherlands

**Henk Schut** Department of Clinical and Health Psychology, Utrecht University, Utrecht, The Netherlands

**Benjamin Schüz** Division of Psychology, University of Tasmania, Hobart, TAS, Australia

**Nadine A. Schwab** Department of Clinical and Health Psychology, University of Florida, Gainesville, FL, USA

**Forrest Scogin** University of Alabama, Tuscaloosa, AL, USA

**Theresa L. Scott** School of Psychology, The University of Queensland, St Lucia, QLD, Australia

**Michael K. Scullin** Department of Psychology and Neuroscience, Baylor University, Waco, TX, USA

**Jori Sechrist** Department of Sociology, McMurry University, Abilene, TX, USA

**Geir Selbaek** National Norwegian Advisory Unit on Ageing and Health, Vestfold Hospital Trust and Oslo University Hospital, Oslo, Norway

**Juan Pedro Serrano Selva** Department of Psychology, Faculty of Medicine, University of Castilla-La Mancha, Albacete, Spain

**Susan Sharp** Memphis Veterans Affairs Medical Center, Memphis, TN, USA

**Michael Sharratt** Schlegel-University of Waterloo Research Institute for Aging, Kitchener, ON, Canada

**Veronica L. Shead** South Texas Veterans Health Care System, San Antonio, TX, USA

**Christine Sheppard** University of Waterloo, Waterloo, ON, Canada

Bruyère Research Institute, Ottawa, ON, Canada

**Yee Lee Shing** Center for Lifespan Psychology, Max Planck Institute for Human Development, Berlin, Germany

**Jelena S. Siebert** Department of Psychological Aging Research, Institute of Psychology, Heidelberg University, Heidelberg, Germany

**Mersina Simanski** Stanford University, Stanford, CA, USA

**David Situ** Department of Psychology, California State University, Los Angeles, CA, USA

**John Skoumas** 1st Cardiology Clinic University of Athens, Athens, Greece  
Research Institute for Longevity and Prevention of Geriatric Diseases, Athens, Greece

**Glenn E. Smith** Mayo Clinic, Rochester, MN, USA

University of Florida College of Public Health and Health Professions, Gainesville, FL, USA

**Matthew Lee Smith** Department of Health Promotion and Behavior, College of Public Health, The University of Georgia, Athens, GA, USA

Department of Health Promotion and Community Health Sciences, Texas A&M Health Science Center and School of Public Health, College Station, TX, USA

**Jacqui Smith** Health and Retirement Study, Survey Research Center, Institute for Social Research, University of Michigan, Ann Arbor, MI, USA

**James Smith** Rand Corporation, Santa Monica, CA, USA

**Amanda Sonnega** Health and Retirement Study, Survey Research Center, Institute for Social Research, University of Michigan, Ann Arbor, MI, USA

**Rachita Sood** University of Miami Miller School of Medicine, Miami, FL, USA

**Cyndy G. Soto** University of Nevada, Reno, NV, USA

**Céline Souchay** Laboratoire de Psychologie & Neurocognition (LPNC), CNRS-UMR 5105, University Grenoble Alpes, Grenoble, France

**Laura K. Soulsby** School of Psychology, Eleanor Rathbone Building, Liverpool, UK

**Anne K. Soutter** Department of Management Marketing and Entrepreneurship College of Business and Law, University of Canterbury, Christchurch, New Zealand

**Dario Spini** Faculty of Social and Political Sciences and Swiss National Centre of Competence in Research LIVES, University of Lausanne, Lausanne, Switzerland

**Ekaterina Staikova** Emory University Brain Health Center, Atlanta, GA, USA

**Christian Stamov-Roßnagel** Jacobs University, Bremen, Germany

**John M. Starr** Alzheimer Scotland Dementia Research Centre, University of Edinburgh, Edinburgh, Scotland, UK

**Ursula M. Staudinger** Columbia Aging Center, Columbia University, New York, NY, USA

**Allison A. Steen** University of Illinois, Urbana, IL, USA

**Christodoulos Stefanadis** 1st Cardiology Clinic University of Athens, Athens, Greece

Research Institute for Longevity and Prevention of Geriatric Diseases, Athens, Greece

**Michelle Steffens** School of Psychology, The University of Queensland, Brisbane, QLD, Australia

**Andrew Steptoe** Department of Epidemiology and Public Health, University College London, London, UK

**Harvey L. Sterns** The University of Akron, Akron, OH, USA

**Brendan Stevenson** School of Public Health, Massey University, Palmerston North, New Zealand

**Cassandra Stevenson** Physical Medicine and Rehabilitation Service, VA Northern California Healthcare System, Martinez, CA, USA

**Elizabeth A. L. Stine-Morrow** University of Illinois, Urbana, IL, USA

**John Strauss** School of Economics, University of Southern California, Los Angeles, CA, USA

**David L. Strayer** The University of Utah, Salt Lake City, UT, USA

**Carla M. Strickland-Hughes** University of Florida, Gainesville, FL, USA

**Margaret Stroebe** Department of Clinical and Health Psychology, Utrecht University, Utrecht, The Netherlands

**Jessica V. Strong** Geriatric Mental Health, VA Boston Healthcare System, Boston, MA, USA

**Bonnie Adele Sturrock** Department of Surgery, Centre for Eye Research Australia, Royal Victorian Eye and Ear Hospital, Ophthalmology, University of Melbourne, Melbourne, VIC, Australia

**Claire Surr** Faculty of Health and Social Sciences, Leeds Beckett University, Leeds, UK

**Makoto Suzuki** Okinawa Research Center for Longevity Science, Urasoe, Okinawa, Japan

Faculty of Medicine, University of the Ryukyus, Okinawa, Japan

**Cassandra Szoeki** Department of Medicine - Royal Melbourne Hospital, Consultant Neurologist Department of Neuroscience, Melbourne Health, The University of Melbourne, Parkville, VIC, Australia

**Vanessa Taler** University of Ottawa and Bruyère Research Institute, Ottawa, ON, Canada

**Kristine M. Talley** School of Nursing, University of Minnesota, Minneapolis, MN, USA

**Sarah (Uma) K. Tauber** Department of Psychology, Texas Christian University, Fort Worth, TX, USA

**Benjamin Tauber** Department of Psychological Aging Research, Institute of Psychology, Heidelberg University, Heidelberg, Germany

**Philip Taylor** Federation Business School, Federation University Australia, Churchill, VIC, Australia

**Ruth Teh** Department of General Practice and Primary Health Care, School of Population Health, The University of Auckland, Auckland, New Zealand

**Antônio Lúcio Teixeira** Laboratório Interdisciplinar de Investigação Médica, Faculdade de Medicina, Universidade Federal de Minas Gerais, Belo Horizonte, MG, Brazil

**Laetitia Teixeira** UNIFAI and CINTESIS, ICBAS – University of Porto, Porto, Portugal

**Adam Theobald** Centre for Healthy Brain Ageing, University of New South Wales, Sydney, NSW, Australia

**Shane A. Thomas** School of Primary Health Care, Monash University, Melbourne, VIC, Australia

International Primary Health Care Research Institute, Shenzhen, China

**Susan P. Thompson** University of Nevada, Reno, NV, USA

**Steven R. Thorp** VA San Diego Healthcare System, San Diego, CA, USA

University of California, San Diego, San Diego, CA, USA

**Franka Thurm** Department of Psychology Chair of Lifespan Developmental Neuroscience, TU Dresden, Dresden, Germany

**Eileen C. Toomey** Saint Louis University, Saint Louis, MO, USA

**Dayna R. Touron** University of North Carolina at Greensboro, Greensboro, NC, USA

**Andy Towers** School of Public Health, Massey University, Palmerston North, New Zealand

**Samuel D. Towne, Jr** Department of Health Promotion and Behavior, College of Public Health, The University of Georgia, Athens, GA, USA

**Julian Trollor** Department of Developmental Disability Neuropsychiatry, School of Psychiatry, University of New South Wales, Sydney, NSW, Australia

Cooperative Research Centre for Living with Autism (Autism CRC), Long Pocket, Brisbane, QLD, Australia

**Donald M. Truxillo** Department of Psychology, Portland State College of Liberal Arts and Sciences, Portland State University, Portland, OR, USA

**Kerstin Unger** Department of Neuroscience, Brown University, Providence, RI, USA

**Willy Marcos Valencia** Geriatrics Research, Education and Clinical Center (GRECC), Miami VA Medical Center, Miami, FL, USA

Department of Public Health Sciences, University of Miami Miller School of Medicine, Miami, FL, USA

**S. P. J. van Alphen** Department of Clinical and Life Span Psychology, Vrije Universiteit Brussel (VUB), Brussels, Belgium

**Silvia D. M. van Dijk** University Center for Psychiatry, University Medical Center Groningen, Groningen, The Netherlands

**Beatrice Van der Heijden** Institute for Management Research, Radboud University, Nijmegen, The Netherlands

Open University of the Netherlands, Heerlen, The Netherlands

**Katie Van Moorleghem** Palo Alto University, Palo Alto, CA, USA

Sierra Pacific Mental Illness Research Education and Clinical Center, VA Palo Alto Health Care System, Palo Alto, CA, USA

**Nico W. Van Yperen** Department of Psychology, University of Groningen, Groningen, The Netherlands

**Hilde Verbeek** Department of Health Services Research, Faculty of Health, Medicine and Life Science, CAPHRI School for Public Health and Primary Care, Maastricht University, Maastricht, The Netherlands

**Paul Verhaeghen** Georgia Institute of Technology, Atlanta, GA, USA

**Frans R. J. Verhey** School for Mental Health and Neuroscience, Alzheimer Center Limburg, Maastricht University Medical Center, Maastricht, The Netherlands

**Dominique Verté** Vrije Universiteit Brussel/ University College Ghent, Brussels, Belgium

**Eimee Villanueva** Palo Alto University, Palo Alto, CA, USA

**Manuel C. Voelkle** Institute of Psychology, Humboldt University Berlin, Berlin, Germany

Max Planck Institute for Human Development, Berlin, Germany

**Deborah Vollmer Dahlke** Health Promotion and Community Health Sciences, Texas A&M Health Science Center and School of Public Health, College Station, TX, USA

**Hans-Werner Wahl** Department of Psychological Aging Research, Institute of Psychology, Heidelberg University, Heidelberg, Germany

Network Aging Research (NAR), Heidelberg University, Heidelberg, Germany

**Tomoko Wakui** Tokyo Metropolitan Institute of Gerontology, Tokyo, Japan

**Katherine E. Walesby** Alzheimer Scotland Dementia Research Centre and Centre for Cognitive Ageing and Cognitive Epidemiology, University of Edinburgh, Edinburgh, Scotland, UK

**Nicole Walker** School of Psychology, The University of Queensland, Brisbane, QLD, Australia

**Ruth V. Walker** The University of Akron, Akron, OH, USA

**Sarah J. Wallace** The University of Queensland, St Lucia, Brisbane, QLD, Australia

**Wylie H. Wan** Oregon Health and Science University, Portland, OR, USA

**Anne Wand** School of Psychiatry, University of NSW, Sydney, NSW, Australia

South East Sydney Local Health District, Sydney, NSW, Australia

**Yafeng Wang** Institute of Social Science Survey, Peking University, Beijing, China

**Daniela Weber** World Population Program, Wittgenstein Centre for Demography and Global Human Capital, International Institute for Applied Systems Analysis, Laxenburg, Austria

**Jennifer C. Weeks** Department of Psychology, University of Toronto, Toronto, ON, USA

Rotman Research Institute, Baycrest, Toronto, ON, USA

**Matthias Weigl** Institute and Outpatient Clinic for Occupational, Social, and Environmental Medicine, Ludwig-Maximilians-University, Munich, Germany

**Stephanie Y. Wells** VA San Diego Healthcare System, San Diego, CA, USA  
University of California, San Diego, San Diego, CA, USA

**Yvonne Wells** La Trobe University, Melbourne, VIC, Australia

**Kathleen A. Welsh-Bohmer** Departments of Psychiatry and Neurology, Duke University Medical Center, Durham, NC, USA

**Britta Wendelstein** Section of Geriatric Psychiatry, Heidelberg University, Heidelberg, Germany

Institute of Gerontology, Heidelberg University, Heidelberg, Germany

**Robert West** Department of Psychology, Iowa State University, Ames, IA, USA

**Robin L. West** University of Florida, Gainesville, FL, USA

**Markus Wettstein** Department of Psychological Aging Research, Institute of Psychology, Heidelberg University, Heidelberg, Germany

Network Aging Research (NAR), Heidelberg University, Heidelberg, Germany

**Bradley Willcox** Okinawa Research Center for Longevity Science, Urasoe, Okinawa, Japan

Hawaii Lifespan and Healthspan Studies, Kuakini Medical Center, Honolulu, HI, USA

Department of Geriatric Medicine, John A. Burns School of Medicine, University of Hawaii, Honolulu, HI, USA

The Queen's Medical Center, Honolulu, HI, USA

**D. Craig Willcox** Okinawa Research Center for Longevity Science, Urasoe, Okinawa, Japan

Department of Human Welfare, Okinawa International University, Ginowan, Okinawa, Japan

Hawaii Lifespan and Healthspan Studies, Kuakini Medical Center, Honolulu, HI, USA

Department of Geriatric Medicine, John A. Burns School of Medicine, University of Hawaii, Honolulu, HI, USA

**Sherry L. Willis** Department of Psychiatry and Behavioral Sciences, University of Washington, Seattle, WA, USA

**Tim D. Windsor** Flinders University, Adelaide, SA, Australia

**Barbara Wisse** Department of Psychology, University of Groningen, Groningen, Netherlands

**Amber E. Witherby** Department of Psychology, Texas Christian University, Fort Worth, TX, USA

**Oliver T. Wolf** Department of Cognitive Psychology, Institute of Cognitive Neuroscience, Ruhr University Bochum, Bochum, Germany

**Gloria Wong** The University of Hong Kong, Hong Kong, China

**Linda Worrall** The University of Queensland, St Lucia, Brisbane, QLD, Australia

**Camille B. Wortman** Department of Psychology, SUNY Stony Brook, Stony Brook, NY, USA

**Sarah Wright** Department of Management Marketing and Entrepreneurship  
College of Business and Law, University of Canterbury, Christchurch, New  
Zealand

**Carsten Wrosch** Concordia University, Montreal, QC, Canada

**Susanne Wurm** Institute of Psychogerontology, Friedrich-Alexander  
Universität Erlangen, Nürnberg (FAU), Germany

**Jean F. Wyman** School of Nursing, University of Minnesota, Minneapolis,  
MN, USA

**Lale M. Yaldiz** Department of Psychology, Portland State University,  
Portland, OR, USA

**Zixuan Yang** Centre for Healthy Brain Ageing, University of New South  
Wales, Sydney, NSW, Australia

**Melissa A. Yanovitch** PGSP-Stanford PsyD Consortium, Palo Alto, CA,  
USA

**Mônica Sanches Yassuda** University of São Paulo, São Paulo, SP, Brazil

**Dannii Y. Yeung** Department of Applied Social Sciences, City University of  
Hong Kong, Hong Kong, China

**Brian Yochim** Department of Medicine, National Jewish Health, University  
of Colorado School of Medicine, Denver, CO, USA

**Carmen K. Young** Department of Psychology, Rice University, Houston,  
TX, USA

**Hannes Zacher** Department of Psychology, University of Groningen, Gro-  
ningen, The Netherlands

**Sara Zaniboni** Department of Psychology and Cognitive Science, Università  
degli studi di Trento, Rovereto, TN, Italy

**Yi Zeng** Center for the Study of Aging and Human Development and Geri-  
iatrics Division, School of Medicine, Duke University, Durham, NC, USA

Center for Healthy Aging and Development Studies, National School of  
Development, Peking University, Beijing, China

**Andreas Zenthöfer** Department of Prosthodontics, University Hospital Hei-  
delberg, Heidelberg, Germany

**Yaohui Zhao** National School of Development, Peking University, Beijing,  
China

**Hanna Zieschang** Institute for Work and Health of the German Social  
Accident Insurance, Dresden, Germany

**Daniel Zimprich** Department of Psychology, Ulm University, Ulm, Baden-  
Württemberg, Germany



# A

## Acceptance and Commitment Therapy

María Márquez-González<sup>1</sup> and  
Andrés Losada Baltar<sup>2</sup>

<sup>1</sup>Departament of Biological and Health  
Psychology, Universidad Autónoma de Madrid,  
Madrid, Spain

<sup>2</sup>Department of Psychology, Universidad Rey  
Juan Carlos, Madrid, Spain

### Synonyms

ACT; Contextual therapy; Third generation of behavioral therapies; Third wave of behavioral therapies

### Definition

Acceptance and Commitment Therapy (ACT) is a behavioral experiential psychotherapy which “reformulates and synthesizes previous generations of behavioral and cognitive therapy and carries them forward into questions, issues, and domains previously addressed primarily by other traditions, in hopes of improving both understanding and outcomes” (Hayes 2004). ACT takes a transdiagnostic and functional approach to psychological problems: it is the function of behavior that matters, not its shape. Consequently, different clinical diagnoses are, in essence,

more similar than one would think from looking at their names in the DSM-V, as they involve dysfunction in the same dimensions. In this regard, many anxiety, depressive, or addictive disorders, among others, have in common that they involve experiential avoidance and cognitive fusion. These processes will be defined later. Also, as a consequence of ACT’s focus on the context of psychopathology, it situates psychological problems in the “broader context” of people’s lives. Hence, aspects such as purpose, meaning, personal values, or sense of coherence are germane to understanding psychological problems and to working out solutions to them.

### Psychological Interventions with Older Adults

With the aging of the population there is expected to be a significant increase in the number of elderly people suffering psychological distress. Research has already shown that there are psychological interventions that work for helping distressed older adults, with most of the evidence coming from cognitive-behavioral interventions (Gatz 1997). Evidence has been put forward supporting the efficacy of Cognitive Behavioral Therapy (CBT) for treating depression and sleep problems in older adults, with effect sizes within the range of those found for younger adults (Satre et al. 2006).

In spite of this, there is some justification for further research on alternative therapeutic approaches targeting the elderly population. One of them has to do with the nature of CBT, which may limit its efficacy for some older adults' psychological problems. The basic assumption in CBT is that individuals can be trained in strategies to understand the factors that maintain their problems, as well as in techniques for dealing with them, which usually involve changing thoughts and behaviors (e.g., cognitive restructuring, skills training, or relaxation). However, many problems older adults face include aspects that are not easily modifiable. Even though growth and gains in different domains can occur in old age, aging brings with it important and irremediable changes or losses in physical (e.g., health problems) and social resources (e.g., death of loved ones), as well as in the contexts or scenarios people live in (e.g., retirement, "empty nest"). Challenging the validity of thoughts, emotions, or behaviors associated with these changes may not be the best way to face the problems, given the realistic nature of the problems (Petkus and Wetherell 2013).

Older adults' psychological or emotional problems are frequently related to difficulties in adapting to their changing realities. Despite the fact that some studies find aging to be related to improvements in emotion and self-regulation strategies (Reed and Carstensen 2014), it is nevertheless true that when faced with losses and changes in important life domains, many older adults have problems accepting them. Consequently, they tend to avoid the situations, thoughts, and emotions associated with these events, which leads to maladaptive behavior patterns that can result in disengagement from life and affect their well-being.

In recent decades, the field of psychological intervention has witnessed the emergence of the so-called third generation of behavioral therapies (Hayes 2004), which place the emphasis of intervention on increasing people's ability to accept the "hassles" and problems inherent to life, as well as the aversive experiences associated with them (thoughts, sensations, and emotions), while acting in the direction of personal values. Acceptance and Commitment Therapy (ACT) is the

standard-bearer of this third generation, and its characteristics make it especially suitable for older adults, as discussed later.

## **What Is Acceptance and Commitment Therapy?**

A basic assumption in ACT is that psychological suffering is an inherent characteristic of human life (Hayes 2004). ACT makes a strong criticism of the "healthy normality" hypothesis that seems to underlie mainstream Western psychology, according to which humans are, by their nature, psychologically healthy, and well-being and happiness is the hallmark of psychological health. This assumption is a correlate of the welfare society prevalent in the West and in the richer countries in general, but sharply contrasts with people's everyday experience, which demonstrates that problems, losses and difficulties, and the associated suffering, are more the norm than the exception in human life. Experiences such as being worried, having intrusive thoughts or feeling sadness, anxiety, anger, or other uncomfortable emotions are normal psychological experiences that go hand in hand with human existence. Assuming that these aversive experiences are normal, and being able to accept them and tolerate them while acting in the direction of personal values, are essential requirements for adaptation and psychological health. According to ACT, the hallmark of human ability for adaptation and psychological health is psychological flexibility, defined as the ability to act in chosen directions, in line with one's personal values, regardless of the uncomfortable internal experiences (thoughts, emotions, or sensations) one is having at that moment, and while remaining in contact with the present (Hayes et al. 2011). Many different forms of psychopathology are manifestations of psychological rigidity, which consists of the following six processes (also called hexaflex): (a) experiential avoidance; (b) cognitive fusion; (c) attachment to the conceptualized self; (d) loss of contact with the present moment (inflexible attention); (e) disruption of values; and (f) inaction.

(a) Experiential avoidance is the opposite tendency to acceptance and has been described as the unwillingness to remain in contact with particular private events such as emotions, thoughts, or behavioral predispositions (Hayes et al. 2011). According to ACT, “many forms of psychopathology are not abnormal behavior, emotions or thoughts, but rather “bad solutions” that people apply to solve their distress or, in other words, “unhealthy efforts to escape and avoid emotions, thoughts, memories, and other private experiences” (Hayes et al. 1996). Research shows that avoidance can have undesired effects: trying to suppress a thought or an emotion may generate a boomerang effect, increasing the frequency and intensity of these experiences (Campbell-Sills et al. 2006; Hooper and McHugh 2013). Thoughts or emotions associated with relevant negative life events such as the death of a loved one are not easily changeable, and trying to fight them (suppress or reject them) may limit people’s chances to continue living their lives in an adaptive way.

As already pointed out, ACT starts out from the belief that human suffering is a ubiquitous experience. It highlights the need to strengthen, in clinical practice, people’s ability to accept this suffering and deal with it in appropriate ways. This does not involve resignation or helplessness, but rather acknowledgement and active embracement of the aversive experiences associated with problems and losses, in order to be able to integrate them and continue living rich and meaningful lives. In clinical practice, this involves helping people to “make room for” undesired emotions and thoughts, understanding the paradox of “control,” (the harder we try to control these experiences, the more difficult it becomes) and both the futility and cost of avoidance.

Hence, ACT does not focus on the elimination or reduction of aversive experiences, but on people’s personal values and goals. These motivational variables are the framework of intervention in ACT, which is aimed

at helping people develop coherent and satisfactory lives, despite the presence of unavoidable suffering.

(b) Cognitive fusion is the tendency to be psychologically entangled with and dominated by the form or content of thoughts, believing in their literal content, or, in more general terms, the excessive or improper regulation of behavior by verbal processes, such as rules and derived relational networks (Hayes et al. 2011). When people rigidly believe (are fused with) the contents of their mind (e.g., “elderly people are unable to learn new things” or “I don’t have anything interesting to say”), they will have trouble being aware of contextual or direct experience clues, and will act in a maladaptive way (e.g., not attending courses to learn new things, or not participating in debates or conversations with other people). Being fused with verbal or cognitive rules (e.g., “I am not interesting for other people. People do not like me”) is maintained in part because compliance with verbal rules is rewarding. Cognitive fusion is also related to checking behavior of clues that may confirm or disconfirm the thought or verbal rule (e.g., “That expression on her face means that she’s bored with my conversation”). This checking behavior limits people’s behavioral repertoire and action opportunities for living in the present. An important manifestation of cognitive fusion is an excessive entanglement with “giving reasons,” which leads some people to prefer “to be right” than to be happy (e.g., “I didn’t go to the party because I am not good company and because I was feeling anxious”). ACT tries to change the way one relates to thoughts by undermining these maladaptive verbal contexts (literality and giving reasons), generating new scenarios in which maladaptive functions of thought are diminished. Specifically, cognitive defusion techniques include deliteralization (e.g., the “Milk, Milk, Milk” exercise; word repetition) (Titchener 1916), and physicalizing exercises (e.g., “Imagine that your thought is an object inside your head: what shape has it? What color is it?”) among others (Snyder et al. 2011).

ACT also includes many interesting exercises for undermining reasons as causes of behavior (Hayes 2004; Hayes et al. 2011).

- (c) Conceptualized self or cognitive fusion with self-concept occurs when a person is rigidly fused with his or her self-concept (“I’m an old and lonely man”) or self-story, and finds great reward in telling coherent self-narratives. In this context, people are likely to attend to and process stimuli and information confirming their schemas and to behave consistently with them (e.g., not interacting with other people, not involving themselves in activities). This usually leads to a reduced likelihood of being open to new or flexible ways of thinking about and coping with problems, as well as to self-fulfilling prophesies (to behave like a lonely man can indeed generate more loneliness). ACT aims to train patients in skills for decentering from their self-concept-related thoughts, emotions and sensations, and taking perspective (experiencing “self-as-context”), that is, acting as observers of these experiences, in order to facilitate more flexible ways of analyzing their problems and provide possible alternatives of thinking and behavior.
- (d) Lack of contact with the present moment. The tendency to focus on the past (e.g., rumination) or the future (e.g., worry) is another manifestation of psychological rigidity. This process involves loss of contact with the present moment (here and now) and a pattern of inflexible attention, which interferes with the ability to live in the present moment and fully perceive and experience the consequences of behavior. Such rigidity can prevent adaptive and flexible ways of coping with problems. ACT sets out to train people to attend to the present moment and enrich their experience of the “here and now” by fostering attentional control. For this purpose, ACT uses mindfulness techniques, which involve awareness of and focused attention on breathing and body sensations, among other experiences.
- (e) Disruption of values. Another source of psychological distress is related to the lack of clarification of or disconnection from personal values. In ACT, a value is a personal choice,

and not something based on a decision making process, nor the opinion of others. For example, a woman chooses to care for her husband with dementia at home, on the basis of her value “to love my husband and keep him safe and secure.” ACT aims to help people clarify or reconnect with their personal values, which are the main source of meaning and sense of purpose, cornerstones of well-being.

- (f) Behavior inconsistent with values. When people have not clarified their values or are disconnected from them, it is more likely that they will show passivity (lack of action), inconsistent behavior (acting in ways that are inconsistent with one’s values), impulsivity, or persistent avoidance. In ACT, patients are encouraged to commit to their values, that is, to develop stable patterns of effective behavior consistent with their personal values. This involves helping them to initiate and maintain actions that are values-based, redirecting behavior towards the desired values, and maintaining the purposes in the face of barriers (Hayes et al. 2011). It also involves discovering and overcoming barriers to committed actions, which usually implies the use of traditional behavioral techniques such as skills training, exposure, or problem-solving, which are perfectly compatible with ACT.

### **Why Is ACT an Interesting Therapeutic Approach for Older Adults?**

As already pointed out, a substantial proportion of elderly people suffering from different forms of psychopathology have a long history of efforts to reduce the distress associated with their psychological problems. This history of failures may be related to the fact that many of these problems involve difficulties for adapting to hard-to-change factors, such as irremediable losses (e.g., death of loved ones) and changes (e.g., retirement), and to the aversive experiences associated with them (e.g., sadness or self-devaluative thoughts). These hard-to-change events usually have a great impact on older adults’ set of personal values, as some of

them may be more difficult to pursue and some goals and objectives may be no longer attainable. In these circumstances, flexible goal adjustment is required in order to keep the person engaged in life and committed to their personal values. This adjustment involves disengaging from inappropriate goals and replacing them with more feasible ones, processes that have been found to be associated with better emotional well-being (Wrosch et al. 2006).

However, the truth is that, when faced with these life events and the associated uncomfortable experiences (emotions, sensations, or thoughts), many older adults have considerable difficulty adjusting their set of goals, reformulating their affected values, or restructuring their values hierarchy, and end up experiencing a blockage or disconnection from important valued life domains. These types of problems frequently experienced by older adults make particularly interesting the use in this population of an alternative therapeutic approach such as ACT which, instead of promoting a control-oriented approach focused on change, fosters acceptance as the main way of coping with the difficulties and problems (Petkus and Wetherell 2013).

It is important to note here that ACT's focus on the importance of values clarification and the development of patterns of behavior consistent with personal values fits very well with two of the main theoretical models of human development across the lifespan: the Selective Optimization with Compensation Model of successful ageing (SOC) (Baltes and Baltes 1990) and the Motivational Theory of Life-Span Development (Heckhausen et al. 2010). A basic assumption of these approaches is that people are active and goal-oriented agents in their lifespan development, who strive for adaptation to losses and changes throughout the lifespan, displaying motivational processes such as goal selection, goal pursuit, and goal disengagement.

As suggested in the above paragraph, motivation, values-oriented action, and flexible goal adjustment are essential elements of adaptation throughout the lifespan and, particularly, in old age. The combination of theoretical models of human development with ACT provides a useful

platform from which to develop psychological interventions aimed at helping older people adapt to changes, losses and life transitions, which are frequently involved in psychological problems in old age. This can be illustrated in the following clinical case: an elderly man gets depressed after retirement, because he has always had the value of "being a good professional" as a priority in his life, to the detriment of other areas of values (friendship, leisure time, etc.). As this value is no longer possible for him to follow and he has not clarified or committed to other areas of values, he is likely to experience an emptiness of values, and to become caught up in patterns of experiential avoidance that eventually lead to depression. Cognitive fusion with thoughts such as "I am no longer useful" or "I am finished" is also very likely in this case. Therapeutic work from ACT would focus on fostering acceptance of his current circumstances and the associated aversive experiences, and helping him to clarify and commit to personal values that bring meaning and purpose to his life. This may involve: (a) reformulating his former main value, identifying the underlying sources of meaning and satisfaction, in order to generate a related but attainable value, such as "being productive or useful for other people"; (b) helping him to retrieve and strengthen other values; and (c) undermining verbal dysfunctional processes (cognitive fusion and conceptualized self) through training in cognitive defusion techniques and strengthening the self-as-context perspective.

Other characteristics that make ACT a suitable therapeutic approach for older adults are the following:

- (a) Transdiagnostic approach. The high prevalence of subsyndromal psychological problems and the frequent comorbidity between anxiety and depression in the elderly population may be related to the limitations of current diagnostic criteria for use with this population. The transdiagnostic nature of ACT makes this therapy particularly suitable for the elderly (Petkus and Wetherell 2013).
- (b) Methodology. ACT departs from psychoeducational and verbal techniques, which are

central in CBT, and uses a methodology mainly involving metaphors, paradoxes, and experiential exercises. These techniques are particularly suitable for many older adults who, due to cohort differences (e.g., lower level of formal education) or other reasons (e.g., cognitive impairment), may show limitations in abstract thinking or verbal reasoning ability.

- (c) Focus on eudaimonic well-being (values and goals). According to Socioemotional Selectivity Theory (Carstensen et al. 1999), the goals of older adults are focused on optimizing emotional meaning and well-being, and they usually invest more cognitive and behavioral resources than their younger counterparts in pursuing their emotionally meaningful goals. For its part, Erikson's theory of development (Erikson 1950) states that the major psychosocial crisis to be resolved in old age is ego integrity versus despair. This crisis is precipitated by the awareness of mortality. The achievement of ego integrity requires that people review their life-career to determine whether it was a success or a failure. Older adults who succeed in this crisis are those who are able to accept how things have turned out in their lives, and find order and meaning in it. There is some evidence suggesting the great importance of having achieved generativity in order to satisfactorily resolve the ego integrity crisis (James and Zarrett 2006).

On the other hand, generativity is a motivational tendency that can be defined as concern for and commitment to establishing and guiding the next generation (Erikson 1950). It has been found to increase in old age, in which many people are mainly interested in obtaining emotional meaning through the pursuit of values and goals related to the achievement of younger generations' well-being (Sheldon and Kasser 2001).

Finally, the gerotranscendence theory (Tornstam 1989) states that aging persons gradually develop "a shift in meta-perspective, from a materialistic and rational vision to a more cosmic and transcendent one, normally followed by an increase in life

satisfaction" (p. 60). This motivational change has some consequences, such as a reduction in self-centeredness and in interest in superfluous social interaction and material things, or a shift from egoism to altruism. Once again, older adults' tendency for self-transcendence is highlighted in gerontological theory.

These considerations point to the possibility that older adults' mental health and well-being involve more eudaimonic aspects, as they are related to the fulfillment of particular motivational tendencies. In this regard, an association has been found between wisdom and eudaimonic well-being, suggesting that wise persons' mental health is largely determined by their involvement in values-related meaningful activities (Webster et al. 2014).

A comparison between CBT and ACT suggests that, while cognitive-behavioral therapy is grounded in a somehow more individualistic and self-centered perspective, more focused on hedonic well-being since it aims at decreasing negative affect (anxiety and depression), ACT is more focused on eudaimonic well-being, being aimed at helping people to live their life in accordance with their personal and intrinsic values. As Petkus and Wetherell (Petkus and Wetherell 2013) suggest, this therapeutic objective "may resonate more with older adults" (p. 49). ACT seems to fit better with older adults' tendency for self-transcendence and generativity, to the extent that its main therapeutic objective is precisely to help people fulfill their motivational tendencies. Indeed, there is some evidence that attrition rates are lower among older adults treated with ACT when compared to those who received CBT (Wetherell et al. 2011).

- (d) More focus on strengths. In relation to its focus on eudaimonic well-being, and as Petkus and Wetherell (Petkus and Wetherell 2013) suggest, ACT may also be particularly suitable for older adults because it is more focused on and takes more advantage of the person's strengths and resources. Gerontological research evidence reveals aging-related gains and growth in different domains, such

as those of resilience (Gooding et al. 2012) or emotion regulation (Scheibe and Carstensen 2010).

## Research Studies on ACT and Aging

The empirical evidence in support of ACT as a helpful therapy for older adults is reviewed in the following paragraphs.

Wetherell et al. (2011) provide data on 12 adults aged 60 or more with a principal diagnosis of Generalized Anxiety Disorder (GAD). Participants were randomized to ACT or CBT individual treatment, consisting of 12 sessions. The authors conclude that an ACT intervention for older adults with GAD is feasible, with reductions in worry and depressive symptoms. They suggest that novice therapists may conduct this type of intervention. However, they reported that the effects on the 7 participants in the ACT intervention in this study were substantially lower than those observed in younger adult samples with GAD. They suggest that an adaptation of the intervention with fewer elements, but relevant to older adults, may increase the effects.

McCracken & Jones (2012) conducted an ACT intervention for 40 participants with chronic pain aged 60 and over. The main aim of the intervention was to increase psychological flexibility. There was no control group or randomization to different interventions. The intervention was delivered over a period of 3 or 4 weeks, 5 days a week, by an interdisciplinary team. Medium to large effects in the expected directions were observed in pain intensity, pain acceptance, physical disability, psychosocial disability, mindfulness, and depression.

Alonso, López et al. (2013) published a pilot study on an ACT intervention for nursing home residents with chronic pain, compared to a control group. Ten older adults participated in the intervention, which was based on a combination of ACT and the Selective Optimization with Compensation Model (Baltes and Baltes 1990), and consisted of ten 2-hour sessions. The results suggest that this intervention was successful for increasing participants' satisfaction with the time

and effort devoted to living according to their own values. In addition, participants in the ACT intervention reported a reduction in the belief that medication is the sole or principal treatment for their pain.

Karlin and colleagues (2013) compared an ACT treatment for depression in veterans aged 18–64 and 65-plus who sought treatment for depression. ACT training consisted of up to 16 sessions, and there was no control group. The treatment protocol did not have specific content related to older adults. They found large effect sizes for their intervention, both for older adults and the under-65s. They also reported increases in quality of life and therapeutic alliance.

Other studies have been conducted with samples that included participants from different age groups, including older adults. For example, Wetherell and colleagues (in press), in a study comparing ACT and CBT for adults with chronic pain, found data suggesting that older adults are more likely to respond to ACT, as compared to younger adults, who are more likely to respond to CBT. In addition, they suggest that ACT is particularly appropriate and acceptable for older adults considering that “older adults may have experienced a greater number of failed efforts to reduce their pain; thus, an intervention that focuses on living well with pain, as opposed to pain reduction, may have more appeal to older individuals.” McCracken, Sato and Taylor (2013) carried out a study analyzing the effect of an ACT intervention for people with chronic pain. In that study, a significant proportion of the sample was aged 65 or older. The findings showed that the intervention was associated with a decrease in depression, lower disability, higher pain acceptance, and other ratings of overall improvement. Acceptance and Commitment Therapy has also been proposed as a promising therapeutic approach for helping family caregivers of people with dementia. (Márquez-González et al. 2010), through a pilot study of an eight-session ACT intervention for dementia caregivers delivered in group format, found preliminary data suggesting the potential interest of this therapy for helping dementia family caregivers. These promising results have been confirmed in a recent randomized controlled trial

in which the differential efficacy of an ACT intervention and a Cognitive Behavioral Therapy for dementia family caregivers' was analyzed (Losada et al. 2015). Both interventions were delivered in an individual format, and a significant statistical and clinical effect of the ACT intervention was found for the reduction of caregivers' anxiety and depressive symptoms.

## Conclusions and Suggestions for the Future

The revised studies point in the direction of supporting ACT as a treatment option that may contribute to helping elderly people suffering distress. However, there is a gap in the availability of outcomes from randomized controlled trials, and there is also a clear need for new research studies aimed at analyzing and identifying the specific processes and action mechanisms involved in ACT interventions (e.g., increase of acceptance, cognitive defusion, clarification of values, increase in values-consistent behavior), which are considered from this approach to be key factors in the explanation of older adults' mental and physical health. In this regard, there are studies showing that mindfulness with older adults is successful for improving mental and physical outcomes (Morone et al. 2008).

Furthermore, there is an important need for further studies developing ACT-based interventions for disorders and psychological problems that are particularly prevalent or disturbing in the aging population, such as depression, anxiety, or grief. Likewise, such interventions should be developed to be implemented in different contexts, including the community, primary care, nursing homes, home care, and so on.

Finally, considering that ACT and CBT are not incompatible, but rather share some components (e.g., skills training, problem-solving, exposure), the development of interventions combining the two approaches, such as that developed by Lunde and Nordhus, may be a good way of providing answers to specific needs presented by older people with psychological problems.

In conclusion, ACT seems to be a promising approach for understanding and treating many psychological problems in the elderly, helping them to: (a) accept and be open to their uncomfortable experiences in the here and now; (b) choose valued life-directions that provide them with meaning and purpose; and (c) take action, engaging in stable patterns of values-consistent behavior.

## Cross-References

- ▶ [Aging and Psychological Well-being](#)
- ▶ [Clinical Issues in Working with Older Adults](#)
- ▶ [Cognitive Behavioural Therapy](#)
- ▶ [Contextual Adult Life Span Theory for Adapting Psychotherapy \(CALTAP\) and Clinical Geropsychology](#)
- ▶ [Life Management Through Selection, Optimization, and Compensation](#)
- ▶ [Motivational Theory of Lifespan Development](#)

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## Active Aging

Constança Paúl<sup>1</sup> and Alexandra Lopes<sup>2</sup>

<sup>1</sup>UNIFAI and CINTESIS, ICBAS – University of Porto, Porto, Portugal

<sup>2</sup>Institute of Sociology, University of Porto, Porto, Portugal

### Synonyms

Aging well; Optimal aging; Positive aging; Productive aging; Successful aging

### Definition

The World Health Organization (WHO) defines active aging as “...*the process of optimizing opportunities for health, participation and security in order to enhance quality of life as people age*” (WHO 2002, p. 12). For many years, the WHO has emphasized healthy aging, primarily defined as aging without major pathologies. In the early 1990s, it has begun developing the concept of active aging, jointly with other governmental and nongovernmental organizations initiatives, offering a policy framework that emphasizes the link between activity, health, independence, and aging well. Active aging emerged as a more comprehensive concept than healthy aging, as it considers not only health indicators but also psychological, social, and economic aspects, which are to be looked at the community level, within gender and cultural perspectives.

Currently the WHO’s active aging concept leads the global policy strategy in Europe (Walker 2009). The document produced by the WHO (2002), although not exempt of criticism, was adopted as a guide in many health and social inclusion national plans all over the world and it has definitely changed the dominant approach to old age that for many decades had been grounded in the deficit theories. Some go further considering that it opened the way to a new model of governance of aging (Boudiny and Mortelmans 2011).

## History of the Concept

The model of active aging emerged in the aftermath of the demographic changes experienced across most of the western world from the 1950s onward. Its roots date back to the 1960s and to the influential work of Havighurst (1963) in the United States and his activity theory. This author supported the idea that “successful ageing means the maintenance as far and as long as possible of activities and attitudes of middle age” (Havighurst 1963, p. 8), stressing that the maintenance of such activities in later stages of life are associated with higher levels of wellbeing and quality of life. According to the formulation, people should keep active and replace professional activities by others when they have to retire from the labor market, or replace friends by others when the former have died. This activity theory brought an alternative approach to aging in opposition to the theory of disengagement of Cumming and Henry (1961), which considered the mutual withdrawal between old people and society. Eager of a more positive approach to old age, a stage in life that more and more people were achieving, academics and professionals working in the field have welcomed this activity theory and from inception it gathered wide enthusiasm. Later Neugarten (1964) would stress the relevance of being socially engaged and active to age successfully. This became one of the most influential theories to inform aging policies up to the emergence in the late 1980s of the concept of successful aging by Rowe and Kahn (1987, 1997, 1998) in the United States. Slightly more moderate approaches are found in work inspired by the theory of continuity of Atchley (1989) who claims that, despite the importance of maintaining activities of middle age in later life to achieve higher levels of wellbeing in old age, it is not so much the amount of activities that matters but instead the meaning activities carry for the individual. Moreover, alongside the maintenance of meaningful activities, Atchley stresses that processes of adjustment and adaptation also mark later stages of life. Also more moderate is the proposal of Caradec (2007) that offers a conceptual framework to discuss active aging that puts the process

of aging in the crossroads of two opposing forces, the pressure toward disengagement and the pressure toward remaining connected to the world. Managing the tension between these two forces is the challenge of aging (*l'épreuve*). Active aging, in that sense, involves the process but also the outcome of the reorganization of activities that allow us to manage the tension between disengagement and continuity. Caradec further adds that individuals will experience this process differently according to the resources they control, both personal and social (Caradec 2010).

The overarching use of the concept of active aging though was not so much the result of the conceptual developments headed by the academia but rather the outcome of the inclusion of the term in the agenda of some supranational institutions, the one holding the highest impact being the World Health Organization (WHO). The first references to the term active aging can be traced back to some documents issued by the European Union (1999a, b, 2002) and the OECD (2000). In all cases, the term appears alongside the discussion on the challenges of demographic aging. More specifically, active aging is portrayed as the way out from the pressures on welfare systems stemming from the increasing number of older people with some form of dependence or as the way out from the pressures on pension systems.

But the final kick that boosted the concept of active aging to the global arena comes with the WHO declaration on the principles of policy that nations should adopt to promote active aging (WHO 2002). From then onward, there has been a proliferation of policy initiatives at both global, regional, and local levels that follow closely the guidelines put forward by the WHO and that constitute the framework that is taken as a reference across most countries not only for organizations operating in aging-related issues but also for individuals and for the way they experience the aging process.

### **The Active Aging Model and Its Applications**

The concept of active ageing (WHO 2002) is based on three pillars that are mentioned in the

definition itself: participation, health, and security. Recently, the International Longevity Centre of Brazil (2015) whose president is Alexandre Kalache, the previous responsible for the active aging approach launched by WHO, released a report titled *Active Ageing: A policy framework in response to the longevity revolution*. In this piece of work, Kalache revises the concept of active aging to incorporate more recent and new developments in life course perspectives. To the original pillars a new one was added – lifelong learning – that supports all the other pillars and puts information as vital to active aging. Besides formal education, and work-related knowledge acquisition, it presents a more inclusive approach to lifelong learning to diminish vulnerability, namely, among older persons.

The proposed model encompasses six groups of determinants of active aging, each one including several aspects: (1) health and social services (promoting health and preventing disease, health services, continuous care, mental health care); (2) behavioral (smoking, physical activity, food intake, oral health, alcohol, medication); (3) personal (biology and genetics and psychological factors); (4) physical environment (friendly environment, safe houses, falls, absence of pollution); (5) social (social support, violence and abuse, education); and (6) economic (wage, social security, work). These determinants of active aging are embedded in cultural and gender contexts. These so-called determinants, appearing in the model are not mutually exclusive and there are overlaps between them, mixing individual as well as societal aspects and transient and life course issues. The WHO (2002) report recommended that health policy for old people be implemented through Health Plans at global regional, national, and local levels.

According to the WHO document on active aging (WHO 2002), the key aspects of active aging are (1) autonomy which is the perceived ability to control, cope with, and make personal decisions about how one lives on a day-to-day basis, according to one's own rules and preferences; (2) independence, the ability to perform functions related to daily living – i.e., the capacity of living independently in the community with no

and/or little help from others; (3) quality of life that “*is an individual’s perception of his or her position in life in the context of the culture and value system where they live, and in relation to their goals, expectations, standards and concerns. It is a broad ranging concept, incorporating in a complex way person’s physical health, psychological state, level of independence, social relationships, personal beliefs and relationship to salient features in the environment*” (Harper and Power 1998). As people age, quality of life is largely determined by the ability to maintain autonomy and independence and healthy life expectancy, which is how long people can expect to live without disabilities.

There are some distinctive elements in how the WHO defines active aging in terms of its implications for policy design and for all sorts of interventions in aging-related issues. Firstly, the WHO sees active aging as a domain of collective responsibility. Although one could argue that there is also an orientation to individual responsibility phrased in the statement that individuals must participate in certain types of activities and adopt certain types of behavior, ultimately this is conditioned by the opportunities individuals have to fulfill their potential. Optimizing these opportunities is clearly a domain for societal action and opens the space for a discourse on rights and on state obligations. This is further reinforced by the emphasis the WHO puts on the resources that need to be made available to individuals to maximize their opportunities to age with quality of life.

Secondly, the WHO sees active aging as a process that is materialized in a vast array of multidimensional activities and not exclusively in productive labor-market-related activities. This is very relevant as it clearly distinguishes the WHO approach to active aging from the one of other supranational organizations such as the OECD which focuses on labor market productivity issues associated with population aging. Active aging therefore is not just about creating the conditions to postpone the exit from the labor market of older workers (which has been the dominant topic in many national debates on how to face the challenges of demographic aging for

social protection systems) but also about considering the economic and the social value added by other activities not directly related to the labor market (e.g., voluntary work, family care). Furthermore, the WHO concept of active aging includes clearly nonproductive activities as examples of activities with which individuals can engage to achieve quality of life as they age (e.g., spiritual activities).

Thirdly, the concept of active aging of the WHO embeds what one could label as an inclusive approach to the process of aging. It acknowledges that processes are formed along the life course and that the way one lives in old age is largely conditioned by prior phases of life and inscribed in individual life trajectories. It also emphasizes that active aging is a bottom-up process where people participate in building the appropriate conditions to age with quality of life. This is quite important as it grounds active aging in the recognition of differences in how people age and in the need to respect and accommodate the specificities of everybody. Finally, it notes that there are individuals that accumulate disadvantages and as such are at higher risk of being deprived from the chances of aging actively. That is the case of those who have physical and/or cognitive impairments or who are disadvantaged economically.

The objective of the WHO model is to guide policies on aging in order to avoid incapacity and its high financial costs for societies that are facing a deep demographic change toward aging. But in doing so, the concept of active aging looks for ways to reconcile the need to contain social and financial costs of aging with the recognition of rights of older people as well as the recognition of the potential to add value to societies along the life course and also in old age.

### **Operationalization and Evaluation of Policies Versus Evaluation of Individual Outcomes**

The concept of active aging is nevertheless a very complex one, and researchers soon began trying to understand what it means to laypeople as well

as finding ways to operationalize and evaluate its applications (e.g., Fernandez-Ballesteros et al. 2010). Bowling reported that the most common perceptions of active aging were having/maintaining physical health and functioning (43%), leisure and social activities (34%), mental functioning and activity (18%), and social relationships and contacts (15%) (Bowling 2008). The predictors of positive self-rated active aging were optimum health and quality of life. More recently, Stenner et al. (2011) described the subjective aspects of active aging by inquiring people about the meaning of the expression “active aging.” The authors have shown that most people mention physical activity but also autonomy, interest in life, coping with challenges, and keeping up with the world. Frequently people mix physical, mental, and social factors and stressed *agentic capacities* and living by one’s own norms. Stenner et al. (2011) have used this evidence to critically question the deterministic view of the WHO model and have emphasized the need for a “challenge and response” framework, a psycho-social approach to the conflict between facts and expectations and the proactive attitude of people.

In an attempt to test empirically the WHO active aging determinants model, Paúl et al. (2012) arrive to the conclusion that the most important determinants of active aging appears organized in a factor that can be defined as perceived and objective health and independent functioning and a factor where personal determinants like psychological distress, loneliness, personality characteristics, happiness, and optimism emerge as highly relevant to individual active adaptation to the aging process.

In sum, active aging and other similar terms, such as successful aging, positive aging, or aging well, are viewed as scientific concepts operationally portrayed by a broad set of bio-psycho-social factors assessed through objective and subjective indicators as well as being closely related to lay concepts reported cross-culturally by older persons (Fernandez-Ballesteros 2011).

Objective as well as subjective health and functionality seem to be major components of active aging in line with Pruchno et al.’s (2010a, b) findings. By keeping active in the broader sense

of the concept, old people can overcome difficulties and keep highly motivated to participate in the social world, and engage in healthy behavior, which in turn has a positive impact in quality of life during the aging process. In line with this, actions targeting active aging have to take into account the prevention of health problems across the life span and the promotion of psychological resilience, avoiding loneliness or increasing happiness and subjective wellbeing. These actions can occur at both the individual and social policy level. Examples of actions at the social policy level are mechanisms that guarantee adequate income and policies to plan retirement and to guarantee the sustainability of pension systems.

### Critical Perspectives for the Future

The balance between individual and social responsibility in aging well is probably the key aspect of the active aging model as both contribute to aging outcomes that means people should adopt a healthy life style and stay engaged with society but this can only be achieved in friendly and supportive contexts that guarantee access to a diversity of services and value individual options and dignity.

One major implication of the active aging model as it has been spreading among policy makers is the emphasis it puts on a productivist perspective that focuses mostly on the extension of working life ignoring other forms of nonpaid work (Foster and Walker 2014). The foundational rhetoric of active aging is the recognition of autonomy and capacity of older citizens to engage in meaningful social action, as opposed to disengagement. Therefore it is focused on eliminating age barriers to the participation of older workers in the labor market and it is very hostile to the culture of early exit from the labor market. As a result, it paves the way to a new legitimacy to what is considered successful aging, one that is largely dependent on an almost endless participation in the productive sphere of society (or in some sort of equivalent). In terms of public policies, this translates into pressures toward postponing retirement, into investments in training of older workers,

among others. Authors such as Foster and Walker consider that there are other forms of creation of social value that are outside the realm of the labor market and that need to be included in the public policies forum, such as nonpaid family care and voluntary work. Although these are included in the concept of active aging as dimensions of participation, they have a very shy expression in the policy domain.

Other authors go even further in their criticism of the concept of active aging and emphasize its normative dimension (Boudiny 2013). They argue in that respect that the concept encapsulates a standardized approach to aging as strong as the past approaches that would equate aging to frailty and disengagement. In that sense, today as before, it is about prescribing appropriate and socially desirable modes of aging and as such it is about a model of governance of aging bodies. Remaining active and willing to be active become social norms. Those who do not conform, sometimes for reasons they cannot control, to these social norms of aging are “aging badly.”

Despite the criticisms, the model of active aging as a framework to implement individual and societal strategies that foster an aging process marked by quality of life seems to have gathered wide consensus. If those strategies are thought of as multidimensional in their nature, articulating individual and societal responsibilities and focusing on inclusion and participation of all irrespective of age-related constraints or any other constraints, they can pave the way to aging well for the growing generations of people who have higher expectations in terms of the number of years of life they will enjoy but also higher expectations about the quality of life they desire to those years.

## Cross-References

- ▶ [Activity Theory, Disengagement Theory, and Successful Aging](#)
- ▶ [Aging and Psychological Well-Being](#)
- ▶ [Aging and Quality of Life](#)
- ▶ [Health Promotion](#)

- ▶ [Psychological Theories of Successful Aging](#)
- ▶ [Psychological Theories on Health and Aging](#)
- ▶ [Psychology of Longevity](#)
- ▶ [Psychosocial Well-Being](#)

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## Activity Theory, Disengagement Theory, and Successful Aging

Marguerite DeLiema<sup>1</sup> and Vern L. Bengtson<sup>2</sup>

<sup>1</sup>Stanford Center on Longevity, Stanford University, Stanford, CA, USA

<sup>2</sup>School of Social Work and Edward R. Roybal Institute on Aging, University of Southern California, Los Angeles, CA, USA

### Synonyms

Activity theory of aging; Disengagement theory of aging; Successful aging

### Definitions

Interdisciplinary gerontological perspectives that attempt to explain why some individuals are better

able to adapt to the challenges of aging than others.

Activity and disengagement theories of aging were the first to use social science data to explain why some individuals, or groups, are more adaptive or “successful” in meeting the multiple and inevitable challenges of aging than other persons. These theories for the first time focused on social, psychological, and interpersonal factors in addition to more observable physiological and medical conditions of aging. They also called attention to the positive and healthy aspects of aging rather than frailty, decline, and decrement – which was the focus at the time, not only of the medical establishment in geriatrics but also within social services and public policy for the aged. The debates following activity and disengagement theories changed scientific discourse, service delivery and policy in the decades following 1960, providing evidence of the power of theories to alter research and practice in gerontology.

Activity and disengagement theories were based on a developmental perspective applied to later life, a view that aging involved a progression from one stage to another rather than a decline from middle age to an end state. These theories also involved an interdisciplinary perspective on aging – based on medical/physiological data on age-related conditions, but also psychology, sociology, and later social work perspectives on functioning. These were immense contributions to the developing field of gerontology in the 1950s and 1960s.

### Activity Theory of Aging

Activity is any “regulated or patterned action beyond routine physical or personal maintenance” (Lemon et al. 1972; Havighurst 1961). Types of activity include interaction with family and friends, participation in organizations, and more solitary recreational activities like reading, watching television, and doing household chores. The basic premise of activity theory of aging is that individuals should maintain the activities and orientations of middle age for as long as possible, and then find substitutes for those activities which

they must give up as they age in order to maintain high life satisfaction in retirement (Havighurst 1961). According to the theory, active engagement in various new roles (e.g., taking up volunteer activities following retirement) is “successful adaptation” to aging.

Activity theory goes something like this: As people age they experience life events such as widowhood, failing health, and retirement that reduce participation in normative mid-life social roles. If uncompensated, these “role losses” lead to lower activity, which may result in lower life satisfaction and functional decline, particularly when the event, such as retirement, is not the individual’s choice. According to activity theory, people should find substitute roles for the work and parenting roles they left behind in mid-life in order to maintain their sense of self-worth. Active engagement in new social roles appropriate for older adults – volunteering, grandparenting – is further reinforced by cultural norms, fostering personal feelings of self-worth and higher life satisfaction in older age (Lemon et al. 1972; Havighurst 1961).

Activity theory was first proposed based on empirical evidence by Havighurst and Albrecht in their 1954 book, *Older People* (Havighurst and Albrecht 1953). Their data, drawn from the first large-scale American social survey of the elderly, showed that older adults who participated in appropriate social roles for the aged, like spending time with grandchildren and attending church, were happier and more adjusted in later life than those who were not similarly engaged in social roles. Thus, social engagement was seen as a causal factor in maintaining high levels of “adjustment,” or life satisfaction, in the later years.

Activity theory was labeled an “implicit” theory of aging (Havighurst 1961) because it naturally guided most medical and social work practice in the Post World War II era – and still does, to some extent, since it so well reflects American values of productivity and the desire to remain youthful (Bengtson and Kuypers 1971). Activity theory offered a conceptual justification underlying many programs for the elderly, influencing the passage of the Older Americans Act in 1965.

It was not until much later that a systematic empirical test of the theory was provided by Lemon, Bengtson and Peterson in 1972. They amplified the concepts and mechanisms of the theory and developed a set of axiomatic statements based on social theorist George Herbert Mead’s symbolic interactionist theory. These axioms articulated how activities provide role supports that help sustain positive self-concepts leading to higher life satisfaction. They postulated that the greater the activity level – formal social activities like participating in organizations, informal activities such as getting together with friends, or solitary activities such as reading – the greater the role support one will receive. The more role support one receives, the greater the contribution to a positive self-concept, leading, in turn, to higher life satisfaction in later life. Six hypotheses were derived from these axioms and tested with data. Only one – high levels of informal social activity such as with friends, family, and neighbors – was positively related to life satisfaction for elderly persons. Other activity types – high formal activity in organizations, for example; or high solitary mental activity such as reading – were not significantly related to life satisfaction (Lemon et al. 1972).

In 1982, Longino and Kart replicated the Lemon et al. (1972) study using a more socioeconomically diverse sample (to avoid its possible middle-class bias) and included more in-depth measures of activity (asking respondents to reconstruct the previous day’s activities from morning through bedtime). They found, again, that informal social activities with friends and family had a positive effect on life satisfaction in all socioeconomic groups, but that formal activities such as attending group meetings were *negatively* associated with life satisfaction. Solitary activities, like reading, writing and watching television, had no effect (Longino and Kart 1982).

Reitzes, Mutran, and Verrill extended activity theory using more direct measures of role support and examined whether certain activity types increase self-esteem in later life (Reitzes et al. 1995). Only leisure activities were positively associated with self-esteem. There were considerable gender differences mediating

the relationships; that is, for men, solitary activities were significantly related to positive self-esteem, and for women, activities with relatives and work friends were significant as were other types of activities when commitment to the role was high.

Further support for Lemon et al.'s (1972) study of activity theory was found in an English context. Knapp (1977) found a significant relationship between informal activity (the hours per week spent with friends and family) and life satisfaction, but the association between formal activities and solitary activities with life satisfaction was weak (Knapp 1977). More recently Zaraneck and Chapeleski (2005) reported some support for the theory in a study of casino gambling as a social activity among urban elderly, although participants who visited the casino most frequently (monthly or more) reported poorer social support and less participation in other social activities than the infrequent gamblers (Zaraneck and Chapeleski 2005).

In short, it is surprising that so few empirical studies to date have tested the principal assertion of activity theory – that maintaining levels of socio-emotional engagement is associated with a sense of life satisfaction among older individuals. This is the basis of the activity theory of aging, yet only engagement in informal activities has received sufficient empirical support, suggesting that different forms of activity have a different impact on life satisfaction. Despite lack of robust evidence for all types of activity participation, this perspective is still the predominant view of how to age successfully in the United States. Activity theory fits well with American cultural values (Keep active! Be productive!) and has received new life in recent years within the much-publicized “successful aging” paradigm reviewed at the end of this chapter.

## Disengagement Theory

In *Growing Old* (1961), Elaine Cumming and William E. Henry described disengagement as, “An inevitable mutual withdrawal or disengagement, resulting in decreased interaction between the aging person and others in the social systems

he belongs to” (Cumming and Henry 1961). This was the first formal attempt to explain normal or “successful” late life development from a perspective that combined psychodynamics with social systems analysis in the tradition of Durkheim and Talcott Parsons. Adults who disengaged were viewed as well adjusted; those who did not were social “impingers” (Cumming 1963).

The ideas of disengagement theory were first articulated by Cumming and Henry in 1959, a few years after they had joined Havighurst’s University of Chicago team. Cumming, a sociologist, and Henry, a psychoanalyst, developed their concepts while analyzing data from Havighurst’s Kansas City Study of Adult Life, an interdisciplinary community-based investigation to examine health, employment, leisure, and civic participation activities of older adults (Achenbaum and Bengtson 1994).

The concept of disengagement reflected Durkheimian functionalist theory by way of Talcott Parsons, which was the reigning theoretical paradigm in American sociology in the 1950s and 1960s. According to disengagement theory, as individuals age there is a gradual but inevitable constriction in “social life space,” evidenced by declines in the number of social partners and frequency of social interactions. At the same time there is withdrawal from social institutions (transition from work to retirement). Disengagement, therefore, is functional for both the social system and for the individual: It prepares society for the loss of the individual through the disengagements of retirement and then death; it prepares the individual for death through progressive disengagement from society (role loss). Thus, through this process of mutual withdrawal there is no disruption to the social equilibrium (Cumming and Henry 1961; Cumming 1963; Achenbaum and Bengtson 1994).

According to Cumming and Henry, disengagement is partially explained by older adults’ internalization of Western cultural values that esteem youth over age – primarily vitality, productivity, and efficiency. Withdrawal is thus regarded as an obligation to the functional maintenance of the social system because it allows younger generations to replace older adults in positions of

increasing power and importance. Disengagement is also caused by increasing physical frailty and by psychological changes involving a greater interiority of experiencing – a psychic turning inward. According to *Growing Old*, the process is inevitable, irreversible, and universal – it happens to older people in all cultures and throughout all time periods (Cumming and Henry 1961).

The reception disengagement theory received from the gerontological community was immediate – and negative, particularly among sociologists. Maddox (1964) criticized Cumming and Henry's claim that disengagement theory is intrinsic and inevitable, noting the considerable variability between study participants in the indicators of psychological and social disengagement once age was held constant (Maddox 1964). Rose (1964) was concerned with the ethnocentric assumption that disengagement is universal across societies and across time. He contended that disengagement emerged as a function of American culture, arising from Western trends in longevity and institutions like Social Security that created a new and special role for the aged (Rose 1964). Neugarten (1969) herself a part of the University of Chicago research team but who was critical of her colleagues' psychoanalytic focus, suggested that disengagement theory ignored the heterogeneity of older people noting that the Kansas City panel was comprised largely of White, upper-middle class adults. She also claimed that disengagement theory discounted the impact of social status and social structure on the aging experience (Neugarten 1969). Bengtson (1969) questioned the functionalist assumptions of the universalistic processes of disengagement. Using data from a subsequent University of Chicago cross-national study of aging directed by Havighurst and Neugarten, Bengtson showed that disengagement was not universal across societies nor across occupational groups of retirees. Instead, there were a variety of socio-emotional activity patterns – some high, some low – that linked to high levels life satisfaction (Bengtson 1969).

Fifteen years after its initial statement, the debate over disengagement theory was still going strong. Hochschild (1975) presented a

conceptual critique, arguing that disengagement theory was non-falsifiable – individuals who didn't disengage were simply labeled “unsuccessful” and maladjusted, rather than considered as counter evidence to the theory. In addition, disengagement theory presents a deterministic view of successful aging. It assumes that if older adults willingly disengage, that this is advantageous to both them and to society (Hochschild 1975).

This barrage of criticism left disengagement theory with few researchers who appeared motivated to test or modify the theory further, and the term disengagement theory appears very seldom in current gerontological research literature. However, its development represented an important historic milestone in gerontology. As a theory, as an explanation for normal human aging, it was parsimonious, data driven, and logically explicit – in short, scientific. The upshot of the disengagement theory is that it set the stage for the formulation of other gerontological theories (Achenbaum and Bengtson 1994), most notably Socioemotional Selectivity Theory (Carstensen 1995), which represents in some respects a logical extension of disengagement theory. Carstensen (1995) noted that the declines and withdrawals were not universal across all realms of engagement, but rather selective as older people decided where to place their emotional bets and where to cut their losses. This involved *socioemotional* selectivity, a process by which older people optimize coping strategies (Carstensen 1995).

### Successful Aging as a Concept or Theory

In 1961, Robert Havighurst published a journal article that introduced the term “successful aging” to the gerontological literature (Havighurst 1961); 28 years later, John Rowe and Robert Kahn published their immensely-successful book by the same title, *Successful Aging* (Rowe and Kahn 1998). Havighurst's conception of successful aging is reflected in the “activity theory” summarized above (Lemon et al. 1972; Havighurst 1961). Many of these same ideas are reflected in Rowe and Kahn's formulations for successful aging (Rowe and Kahn 1987, 1998).

Rowe and Kahn (1998) argued that most research on aging normalizes the disease process as a natural part of growing old but does not sufficiently account for differences in lifestyle, nutrition, exercise, social support, and social structure that moderate the effects of aging and determine the extent to which a person becomes disabled or ill. They classified normal aging as either *usual* or *successful*. In usual aging, extrinsic factors such as poor diet, lack of exercise, and poverty accelerate the effects of aging alone; whereas in successful aging, extrinsic factors play a neutral or positive role. These two pathways are differentiated by extrinsic factors only; Rowe and Kahn argue that there are no intrinsic factors innately linked to chronological age. In other words, disease and disability are age related, not age dependent.

Rowe and Kahn (1998) suggest that the three components of successful aging are (1) avoiding disease, (2) engagement with life, and (3) maintaining high physical and mental functioning. A person can meet these three criteria by eating healthy foods, exercising regularly, and remaining socially and intellectually active through close interpersonal relationships and productive activities that provide meaning to the older person. A major tenet of the successful aging paradigm is that aging is plastic; that is, individuals have the capacity to modify their aging trajectory through changes in lifestyle, nutrition, and other behaviors.

While Rowe and Kahn (1998) emphasize activity and social engagement as components of successful aging, they do not acknowledge Havighurst's prior theoretical work in activity theory nor the empirical work that failed to support activity theory. They also fail to explicitly discuss the contributions of disengagement theory, or how social structures and economic forces act to expand or constrict an individual's ability to age successfully according to their three principles. These are agendas for future work on the "successful aging" paradigm.

Rowe and Kahn's work transcended the academic community and was immensely popular among general audiences. A major contribution of their ideas is that they explicitly linked

sociological and psychological processes to biological outcomes: an expansion of Havighurst's early conception of "successful aging." Also, Rowe and Kahn's ideas reflect the growing focus on life course theories of aging, including cumulative advantage/disadvantage theories that guide much of the research on individual aging today.

## Conclusion

Activity theory, disengagement theory, and successful aging advanced the field of gerontology in important ways. First, all three perspectives focus attention on normative and positive aging, rather than aging as a disease. In the 1960s, disengagement and activity theories shifted the medical/physiological focus on human aging to research exploring the social and emotional lives of older adults. Decades later, Rowe and Kahn's successful aging paradigm combined the biological aspects of aging with psychosocial factors, thereby advancing interdisciplinary perspectives on aging and promoting the application of life course and developmental theories to gerontology.

Whereas the scientific community quickly dismissed disengagement theory, the principles of activity theory – mainly that older adults should stay active to remain satisfied with life – gained momentum and influence much of the research on aging today. Activity and successful aging theories profoundly influenced public policy and the development of health and social services for the aged. The ideas also guide popular discourse on how people can "successfully" adapt to the changes associated with aging, reflected in our culture's persistent desire to remain fit, productive, and mentally sharp. In addition to shaping policy, disengagement, activity, and successful aging theories helped establish gerontology as a discipline and older age as a unique stage of life.

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## Adaptive Resources of the Aging Self, Assimilative and Accommodative Modes of Coping

Jochen Brandtstädter

Department of Psychology, University of Trier,  
Trier, Germany

### Synonyms

Adaptation to disability and loss; Benefit finding; Flexibility; Goal adjustment; Goal pursuit; Resilience; Sources of meaning; Tenacity

### Definition

Resilience and well-being across the life-span hinge on the balanced interplay between two adaptive processes: On activities through which individuals try to achieve goals and maintain a desired course of personal development (assimilative activities), as well as on the adjustment of personal goals to changing action resources (accommodative processes). The concepts of assimilative persistence (or tenacious goal pursuit) and accommodative flexibility (or flexible goal adjustment) refer to individual differences in these two modes of coping.

A person's life course is generally a mixture of intended action outcomes and unintended events, of gains and losses; the balance of these factors varies on historical as well as in individual-ontogenetic dimensions of time. Given this general fact about personal development, notions of positive development and successful aging cannot be simply defined in terms of efficient goal pursuit and avoidance of loss. Rather, a comprehensive theoretical explication of these concepts also needs to consider how people cope with divergences between desired and factual developmental outcomes, how they adjust goals and ambitions to changing developmental resources and constraints, and how they can disengage without

lasting grief or regret from desired life paths that have remained unaccomplished.

Among older adults, personal potentials of action and development are often constrained by functional losses, by a shrinking of social and material resources, and not to the least by the fading of time yet-to-be-lived. Contrary to expectations, however, longitudinal and metaanalytic studies have found considerable stability in measures of well-being and subjective life quality in the transition to old age (Brandtstädter et al. 1993; Diener et al. 1999). The apparent resiliency of the aging self against experiences of loss and constraint may be considered as a further example of the so-called paradoxes of satisfaction that have often been reported in research on well-being and happiness; it becomes less paradoxical when paying heed to the dynamics of changing and adjusting ambitions and to the interplay between goal pursuit and goal adjustment.

To integrate these aspects, the dual-process model of assimilative and accommodative coping (DPM) has been proposed (Brandtstädter 2006; Brandtstädter 2007; Brandtstädter and Greve 1994; Brandtstädter and Renner 1990; Brandtstädter et al. 1998). Both modes of coping reduce goal discrepancies and divergences between actual and desired conditions of personal development, but do so in different ways. In the assimilative mode, the individual tries to avoid or diminish goal discrepancies and developmental losses by instrumental, self-corrective, or compensatory activities. A second way of neutralizing discrepancies between actual and desired states consists in adjusting goals and ambitions to given situational conditions and constraints. These latter accommodative processes involve disengagement from blocked goals and the lowering of aspirations; they come into play when active-assimilative efforts become difficult or remain futile.

The frame of personal goals and ambitions on which people base their evaluation of self and personal development changes over the life course; according to the DPM, it tends to change in ways that help to maintain a positive outlook on

self and personal development. In developmental settings and phases of life that involve changes in personal resources of control, the balanced interplay between assimilative and accommodative processes becomes a key criterion of resilience; old age is a prototypical example.

### Outline of the Dual-Process Model

The model of assimilative and accommodative coping braids together action-theoretical and developmental perspectives. Both processes are basic to the life-long process of intentional self-development (Brandtstädter and Lerner 1999; Greve et al. 2005). In contrast to assimilative activities, however, accommodative processes need not, and often cannot, be intentionally activated. Although one may eventually be able to change personal preferences, ambitions, or beliefs by strategies of self-management (which would already count as assimilative activities), one cannot bring about such changes by a simple act of will. This draws attention to the automatic mechanisms that subserve accommodative processes.

*Assimilative activities:* Assimilative activities comprise all types of intentional behavior through which people try to achieve or maintain a desired course of personal development; in later life, maintenance of resources and valued competences through prevention or compensation of loss become increasingly important as targets of assimilative effort. In the assimilative mode, attention is focused on information that seems relevant for effective goal pursuit, and cognitions that support or help to maintain an intended course of action become more available: Attractive aspects of the goal as well as beliefs related to personal efficacy and the attainability of goals are emphasized, whereas stimuli or enticements that could distract from a chosen course of action are blunted out. When obstacles impede goal attainment, cognitive resources and action reserves are mobilized, which is often supported by a reactant increase in the valence of goals.

A key feature of assimilative modes of coping is the tenacious adherence to goals. Assimilative efforts will have beneficial effects as long as personal goals are commensurate with action resources; in cases of mismatch, the intentional focus of assimilation may shift toward expanding action resources and acquiring new skills or knowledge that may be relevant to efficient goal pursuit, and eventually to activities of optimization or compensation. Optimizing and compensatory activities mark a late state of assimilative effort; they often draw on resources that are themselves subject to age-graded loss. Under conditions of prodigious loss and constraint, assimilative efforts may first increase, but then drop gradually when the costs of further goal pursuit outweigh the benefits (Brandstädter and Rothermund 2003; Brandstädter and Wentura 1995).

According to prevailing clinical notions, feelings of helplessness and depression arise when goals and desired self-representations drift out of the feasible range; from the perspective of the dual-process model, however, this is the critical point where the system shifts toward accommodation.

*Accommodative processes:* The attractive valence of goals largely derives from their relation to other goals and values; eventually goals may remain attractive even when the individual sees no way to attain them. Maintaining a commitment to barren goals, however, becomes maladaptive when it impedes reorientation toward other more promising goals. Accommodative processes counteract such states of escalated commitment. While assimilative activities are driven by the hedonic difference between current situations and intended goal-states, the adaptive function of accommodative mode essentially consists in deconstructing this difference. Facets of accommodative coping include the downgrading of, and eventually disengagement from, blocked goals, as well as a rescaling of ambitions and self-evaluative standards – processes that promote the readiness to accept given circumstances and redirect action resources toward new goals. In sum, the key characteristic of the accommodative

mode is the flexible adjustment of goals and ambitions to losses and constraints as they arise from age-graded as well as from historical changes, but likewise from critical life events that affect physical, social, and material resources.

As regards cognitive mechanisms, the accommodative mode involves an increased availability of cognitions that shed doubt on the attractiveness and attainability of the blocked goal, thus enhancing a positive reappraisal of the given situation. A heuristic-divergent, bottom-up mode of information processing supersedes the more top-down, convergent mindset that characterizes assimilation; the attentional field widens and becomes responsive again to stimuli and action tendencies that have been warded off in the assimilative phase.

*Moderating conditions:* Problems of depression and rumination indicate that the shift from assimilative to accommodative modes of coping is not always a smooth one. The DPM specifies personal and situational conditions that may selectively enhance or impede the two modes of coping. Generally, people find it more difficult to give up goals that are central to their identity and not easily substitutable by equivalent alternatives. A high degree of self-complexity, i.e. a diversified and multifocal structure of personal projects, can thus enhance accommodation. Furthermore, availability of cognitions that supports a positive reappraisal of initially aversive circumstances, as well as low beliefs of control over the critical situation, facilitate the accommodative process, but weaken the motivation to invest assimilative effort. People harboring strong self-beliefs of control are typically more enduring to reach a goal and to overcome obstacles; at the same time, however, they are more prone to unproductive persistence and more likely to miss alternative options. While partly converging with theoretical positions that emphasize the benefits of strong self-beliefs of control, the DPM also highlights potential negative effects. Such side-effects may also account for counterintuitive findings of positive correlations between measures of perceived control and depression (e.g., Coyne 1992).

## Implications for Successful Aging

Although assimilative and accommodative processes are antagonistically related, they can synergistically complement each other in concrete episodes of coping: Problems such as bodily impairment, chronic illness, or bereavement constitute a multifaceted complex of problems that often call for different ways of coping. Under limited action resources, disengagement from some goals can also facilitate the maintenance of other, more central ones. Conflicts between assimilative and accommodative tendencies may occur when goal-related efforts reach capacity limits. Such critical constellations often arise in late life, when questions of how, and into which projects, scarce action resources and life-time reserves should be invested become an acute concern. When important goals are at stake, the wavering between holding on and letting go is experienced as stressful. The accommodative process, however, engages cognitive mechanisms that eventually dissolve such conflicts.

*Dispositional differences:* Individuals differ in the degree to which they prefer, or tend to use, assimilative or accommodative ways of coping and life-management. To assess such interindividual differences, two scales are used: Tenacious Goal Pursuit (TGP) as a measure of assimilative persistence and Flexible Goal Adjustment (FGA) as a measure of accommodative flexibility. TGP and FGA constitute largely independent facets of coping competence, showing slightly negative or close to zero intercorrelations in most studies. Across all age levels, however, both scales show substantial positive correlations with measures of subjective life quality such as satisfaction, optimism, self-esteem, or emotional stability (Brandtstädter 2006; Brandtstädter and Renner 1990). Assimilative persistence and accommodative flexibility apparently improve the affect balance in different ways; while TGP seems to enhance positive affect, FGA dampens negative affect (Coffey et al. 2014; Heyl et al. 2007).

At the same time, however, TGP and FGA show opposed regressions on the age variable,

which points to an increasing dominance of accommodative over assimilative modes of coping in late adulthood. Considering the fading of action resources and the cumulation of irreversible losses in later life, this pattern conforms to theoretical predictions. A broad array of findings attests to the particular importance of accommodative flexibility for coping with age-typical problems. In moderated regression analyses, FGA has been found to dampen the negative emotional impact of losses and constraints; such buffering effects have emerged with regard to bodily impairments, health problems, losses in sensory functions, chronic pain, and problems of bereavement (e.g., Boerner 2004; Darlington et al. 2007; Kranz et al. 2010; Seltzer et al. 2004; Van Damme et al. 2008). Flexible individuals adjust their desired self more stringently to their actual self, and negative experiences in specific areas of life compromise the overall sense of well-being to a lesser degree among individuals scoring high in FGA.

A tendency to find benefits in adversity has been reported for cancer patients, accident victims, and other disadvantaged groups (Affleck and Tennen 1996). The DPM, however, does not imply a general tendency toward benefit finding. Positive reappraisals of an aversive situation would inhibit active problem-solving efforts; accordingly, the DPM proposes that palliative cognitions are more strongly expressed in the accommodative mode when aversive circumstances seem irreversible. In line with these assumptions, higher scores in the FGA were found to predict an increased availability of uplifting thoughts when subjects are confronted with threatening scenarios. Furthermore, flexible individuals are less negatively affected by the prospect of fading life-time reserves, and connotations of being old become more positive with advancing age (Rothermund et al. 1995; Wentura et al. 1995).

Although accommodative processes are triggered by a loss of control over particular goals, they can contribute to maintaining self-beliefs of control in later life. Notions of self-efficacy and control imply confidence in the attainability of

personally important goals; when such goals are no longer attainable, reducing their importance can thus help to preserve a general sense of efficacy. Considering the age-related increase of accommodative tendencies, this rationale can account in part for the stability of self-percepts of control in later life, which has repeatedly been reported (e.g., Grob et al. 1999).

Over the life span, flexible goal adjustment also enhances developmental transitions and role changes, which often require a restructuring of goals and life plans. For example, people scoring high in FGA have fewer difficulties to adjust their goals and maintain personal well-being after retirement; this holds in particular when goal changes are in accordance with the demands of the new situation (cf. Nurmi and Salmela-Aro 2002; Trépanier et al. 2001).

Further implications of the DPM for positive development and successful aging concern issues of depression, rumination, and regret.

*Depression and rumination:* People harboring strong self-beliefs of personal control and efficacy are more persistent in their efforts to cope with stressful events, and are less vulnerable to depression; the positive relationship of the TGP scale with measures of well-being converges with this well-established assumption. The DPM suggests that another important risk factor that contributes to strength and duration of depressive episodes is the inability or reluctance to let go of barren goals and life projects. At the same time, however, the model highlights possible adaptive functions of depressive mood states: The behavioral inhibition that typically accompanies them can weaken unproductive persistence and the escalating of commitment. Furthermore, a mindset of depressive realism tones down positively biased assessments of personal efficacy and of the benefits of goal attainment, biases which support assimilative persistence. From this theoretical perspective, depressive reactions not only indicate problems of shifting from assimilative to accommodative modes of coping, but at the same time can mediate this shift.

Similar arguments apply to processes of rumination, which often are part of the depressive syndrome. Ruminative thinking eventually helps

to find solutions to given problems; when it yields no results, however, attainability beliefs should be weakened and accommodative tendencies be activated. The TGP and FGA scales predict corresponding differences in ruminative styles; among people disposed toward assimilative persistence, ruminative thought primarily revolves around possible problem solutions, whereas it seems more strongly oriented toward positive reappraisal and benefit finding among flexible individuals (see Brandtstädter 2007; Brandtstädter and Rothermund 2002).

*Counterfactual emotions, regret:* Feelings of anger, disappointment, or regret typically occur when one believes that a given undesired course of events was avoidable; thus, they can help to avoid similar mistakes in the future. Moreover, anticipated regret can shield goal pursuit against situational enticements; such anticipations typically tend to overpredict the strength and duration of regret (Gilbert and Wilson 2000). From the perspective of the DPM, this bias can be explained as a joint result of the tendency to accentuate the aversiveness of failure during goal pursuit, and of processes that reduce attractiveness of goals after such failure.

Feelings of disappointment and regret indicate a persisting attachment to opportunities and goals that have remained unachieved; they tend to lose their adaptive value in late life when repairing past mistakes becomes more difficult. In the process of life-review, accommodative flexibility can thus help coming to terms with untoward biographical outcomes. In line with this assumption, the FGA scale has been found to dampen ruminative regret; this effect is particularly strong when mistakes seem irreversible (cf. Brandtstädter 2006; Brandtstädter and Rothermund 2002).

### **Accommodating Meaning Perspectives and Final Decentration**

Our activities gain motivating meaning from future-related projects; we generally assume that we will experience the outcomes of our actions and decisions. When this basic assumption becomes questionable, personal goals and

existential orientations should be profoundly affected. Loss of future meaning can breed feelings of depression and void; accommodating personal goals and life-plans to fading life-time reserves prevents such consequences. More specifically, the experience of a shrinking personal future should induce tendencies to de-emphasize, and eventually disengage from, goals centering primarily on future benefits. At the same time, it can promote an orientation towards more intrinsic, time-transcendent sources of meaning; moral or religious ideals, as well as altruistic and socio-emotional strivings, may be considered as examples.

Questionnaire studies in fact suggest that in the transition to old age, strivings of power, achievement, and competence are increasingly outranked by goals related to spirituality, altruism, and intimacy. Accommodation-theoretical perspectives suggest that the shift toward intrinsic, value-related goals primarily depend on an increasing awareness of life's finitude. This is substantiated by experiments with younger samples where mortality was made salient by a questionnaire that addressed issues of death and dying (e.g., how one would deal with a serious illness). Effects on subsequently assessed value orientations were largely similar to age-related effects, suggesting a weakening of individualistic and egocentric strivings; at the same time, tendencies of assimilative-offensive coping were significantly reduced (cf. Brandtstädter 2007; Brandtstädter et al. 2010). It is of note that clinical studies with patients suffering a terminal illness have reported a similar change toward unselfish, altruistic goals (e.g., Coward 2000).

A growing awareness of life's finitude in later life thus seems to enhance an orientation toward timeless, self-transcendent values; this particular accommodative process has been denoted as "final decentration" (Brandtstädter et al. 2010). An orientation toward time-transcendent contexts of meaning and the dampening of a sense of self-importance are often considered to be hallmarks of wisdom. Philosophical as well as psychological definitions have emphasized sensitivity for the limitations of knowledge and its importance for finding the right balance between engagement and

disengagement (e.g., Baltes and Staudinger 2000; Wink and Helson 1997) – or, as one could also put it, between assimilative and accommodative modes of life-management and coping.

## Conclusion

The model of assimilative and accommodative coping suggests that resiliency and well-being in later adulthood basically depend on the interplay of two adaptive processes: On activities that aim at preventing losses and maintaining a desired course of personal development, as well as on the flexible adjustment of personal goals and ambitions to situational constraints. These adaptive processes are functionally antagonistic, but not mutually exclusive; rather, they constitute complementary modes of maintaining self-continuity and self-esteem. The model applies to the entire life span; it specifies moderating conditions affecting the two basic processes of coping and the balance between them, thus providing a basis for explaining individual differences in coping with developmental transitions, functional losses, and critical life events. The explanatory range of the model extends to phenomena of benefit finding, rumination, regret, as well as to issues of wisdom and self-transcendence.

## Cross-References

- ▶ [Aging and Psychological Well-Being](#)
- ▶ [Life Span Developmental Psychology](#)
- ▶ [Psychology of Wisdom](#)
- ▶ [Self-Theories of the Aging Person](#)

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## Advocacy with Older Adults

Deborah A. DiGilio<sup>1</sup> and Diane Elmore<sup>2</sup>

<sup>1</sup>American Psychological Association,  
Washington, DC, USA

<sup>2</sup>Policy Program, UCLA-Duke University  
National Center for Child Traumatic Stress,  
Washington, DC, USA

### Synonyms

Advocacy; Influencing policy; Political action; Political engagement

Psychologists have significant training in science and/or clinical practice but often have less formal preparation and hands-on experience in policy and advocacy. While most psychologists have not received formal training in policy and advocacy, an understanding of and involvement in policy and advocacy activities can have a positive impact on their professional identities and on the lives of the older adults whom they serve. Such policy and advocacy engagement can also help to raise awareness of the contributions of psychological research and clinical practice in meeting the needs of older adults and marshal much needed resources for this growing segment of the population in the USA and around the world.

### The Role of Policy and Advocacy in Geropsychology

Professional psychology and geropsychology, in particular, have identified an important role for

policy and advocacy efforts across the professional lifespan. In fact, several recent professional guidance documents have included specific reference to policy and advocacy as important components of competency in geropsychology. First, Guideline 2.0 of the American Psychological Association (APA) Guidelines for Psychological Practice with Older Adults (2013) states “Psychologists strive to be knowledgeable about public policy, state and federal laws and regulations related to the provision of and reimbursement for psychological services to older adults and the business of practice. The health care landscape continues to change. Psychologists who serve older adults are encouraged to be alert to changes in health care policy and practice that will impact their professional work including practice establishment, state laws that govern practice, potential for litigation, and reimbursement for services” (American Psychological Association 2014). Next, the Pikes Peak Model for Training in Professional Geropsychology includes language that urges geropsychologists to “apply scientific knowledge to geropsychology practice and policy advocacy” which is viewed as a leadership skill to be encouraged through training, mentoring, and career development (Knight et al. 2009). Increasingly, the geropsychology community is incorporating policy engagement and advocacy as a key component of professional identity and competence.

### How Can Geropsychologists Engage in Advocacy?

There are several key elements of getting involved in advocacy, including identifying policy issues of interest, communicating and developing relationships with policymakers, providing scientific and clinical expertise to inform the policymaking process, and participating in political activities (American Psychological Association 2012). Policy engagement and advocacy may occur at the local, state, national, and international levels.

Many geropsychologists work individually and with colleagues to advocate for improvements in health and aging policies in their states and

localities. At the local level, geropsychologists serve on advisory boards of organizations such as the Alzheimer's Association, senior centers, and Area Agencies on Aging and connect with their legislators in their communities. APA's Science Directorate is building upon this focus of developing local connections with its "Stand for Science" campaign in which advocacy-trained scientists meet face-to-face with their legislators in their local offices or bring legislators and staff in to tour their campus research labs. It is hoped that the real-world value of the research that policymakers are exposed to during such interactions will help them better understand psychological science's contributions to improving health and vitality.

Geropsychologists also work alongside national organizations to impact aging policy at the national level. They have and continue to play an important role in informing and influencing the development and implementation of federal laws and initiatives related to the provision of health and aging services and support for aging research. They urge policymakers to modify existing law or enact new laws to support psychologists in addressing the needs of the older adults whom they serve. The geropsychology community has also been active in commenting on draft strategic plans of government agencies and institutes to direct greater attention to, and funding of, aging-related programming and behavioral and social science research. Examples of such advocacy include efforts to improve psychologist reimbursement rates under Medicare, amend the Older Americans Act to include a greater mental health services authority, expand the focus of the first National Plan to Address Alzheimer's Disease to include greater attention to the critical behavioral and social aspects of this disease, and authorize a comprehensive federal approach to combating elder abuse and neglect. In addition, over the last four decades, psychologists have worked to inform and influence White House Conferences on Aging (WHCoA), an important forum designed to develop recommendations for research and actions related to aging. Organizations that play a leadership role in national aging policy and advocacy in the USA include APA and

its aging divisions and sections, other professional organizations such as Psychologists in Long-Term Care and the Gerontological Society of America, and national coalitions such as the Elder Justice Coalition, the Eldercare Workforce Alliance, and the National Coalition on Mental Health and Aging.

Next, engagement from the geropsychology community on critical legal issues being considered before the courts or by judicial and legal reform task forces has also served as an important form of advocacy. These efforts often occur in collaboration with professional organizations or other stakeholder groups with common interests. Geropsychologists can participate in the preparation and submission of amicus briefs, which are "friend of the court" briefs that an individual or group who has an interest in the matter (but who is not a party to a lawsuit) can petition with the intent of influencing the court's decision. In addition, psychologists can utilize psychological science to inform policy change in elder law at the state and local levels. For example, psychologists representing APA collaborated with the American Bar Association and the National College of Probate Judges to develop a series of handbooks, including *Judicial Determination of Capacity of Older Adults in Guardianship Proceedings* (American Bar Association Commission on Aging et al. 2008). This document in turn helped to inform development of a more detailed medical certificate (guardianship and conservatorship evaluation form) in the state of Massachusetts effective in 2009, which requires information relative to the clinical diagnosis, decision-making impairment, and functional impairment of the individual, as well as the individual's values and social and risk factors and the interaction of the individual with his or her environment. Templates and processes from the *handbook* are now being utilized in other states as well as probate courts in Canada and Australia to assist in the determination of whether older adults retain their rights to self-determination.

The psychology and aging community also engages in policy development and advocacy at the global level. These opportunities include participation in efforts of the United Nations

(UN) and its Committee on Ageing, the International Association of Gerontology and Geriatrics, and HelpAge International. Professional organizations, such as the APA and others, are accredited nongovernmental organizations (NGO) at the UN. This designation affords such groups special consultative status with the UN Economic and Social Council (ECOSOC), among other benefits. APA appoints psychologists to represent the organization within the NGO community at the UN headquarters in New York. These representatives work to identify issues, organize programs and draft statements that bring psychological science and a psychological perspective to bear on global policies and programs, foster dialog and information exchange between psychologists/APA and UN diplomats/UN agencies, and serve as APA's conduit for information about the UN (American Psychological Association 2015a). Both APA and the International Council of Psychologists are members of the NGO Committee on Ageing that works to raise world awareness of the opportunities and challenges of global aging. Its advocacy efforts have included support for adoption of the UN Principles for Older Persons, input to the development of the Madrid International Plan of Action on Ageing (2002), and a focus on the development of a UN Convention on the Rights of Older Persons. Proponents of this convention, which is a multilateral agreement binding under international law second only to a treaty in formality (United Nations 2015), believe that older adults should be explicitly recognized under international human rights laws, which is not the case at present. The UN Committee on Ageing is also instrumental in planning educational events, including the annual Psychology Day at the UN as well as the International Day of Older Persons.

### **Educating and Informing Policymakers About Aging and Geropsychology**

The health and requisite long-term services and support needs of older adults and their caregivers are receiving ever-increasing attention from policymakers. While many policymakers are

aware of these issues, others are just beginning to learn about the important role of psychologists as clinicians, researchers, and educators. Other health professionals such as physicians and nurses are well known to policymakers and are often considered primary experts on health care for older persons. Significant work remains to educate and inform policymakers about the valuable expertise offered by psychologists and the range of services they provide to older adults and their families, both independently and as members of interprofessional clinical care and research teams. This work can best be carried out by psychologists who are uniquely qualified to serve as effective advocates for the field and the populations whom they serve. In order to gain necessary recognition and support, psychologists must actively engage in education and advocacy with policymakers as a core component of their professional identity.

Whether the policy issue is research funding, access to clinical services, or addressing issues of special significance to the aging population (e.g., cognitive aging, suicide prevention), it is critical that policymakers hear directly from their constituents. A common expression in US politics states that "all politics is local." This phrase refers to the significant value that policymakers must place on the basic needs of those whom they directly represent. Psychologists can play a critical role as both experts and constituents, by communicating with the policymakers who represent them both in their home districts and national offices through in-person visits, letters and e-mails, telephone calls, participation in town hall meetings, volunteering for campaigns, and exercising other rights to participate in the democratic process (American Psychological Association 2012). Policymakers are especially responsive to education and advocacy efforts that incorporate both data and anecdotal information (e.g., local or personal stories) about how particular policies and resources impact their families, community, and institutions. Such advocacy efforts by psychologists can have a significant impact on a policymaker's decision to support or oppose existing or proposed initiatives and policies.

While psychologists can inform policymakers on a broad range of issues, there are some specific

aging policy concerns for which psychologists could serve as particularly helpful educators and advocates. First, psychologists can help policymakers understand that mental health is a critical component of overall health and an important part of healthy aging. In addition, psychologists can help dispel common myths and stereotypes about aging, including dissemination of facts that explain that depression and dementia are not inevitabilities of aging and have risk factors that are amenable to intervention across the lifespan.

Both ageism and stigma continue to surround issues related to health and aging, across cultures and nations. Mental disorders are often overlooked among older adults because they may coincide with, and are attributed to, other medical illnesses or life events that commonly occur as people age (such as loss of loved ones). Misinformation and stigma often prevent those in need from seeking treatment and inhibit the development and implementation of appropriate policies to address the mental health needs of older adults.

Another issue ripe for advocacy is the lack of a sufficient health-care workforce capable of meeting the health needs of older adults. The Institute of Medicine (IOM) estimated that each year 5.6–8.0 million older adults in the USA experienced one or more of the 27 behavioral health conditions that occurred in this population (Institute of Medicine 2012). Concerns about the size and preparation of the workforce qualified to care for older adults are highly applicable to psychology, as a small number of psychologists specialize in geropsychology and there has been limited growth in their numbers (Hoge et al. 2015). Psychologists have been very engaged in advocacy on this issue individually and as part of organizational and coalition efforts.

### **Aging Policy and Advocacy at the American Psychological Association**

Advocacy efforts within APA have been guided by the philosophy that public policy should be based on available scientific knowledge and that

psychological research can contribute to the formulation of sound public policy to address specific social problems and improve human welfare (American Psychological Association 2015b).

Within APA, the Office on Aging and the Committee on Aging (CONA) have ongoing initiatives to actively advocate for the application of psychological research and clinical practice to issues affecting the health and well-being of older adults. CONA's mission statement includes this goal: "Contribute to the formulation and support of public policies and associated regulations that promote optimal development of older adults, facilitate psychological practice with older persons, and expand scientific understanding of adult development and aging" (American Psychological Association 2013). Areas of APA aging advocacy, which span the association's directorates of education, practice, public interest, and science, include building a competent workforce to serve older adults by expanding education and professional development opportunities for practitioners and researchers, increasing funding for aging research that contributes to understanding and addressing the challenges and opportunities presented by an aging society, and increasing the availability and reimbursement of publicly funded health and mental health services and integrated models of health care. Further, APA's aging efforts have focused on promoting the application of psychological knowledge to the well-being of older people, with special attention to the influences of gender, ethnicity, culture, sexual orientation, and family in science, practice, and policy relating to older adults. Such attention to diversity and culture in aging policy and advocacy is essential in meeting the needs of the global aging population, which is increasingly diverse. APA and the psychology and aging community have developed relationships with policymakers at the national and international levels focused on aging issues, including key US congressional committees (e.g., Senate Special Committee on Aging), federal agencies and departments (e.g., Administration for Community Living, Department of Veterans Affairs), and stakeholder organizations (e.g., Partnership for Health in Aging, National Alliance for Caregiving, UN Committee

on Ageing, and the World Federation of Mental Health).

Psychologists can also expand their knowledge and skills in aging policy by participating in hands-on policy education and training opportunities for psychologists and trainees, offered by APA such as the Congressional Fellowship Program, the Executive Branch Science Fellowship, and the Public Interest Policy Internship for Graduate Students. Similar programs are also open to psychologists and aging experts from other professions, including the Health and Aging Policy Fellows Program sponsored by the Atlantic Philanthropies and the John A. Hartford Foundation.

### **The Value of Collaborative and Interdisciplinary Aging Advocacy**

Much attention in recent years has focused on the value of interdisciplinary teams and collaborative models in clinical practice and research. Such models are particularly well suited for those working with older adults and on aging issues that are often complex and multidimensional. Similar value can be found in the use of collaborative and interdisciplinary approaches to aging policy development and advocacy.

In fact, many of the most successful, recent, aging policy initiatives have been collaborative in nature. Multi-organizational efforts, particularly efforts involving older adults and their families and caregivers, are viewed more favorably among policymakers than single-focused, discipline-specific efforts. Psychologists have proven to be valued partners working alongside other health, social service, and aging professionals as well as with consumers, families, and caregivers to advocate for needed aging policies. Two case examples of policy collaboration between the psychology community and aging policy allies are presented below.

#### **Example 1: The Eldercare Workforce Alliance and the Affordable Care Act**

Geropsychologists worked individually and in collaboration with the Eldercare Workforce Alliance (EWA), of which APA is a member,

on key aging-related provisions in the Affordable Care Act. EWA is an interdisciplinary coalition of nearly 30 national organizations representing physicians, nurses, psychologists, social workers, pharmacists, physical therapists, direct care workers, eldercare employers, family caregivers, and consumers committed to addressing the geriatric health-care workforce shortages. EWA and its partners worked throughout the US health reform legislative process and secured critical language related to geriatric health professions education and training in the new US health reform law. Specifically, these provisions (1) expanded Geriatric Academic Career Awards to include faculty in psychology and other disciplines, (2) authorized a new Geriatric Career Incentive Awards program to include students of psychology and other disciplines, and (3) expanded Geriatric Education Centers to include schools with programs in psychology and other disciplines. Psychologists were involved in this interdisciplinary advocacy effort in a number of ways. APA staff served in leadership roles in EWA, and psychologists participated in interdisciplinary National Advocacy Days, were highlighted in an educational video, “Advocating for Team Care for Older Adults,” and presented on interdisciplinary panels at congressional briefings on its importance. The organizations continue to work collaboratively to ensure appropriate implementation and sufficient funding of this new law.

#### **Example 2: The National Coalition on Mental Health and Aging (NCMHA) and the 2005 White House Conference on Aging (WHCoA)**

The WHCoA was first held in 1961, with subsequent conferences in 1971, 1981, 1995, 2005, and 2015. The conferences generate ideas and momentum prompting the establishment of and/or key improvements in many of the programs that represent America’s commitment to older Americans (American Psychological Association 2015c). At the 2005 White House Conference on Aging, three-quarters of the 1,200 national delegates voted to improve “recognition, assessment, and treatment of

mental illness and depression among older Americans.” This resulted in mental health being ranked in the top ten of the 50 WHCoA policy resolutions resulting from the conference. A major factor in this success was the concerted effort by the mental health and aging community, facilitated by the National Coalition on Mental Health and Aging (NCMHA). NCMHA is comprised of over 50 professional, consumer, and government member organizations that work together towards improving the availability and quality of mental health preventive and treatment services to older Americans and their families. NCMHA’s 2005 advocacy efforts were well organized, collaborative, and interdisciplinary in nature. The collective challenge of the group was how to take the available empirical evidence regarding the importance of mental health and present it to the WHCoA Policy Committee, staff, and delegates in a compelling, usable format. The NCMHA did this by developing one clear message supported by empirical evidence: “It’s not just health – it is mental health.” That is, mental health is an integral component of general health and personal well-being. This collective, yet basic, message was disseminated by the NCMHA and its member organizations over an eighteen-month period leading up to the WHCoA and carried to the conference, and that message was heard. For the first time, in the history of the WHCoA, mental and behavioral health emerged as a priority. Of note, in preparation for the 2015 WHCoA, the White House recently issued a policy brief on healthy aging, which restates the importance of optimizing behavioral health.

## Conclusion

Policy and advocacy are essential elements of a psychologist’s professional identity. The geropsychology community has a great deal to add to the health and aging policy debate locally, nationally, and globally. The seminal APA publication, “What Practitioners Should Know About

Working with Older Adults,” reminds us that psychologists can maximize their efforts to assist this large and diverse segment of our society by being “armed with facts about the myths and realities of aging, knowledgeable about the problems older adults face, cognizant of how to assess and treat older persons and familiar with the broader professional issues in aging.” (American Psychological Association 1997). As the older adult population continues to increase in size and diversity in the USA and around the world, psychologists have a professional and moral imperative to actively engage in aging policy development and advocacy.

## Cross-References

- ▶ [Age Stereotyping and Discrimination](#)
- ▶ [Attitudes and Self-Perceptions of Aging](#)
- ▶ [Mental Health and Aging](#)

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shaping a wide variety of organizational behaviors and outcomes (Barsade and Gibson 2007). Affect and emotion regulation also undergo substantial systematic (and mostly positive) changes as employees age (Scheibe and Carstensen 2010). Knowledge about age differences in affect and emotion regulation is therefore critical for researchers, managers, and employees.

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## Affect and Emotion Regulation in Aging Workers

Susanne Scheibe, Barbara Wisse and Anika Schulz  
Department of Psychology, University of Groningen, Groningen, Netherlands

### Synonyms

Affect regulation; Core affect; Emotion management; Emotional intelligence; Emotional labor; Mood

### Definition

Affect (mood, emotions) denotes a person's neurophysiological state characterized by a particular valence and activation level, such as pleasure or displeasure, arousal, or relaxation. Affect can be influenced by emotion regulation, describing the process by which a person shapes the nature, intensity, or duration of emotional experience and/or expression.

### Affect and Emotion Regulation in Aging Workers

Affect and emotion regulation are centrally involved in effective functioning in work settings,

## Basics of Affect and Emotion Regulation

*Affect* is a term denoting person's neurophysiological feeling state characterized by a particular valence and activation level, such as pleasure or displeasure, arousal, or relaxation (Russell 2003). Among affective states, moods are usually distinguished from emotions, although the difference between moods and emotions is gradual rather than categorical. Moods are relatively long lasting, lack a discernable cause, and bias cognitions more than actions. Emotions, in contrast, are more short-term reactions, arise in response to discernable events, and are more closely tied to behavior. Emotions arise when persons encounter situations that they appraise to facilitate or hamper the achievement of current concerns, goals, or tasks. Because the achievement of tasks lies at the core of behavior in organizations, emotions are highly relevant to the organizational context. The focus of the current chapter therefore will be on emotions more than moods, although moods will be considered when relevant.

Emotions have many important functions. Some of these functions are more social in nature (i.e., emotions may be used to communicate with and influence others), while others are more consequential for the person who experiences the emotion (i.e., tuning attention, providing feedback about goal progress, and facilitating action). However, emotions are not always functional or appreciated. In many work settings, employees are well advised to modulate or hide their emotions, in order to safeguard their own well-being and effectiveness or to adhere to emotional display norms. *Emotion regulation* refers to the process by which persons shape the nature, intensity,

or duration of an emotional experience and/or its expression (Gross 2015).

Emotion regulation always starts with a *goal* to change the emotion-generative process, which means that the ambition to alter the way in which a person feels is triggered (Gross 2015). This goal can be conscious or unconscious and concern own emotions or those of others, such as clients, supervisors, colleagues, or subordinates. Moreover, emotion-regulatory goals can be driven by hedonic considerations (wanting to feel pleasant emotions) or instrumental considerations (wanting to feel useful emotions; Tamir 2009). Instrumental considerations arise from the notion that affect can be a means to an end. For example, anger facilitates confrontation, happiness facilitates collaboration, joy facilitates creativity, and fear facilitates threat avoidance.

Following the activation of an emotion-regulatory goal, a *process* (or strategy) is activated to reach this goal. People usually have at their disposal many different strategies to regulate emotions, and several classification systems have been developed to organize these into more coherent families of strategies. Parkinson and Totterdell (1999) distinguish strategies based on how they are implemented – cognitively or behaviorally – and whether the intention is to engage with or disengage from the emotional event. Gross (2015) distinguishes whether the action of strategies is early (antecedent focused) or late (response focused) in the emotion-generative process. For example, reappraising an unpleasant customer interaction as a learning opportunity would be a cognitive, engagement, antecedent-focused strategy, whereas suppressing an angry look on one's face would be a behavioral, disengagement, response-focused strategy. Importantly, the various regulatory strategies rely on different capabilities (including emotional expertise, cognitive control, and physiological flexibility), and some of those are more cognitively effortful to implement than others (Consedine and Mauss 2014; Richards and Gross 2000). For instance, the antecedent-focused strategy of reappraisal has been shown to be less cognitively effortful than the response-focused strategy of suppression.

Emotion regulation strategies differ in their *outcomes* or how they impact on the unfolding emotional response and associated cognitions and behaviors. For instance, positive reappraisal of a negative event tends to reduce the extent to which negative emotions are expressed *and* experienced. In contrast, using suppression tends to reduce negative emotion expression but leaves the experience unchanged (and may even enhance physiological activation; John and Gross 2004). Because of this differential impact, the habitual use of certain strategies has downstream consequences for more distal outcomes, including social behavior, the quality of social relationships, and general well-being. In general, antecedent-focused strategies tend to have more positive social and well-being consequences than response-focused strategies and are therefore considered more adaptive in the long run.

## Age-Related Differences in Emotion Regulation

### Theories of Emotion Regulation in Adulthood

Several lifespan theories propose that aging has a substantial impact on emotion-regulation goals, processes, and outcomes. Socioemotional selectivity theory (Carstensen 2006) predicts age-related changes in emotion-regulatory goals as a function of shifts in future time perspective. As individuals grow older, they perceive their remaining time on this earth as increasingly limited, which in turn elicits a stronger focus on current well-being relative to future-oriented pursuits. With aging, goals related to knowledge acquisition, expanding one's social network, or taking risks presumably give way to goals related to nurturing existing relationships, helping others, and pursuing emotionally satisfying activities. Applied to emotion-regulation processes, this implies that emotion-regulatory goals are driven by hedonic considerations more than by instrumental ones (Tamir 2009). This will be especially apparent in situations where negative emotions can help to reach instrumental goals. When disagreeing with a coworker, for instance, younger workers may want to feel angry to more

effectively convey their point, whereas older workers may want to reduce their anger to sustain their positive mood. Preferences for specific types of affective states are also assumed to shift. As a consequence of changes in physiological flexibility, older adults increasingly prefer low-arousal affect (calm or bored) over high-arousal affect (excited or angry; Scheibe et al. 2013).

Lifespan theories also predict that age impacts on the processes and outcomes of emotion regulation. The general prediction is that capabilities needed for different emotion-regulation strategies are subject to age-related changes, leading to shifts in strategy use and effectiveness (Morgan and Scheibe 2014; Urry and Gross 2010). On the one hand, long-term experience and practice in dealing with emotional situations over time should enhance emotional expertise, making older adults generally more effective in handling their emotions (Blanchard-Fields 2007). Indeed, older people have been found to use more adaptive strategies (such as reappraisal) and less maladaptive strategies (such as suppression) in daily life (John and Gross 2004). In addition, it takes them less cognitive effort to successfully reach emotion-regulation goals (Scheibe and Blanchard-Fields 2009). Similarly, the strength and vulnerability integration theory (Charles and Luong 2013) maintains that older adults benefit from their higher emotional expertise when it comes to using emotion-regulation strategies that help to avoid or mitigate negative emotions. Older adults presumably use antecedent-focused strategies such as situation selection (avoiding conflict situations), situation modification (problem-solving), and cognitive or behavioral disengagement (distracting away from negative situations) more often and more effectively than young adults. One particularly well-supported proposition is the “positivity effect” in older adults’ information processing (Reed and Carstensen 2012). The positivity effect entails that, compared to young adults, older adults pay more attention to, and show better memory for, positive over negative information. They also pick up positive social cues more accurately than negative ones (Kellough and Knight 2012).

On the other hand, declining cognitive and physiological capabilities should diminish older adults’ advantage in using strategies that rely heavily on these capabilities. For instance, declines in physiological flexibility with age make regulation of emotional arousal more difficult (Charles and Luong 2013). Response-focused strategies, such as expressive suppression, are applied only after emotional arousal has been fully developed. Such strategies are among the most cognitively effortful (Richards and Gross 2000). Consequently, older adults are assumed to use such strategies less often than younger adults and to have no advantage over younger adults when it comes to strategy effectiveness. In sum, lifespan theories converge in the prediction that antecedent-focused emotion-regulation strategies that avoid or mitigate negative emotions are used more often and implemented more effectively with age, whereas response-focused emotion-regulation strategies are used less often and not implemented more effectively.

### Evidence from Worker Samples

While age differences in affect and emotion regulation have been extensively studied in the general aging literature, organizational researchers have only recently begun to test the generalizability of these findings to work settings. Notably, the work setting has several characteristics that have to be taken into account when studying effects of age differences. For one, the working lifespan represents only a segment of the overall period of adulthood. Given an average retirement age around 60–65 years across most industrialized countries, the label “older workers” correspond to “middle-aged adults” in the aging literature. Therefore, age differences in future time perspective and in capabilities relevant to emotion regulation are likely smaller in worker samples than in samples spanning all of adulthood. Moreover, a “healthy worker effect” must be taken into account, denoting a trend for ill-functioning older workers to leave the workforce, which makes the active workforce a positively selected group. Finally, work settings are often associated with a reduced repertoire of available emotion-regulation strategies; the choice of social partners

may be relatively restricted, and emotional display rules and work role obligations may override behavioral preferences (Davis et al. 2009).

These differences notwithstanding initial cross-sectional studies in a working population are consistent with assumptions of aging effects in emotion-regulation goals, processes, and outcomes. Most studies have been conducted in the service industry. For instance, research in the work domain seems to confirm the proposition that hedonic emotion-regulatory goals get stronger with age: When being in uncomfortable customer situations, older workers were found to report trying to control their emotions more than their younger colleagues (Johnson et al. 2013). Other studies have investigated age differences in use of emotional labor strategies, which are emotion-regulation strategies that are employed in order to align emotional experience with emotional display demands (Dahling and Perez 2010; Cheung and Tang 2010; Sliter et al. 2013). Consistent with theories of emotional aging, a converging finding is that older workers show a more adaptive profile of emotional labor strategies than younger workers do. Specifically, older workers display a more frequent use of deep acting (trying to experience the required emotion; an antecedent-focused strategy) and/or a less frequent use of surface acting (displaying the required emotion but leaving the emotional experience unchanged; a response-focused strategy). The notion that aging facilitates the use of antecedent-focused emotion-regulation strategies is further supported by the finding that older workers' required emotions align more often with naturally felt emotions than those of younger workers. Consistent with developmental theories of affect and emotion regulation, age-related differences in emotional labor strategy use were partially mediated by higher trait positive affect and self-reported emotional expertise (Dahling and Perez 2010; Sliter et al. 2013).

Studies going beyond the service industry produced less consistent findings regarding age differences in strategy use. Congruent with lifespan theories of affect and emotion regulation, a study with executives from different sectors found that older workers engage in behavioral

disengagement when facing workplace conflict (e.g., yielding, delaying responding) more than younger workers, based on behavior ratings by their coworkers (Davis et al. 2009). Young and older workers were equally likely to use active problem-solving (see also Johnson et al. 2013). However, another study with employees from different occupational sectors failed to replicate enhanced behavioral disengagement and instead found older workers to report more active problem-solving (Hertel et al. 2015). Two studies investigated self-reported use of reappraisal and suppression; one found a positive age trend for reappraisal use (Yeung et al. 2011), but the other found age to be unrelated to reappraisal use (Bal and Smit 2012). Both studies converge in finding no age difference in use of suppression.

Aside from strategy use, there is limited evidence that age may confer benefits for effective implementation of antecedent-focused emotion-regulation strategies. Use of both emotion control and problem-solving were more strongly linked with low burnout symptoms in older service workers, compared with their young colleagues (Johnson et al. 2013). In contrast, suppression has been found to be particularly ineffective for older workers (Bal and Smit 2012). Specifically, suppression mitigated the detrimental effect of psychological contract breach on positive affect in young workers but enhanced it in older workers. However, a 5-day diary study among Chinese insurance workers revealed that suppression was associated with better affect in older workers while it was unrelated to affect in young workers (Yeung and Fung 2012), thus suggesting that cultural differences may also play a role in determining age-contingent strategy effectiveness. Importantly, to the extent that older adults can effectively use antecedent-focused emotion-regulation strategies, and thereby circumvent negative situations, their effectiveness in using suppression would matter little for their well-being.

In sum, there is growing evidence in the work domain that antecedent-focused strategies (problem-solving, behavioral disengagement, deep acting) are more often and more effectively used with advanced age, whereas

response-focused strategies (suppression, surface acting) are less often and less effectively used. Yet, there are some inconsistencies in the literature, especially regarding non-service workers samples. In order to clarify the somewhat muddled picture that has emerged on the effects of aging and emotion regulation in the workplace, it will be useful to broaden the perspective. Namely, if employee aging indeed has an impact on emotion regulation, this should be reflected in age-related differences in affect-driven work outcomes. Below, three of those outcomes are considered: occupational stress and well-being, organizational behavior, and leadership.

## Consequences for Work Outcomes

### Occupational Stress and Well-Being

Given the central role of emotion regulation in shaping well-being, one may assume that the age-related changes described above have downstream positive consequences for occupational stress and well-being (Scheibe and Zacher 2013). Indeed, a meta-analysis on age differences in job attitudes revealed that older workers have higher job satisfaction, lower levels of burnout, and generally more favorable and less unfavorable job attitudes (Ng and Feldman 2010). Although age differences were only weak to moderate, they were surprisingly consistent for task-, people-, and organizational-related aspects of well-being. For example, older workers seem to have fewer signs of burnout (task based), are more satisfied with their supervisors (people based), and show stronger organizational commitment (organization based).

Age-related enhancements in occupational well-being are further implied by studies showing higher positive or lower negative affect with increasing worker age (Dahling and Perez 2010; Sliter et al. 2013; Yeung et al. 2011). Nevertheless, several cross-sectional and experience-sampling studies were unable to find significant associations between age and affect in worker samples (Bal and Smit 2012; Yeung and Fung 2012; Amabile et al. 2005; Lee and Allen 2002; Sonnentag et al. 2008). Thus, while positive age

trends in job-related attitudes and well-being appear consistently, evidence on age differences in experienced affect at work is much less convincing. An intriguing possibility that would reconcile these seemingly inconsistent findings is that older workers have as many positive affective experiences as younger workers but attend to them more and weigh them more heavily. This, in turn, may explain their higher ratings on job attitude scales. Such an explanation would be consistent with the age-related positivity effect in information processing (Luchman et al. 2012). Another possibility is that age differences are apparent in low-arousal positive affect, but not high-arousal positive affect, consistent with the shifting affective preferences with age described above. Unfortunately, prior studies have not systematically considered arousal.

Most studies investigated linear relationships between age and occupational well-being; however, some researchers have proposed that age and well-being may be related in a curvilinear manner (Clark et al. 1996). They argue that because middle-aged workers face an accumulation of demands in the work and family domain, aging benefits for occupational attitudes and well-being may not emerge until the late career. Indeed, in some studies age and occupational attitudes and well-being (i.e., job satisfaction and emotional exhaustion) were found to be related in an inverted U-shaped manner (Clark et al. 1996; Rauschenbach and Hertel 2011; Zacher et al. 2014). Note that findings like these underscore the importance of taking into account the fact that the work setting may differ in important ways across occupations.

To date, only few studies directly tested affective processes underlying the positive effects of age on well-being. In one study, older service workers' higher use of deep acting was found to mediate the positive relationship between age and job satisfaction (Cheung and Tang 2010). Another study found older workers' higher use of reappraisal to partially mediate the positive relationship between age and positive affect (Yeung et al. 2011). A third study found older workers' higher use of problem-focused coping to be associated with a reduction in self-reported strain eight

months later (Hertel et al. 2015). These initial findings are consistent with developmental theories proposing stronger emotion-regulation goals and effectiveness with age, which in turn, lead to improved well-being.

In sum, consequences of age-related changes in emotion regulation seem to have a positive effect on occupational stress and well-being. Generally, older workers are more satisfied with their jobs as they are more motivated to maintain positivity in comparison to young workers. However, as most studies investigated direct links between age and well-being outcomes, more rigorous research is needed to test emotion regulation as the underlying mechanism of this effect.

### **Organizational Behavior**

Besides occupational attitudes and well-being, affect and emotion regulation also shape organizational behavior. According to the affective events theory (Weiss and Cropanzano 1996), emotional reactions to affective work events trickle down to influence discrete work behaviors. In their emotion-centered model of voluntary work behavior, Spector and Fox (2002) posit that positive emotions will increase the likelihood that employees show organizational citizenship behaviors (e.g., assisting others, showing loyalty), whereas negative emotions will increase the likelihood of counterproductive work behaviors (e.g., coming late, neglecting instructions). Indeed, daily affective work events were shown to be linked with daily citizenship and counterproductive behaviors through emotions (attentiveness, anger, and anxiety; Rodell and Judge 2009).

Given improvements in affect and emotion regulation with age, one may expect that older workers, compared to their younger counterparts, are generally more likely to show citizenship behavior and less likely to show counterproductive behavior. There is robust evidence that this is indeed the case. A meta-analysis linking age with different aspects of job performance yielded age-related increases in citizenship behaviors and age-related reductions in counterproductive work behaviors in general, as well as age-related reductions in workplace aggression, on-the-job

substance abuse, tardiness, and voluntary absence (Ng and Feldman 2008). Given the importance of such behaviors for organizational effectiveness, these positive age trends demonstrate that older workers contribute effectively to organizational goals. Again, while it is likely that age differences in organizational behavior may at least partly be driven by aging-related changes in affective processes, empirical tests of mediating relationships are lacking to date.

### **Leadership**

Leadership is the ability of a person to influence, motivate, and enable others to contribute toward the effectiveness and success of the organization of which they are members. It has become clear that moods and emotions are deeply intertwined with this ability (Van Kleef et al. 2011): The affective states, emotion-regulation strategies, and emotional competencies of leaders affect leader behaviors and follower affective states and outcomes (Goody et al. 2010; Rajah et al. 2011). The issue of how age may affect leadership via affective processes is particularly interesting given the fact that those in leadership positions usually have a more advanced age than those they lead. This, coupled with the observation that the average age of the workforce in many countries is increasing, suggests that the share of older individuals in leadership positions will continue to grow.

Studies that have combined leader age, affective processes, and one of the potential outcomes of leadership are largely lacking, but some interesting findings have appeared. The existing research illustrates a trend toward less change-oriented behavior among older compared to young leaders (see Walter and Scheibe 2013). Young leaders tend to feel more comfortable in fast-changing environments and to be more willing to take risks and consider new approaches than older leaders do (Oshagbemi 2004). Moreover, it has been found that older leaders show more passive leadership behaviors than younger leaders: They are more likely to display laissez-faire leadership or management by exception (see Walter and Scheibe 2013).

Older leaders' relative lack of agency and change orientation and their more passive leadership behaviors seem to be in line with the above-described lifespan theoretical propositions of age-related changes in goals and strategies of emotion regulation. Specifically, they fit the premises of the socioemotional selectivity theory (Carstensen 2006) that the older people get, the more they shift in focus from future-oriented pursuits to current well-being. Such a shift in focus would arguably be reflected in people's efforts to alter the status quo, because such behaviors are usually conducted in the hope that they may pay off in the future. Likewise, older adults' tendency to prioritize positive over negative information (Reed and Carstensen 2012), and their greater attention to positive social cues than to negative ones (Kellough and Knight 2012) would diminish the perceived necessity of older leaders to act on or to interfere with the ongoing state of affairs. Additionally, older leaders' more passive leadership behaviors fit well with earlier described findings of emotion-regulation strategy shifts with age toward antecedent-focused strategies of conflict avoidance and behavioral disengagement.

Importantly, these more passive styles are not always considered to be more negative in nature. It has been argued that they are rooted in older leaders' willingness to cooperate and delegate more and that they are manifestations of older leaders' general tendency to behave themselves in a more calm and modest manner (Oshagbemi 2004). Notably, their willingness to cooperate and delegate may reflect that they place more value on establishing intimacy with others in the present and developing a sense of belonging in the social environment (Carstensen 2006), while their calm demeanor fits well with older people's general motivation to experience low-arousal positive states (Scheibe et al. 2013). In sum, age differences in affect and emotion regulation seem to have important implications for leadership, and the available evidence does seem to largely corroborate predictions from the general aging literature. Yet, continued inquiry is necessary, because studies that have combined leader age, affective processes, and potential outcomes of leadership are scarce.

## Future Research Directions

Research on affect and emotion regulation in aging workers is historically young and incomplete. In the previous sections, several gaps in the literature were pointed out that require further study. In the following, two additional fruitful avenues for future research will be suggested in domains that have so far neglected worker aging but may benefit from taking into account age-related changes in affect and emotion regulation.

### Group Affect

One interesting avenue for future research is to investigate how worker aging affects the development of group affect or the "consistent or homogeneous affective reactions within a group" (George 1990, p. 108). In organizations, where people often work in teams or subgroups, group affect develops frequently. Group affect is considered to occur as a result of affective interactive sharing processes (the dynamic pathway) and/or dispositional or contextual factors that happen to make group members feel similar (the static pathway; cf., Klep et al. 2011; Kelly and Barsade 2001). Group affect has a substantial impact on various significant outcome variables related to organizational functioning, such as cooperation, coordination, conflict, creative and analytical performance, and absenteeism (Collins et al. 2013). Therefore it is important to consider how aging may affect its development.

As described above, aging theories posit that older adults have a stronger hedonic motivation, a preference for low-arousal positive affect, and an aversion of high-arousal negative affect. As a consequence, older people often feel better or more positive than younger people do (Scheibe and Zacher 2013). Arguably, this tendency should be reflected in the development of group affect: The higher the mean age of the group members, the more likely it is that a positive group affective state will develop. This, in turn, may have positive consequences for group functioning. However, given that the development of group affect is also largely dependent on affective interactive sharing processes, it may be that it arises less

frequently in groups that have higher average age. Affective sharing processes demand that people attend to and notice other group members' affective states, so that over time people converge affectively. However, the accuracy in identifying others' emotions (i.e., emotion recognition) declines with older age, especially as far as negative emotions are concerned, because this demands high cognitive control and processing speed and a willingness to process negative information (Kellough and Knight 2012). In sum, future research may investigate the hypotheses that when average group member age increases, group affect develops less often, but if it does it is more positive in nature.

### Regulating Others' Emotions

The bulk of research on age and emotion regulation in general, and in the work context in particular, has focused on issues around the regulation of people's own emotions. In comparison, research on age differences in regulating other people's emotions is largely lacking to date. In many work situations, modifying another person's emotional experience is, however, crucial to ensuring effective job performance. Psychotherapists' job, for instance, is to change their patients' feelings in response to distressing situations (Pletzer et al. *in press*). Service workers sometimes need to calm down their emotionally aroused clients. Leaders can positively influence their subordinates by bringing them into a positive, enthusiast mood so that they are more engaged and cooperative (Sy et al. 2005). An open question is whether older workers have an advantage over their young colleagues when it comes to regulating their interaction partners' emotions, whether and when they would be motivated to do so, what emotion-regulation strategies they would use, and how effective they would be.

### Conclusion

The process of aging impacts on different facets of affect and emotion regulation. Developmental theories of emotion regulation suggest that young and older workers differ in their

emotion-regulation goals, in the recruited strategies to reach those goals, and in the outcomes of strategy use. Age-related differences in emotion regulation can help explain positive age differences a wide variety of work outcomes, including job attitudes and well-being, organizational behavior, and leadership. It appears that older adults' stronger motivation to maintain well-being and their increasing emotional expertise represent a domain of strength for older workers and help them contribute to organizational effectiveness in important ways. For future research, it will be fruitful to explore whether similarly positive age differences are found in further relevant occupational outcomes, such as group affect and the regulation of other people's emotions.

### Cross-References

- ▶ [Age-Related Changes in Abilities](#)
- ▶ [Aging and Psychological Well-being](#)
- ▶ [Conflict Management and Aging in the Workplace](#)
- ▶ [Job Attitudes and Age](#)
- ▶ [Job Crafting in Aging Employees](#)
- ▶ [Leadership and Aging](#)
- ▶ [Socioemotional Selectivity Theory](#)
- ▶ [Strength and Vulnerability Integration](#)
- ▶ [Stress and Well-being: Its Relationship to Work and Retirement for Older Workers](#)
- ▶ [Workplace Mentoring, Role of Age](#)

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## Age and Blended Working

Kiki M. M. De Jonge<sup>1</sup>, Nico W. Van Yperen<sup>2</sup> and Eric F. Rietzschel<sup>1</sup>

<sup>1</sup>University of Groningen, Groningen, The Netherlands

<sup>2</sup>Department of Psychology, University of Groningen, Groningen, The Netherlands

## Synonyms

Distributed work; Flexwork; Mobile work; Remote work; Telecommuting; Telework; Trust-based working.

## Definition

Blended working is the opportunity to blend on-site and off-site working (i.e., working location- and time-independently), which is enabled by the utilization of information and communication technologies (ICTs) that provide workers with almost constant access to job-relevant information and coworkers.

## Introduction

The workforce is aging rapidly, which means that organizations will have to learn how to manage older workers better to avoid labor shortages and a loss of organizational effectiveness (Czaja and Moen 2004). One way to do this, is to rely more on *blended working* practices, that is, the opportunity to blend on-site and off-site working enabled through modern information and communication technology (ICT) facilities (Van Yperen et al. 2014). This chapter summarizes and gives an overview of the opportunities and threats that blended working may have for older workers, and aims to show that blended working practices can be helpful to retain older workers and can keep them satisfied, motivated, and productive in their jobs.

Working from the office, having a business meeting with colleagues in a restaurant, preparing a meeting in the train, online file sharing, and work-related use of tablets and smartphones are the examples of blended working practices. Off-site working is becoming more and more common through the rise of, among others, the internet, e-mail, video calling and chat, and cloud-based data storage. These technologies provide workers with constant and location-independent access to job-relevant information and coworkers (Van Yperen et al. 2014; McLennan 2008). Obviously, not all work types are suited for blended working, as some work can only be done on-site, at specific times, or through face-to-face communication. Blended working is especially suited for knowledge and information work. These work types are becoming

increasingly common and mainly revolve around obtaining, analyzing, and sharing knowledge, activities that can mostly be performed online and away from the office (Van Yperen et al. 2014; McLennan 2008).

Another major development in the world of work is that since 2010, the global workforce is aging more rapidly than ever before, as post-World War II cohorts are reaching ages 65 and over (Hedge and Borman 2012). Many older workers are delaying their retirement as a result of the recent economic crisis (Elias et al. 2012) but also with the intention to stay productive and mentally healthy (Lee et al. 2009). For organizations, it is important to retain older workers in order to avoid, or at least lower, the forecasted shortage of 20.8 million EU workers by 2030 (Sharit et al. 2009), and to keep workers with high levels of job expertise within the organization (Hedge et al. 2006). This poses new challenges to organizations and their personnel management strategies, since working for income and benefits only does not satisfy the needs of older workers (Hedge et al. 2006). Older workers find it increasingly important to feel intrinsically motivated in their job and put a stronger emphasis on learning and accomplishing new and worthwhile things (Hedge et al. 2006). At the same time, they find it important to experience more flexibility, to have more leisure time and time for nonwork activities, and are less willing to work under high levels of stress (Hedge et al. 2006).

This suggests that implementing blended working may be particularly relevant for older workers. Blended working offers the potential to fulfill older workers' needs and desires by creating a better balance between work and nonwork activities, which can help them to stay satisfied and effective in the job. It allows older workers to (re)design their jobs in a way that suits them best and that appeals to their needs (Hedge and Borman 2012; Hedge et al. 2006; Cutler 2006). Allowing for new and different work opportunities might therefore be a relatively simple and inexpensive method to keep the aging workforce satisfied, motivated, and productive in their job (Hedge et al. 2006).

On the negative side, blended working can pose several threats to older workers' well-being and performance (Van Yperen et al. 2014; McLennan 2008). Possible threats faced by the aging workforce are low levels of experience with the computer technologies required for blended working (Elias et al. 2012), as well as stereotypes about older workers being ill suited for new computer technologies (Sharit et al. 2004). If these threats are not addressed when implementing blended working practices, organizations and their workers will not be able to reap the expected benefits and might even incur unexpected costs. Hence, we will next discuss the opportunities and threats resulting from blended working in more detail, and zoom in on the effects of blended working for the older workforce.

### Blended Working: Opportunities

Blended working has two core aspects: increased *discretion* to work from various locations and times and increased *connectedness* to job-relevant information and coworkers via ICTs. Hence, blended working can result in saving time (due to reduced commuting time) and freedom from distractions and interruptions when (partly) working from home (Van Yperen et al. 2014; Cutler 2006). Working connectedly increases (efficiency in) information access and can provide workers with information and feedback that they would not have obtained as easily or quickly otherwise (Mazmanian et al. 2005). Further, working connectedly via online devices enables workers to maintain or even extend their contact with coworkers, and to avoid social impoverishment and isolation when working off-site (Cutler 2006). Blended working, thus, offers unprecedented opportunities for workers to decide when, where, and how to work. Besides these general (potential) benefits, blended working offers some opportunities that are especially relevant for the older worker.

**Older Workers and Off-site Working.** Research in the US indicates that people working from home tend to be older than the average worker (Lister and Harnish 2011; Bailey and

Kurland 2002). Possibly, older workers have gained enough job experience and earned sufficient trust on part of the organization to make frequent off-site working a viable option (Lister and Harnish 2011). Blended working can also be particularly relevant for the older workforce, as this arrangement may help older workers to move more slowly towards retirement, enabling older workers to keep on working longer than when working traditionally at the office (Lister and Harnish 2011).

**Balancing Work and Nonwork.** Blended working increases flexibility with regard to time and location, and therefore creates the opportunity to find an optimal work-home balance (Van Yperen et al. 2014) (however, see below). This opportunity is especially relevant for older workers, as they tend to shift their emphasis more towards leisure time and nonwork activities. They often want to continue working, but only if work and nonwork activities can be aligned closer with their needs (Hedge et al. 2006). Blended working can be attractive to older workers, because it enables them to obtain this balance through new work arrangements such as compressed workweeks, reduced workdays, job sharing and part-time working, as well as working from home (Hedge and Borman 2012). The result is that older workers can combine work and nonwork activities in a way that fits their needs (Hedge et al. 2006). This increases the probability that older workers will continue their working careers and retain a positive work attitude (Hedge and Borman 2012).

**Freedom from Distractions.** Blended working offers workers the discretion to decide on their optimal workplace and schedule. This way, one can more easily avoid working at a workplace that is known to create distraction. This can be especially helpful for older workers, because stressors such as noise or an overcrowded environment distract them more easily (Hedge and Borman 2012). Having the opportunity to work at other places than the office helps them to deal with these stressors from their direct environment (Hedge and Borman 2012), which could result in their continuing to work longer than they would have in a traditional work arrangement.

**Less Need to Commute.** Blended working lowers the need to commute, as workers can combine working at the office with working from home (Cutler 2006; Thompson and Mayhorn 2012). Travelling to work everyday is thus no longer necessary. This results in efficiency and time savings, and can help to overcome mobility limitations. Older age brings health changes, and workers close to retirement age sometimes face age-related health issues or mobility limitations that can make it difficult to travel to and from the workplace (Thompson and Mayhorn 2012). As the workforce is aging, the number of people facing such issues will increase (Czaja and Moen 2004). The use of blended working practices offers older workers the possibility to manage their health issues in a secure environment (Sharit et al. 2009) and hence increases the opportunity to continue working rather than retire (Czaja and Moen 2004).

It should be noted that, while working *solely* from home can be associated with the risk of professional and social isolation (“out of sight, out of mind”) (Bailey and Kurland 2002), blended working refers to the opportunity to *combine* different ways of working (Van Yperen et al. 2014). Thus, it represents a benefit, as workers are enabled to find or create exactly the set of circumstances that work for them.

**Caregiving Responsibilities.** Given the increasing number of aging or elderly workers, it will become much more common for workers to have to provide elderly care or to take care of a sick or disabled partner or relative (Czaja and Moen 2004). In fact, the majority of workers that need to provide such care are aged 45 years or over (MacDermott 2014). Blended working represents an important opportunity for these workers, similar to the possibilities many young parents are given in order to be able to provide childcare (Hedge and Borman 2012). Blended working practices allow older workers to balance their work and family duties (Bailey and Kurland 2002) and are found to be related to increased work–family balance, lower work–family conflict, greater job satisfaction and productivity, and lower absenteeism (Hedge and Borman 2012).

## Blended Working: Threats

Despite their clear potential benefits, blended working practices can also create several challenges or threats. Some of these are not specific to older workers. For example, being able to decide when, where, and how to work may come with the cost of increased complexity, and being constantly connected can result in feelings of external control, resulting from the pressure to be constantly available (Van Yperen et al. 2014). Task ambiguity may also arise, because being continuously connected to coworkers makes it unclear whether, how, and when information will be pushed to one’s workplace, while role ambiguity can arise resulting from the increased work–home interference. Lastly, working from home increases the threat of procrastination and cyberslacking, and increases the likelihood of getting interrupted or distracted by family members (Van Yperen et al. 2014; Mazmanian et al. 2005). While the above issues apply to the working population at large, there are some possible risks that seem particularly relevant for older workers. We will discuss these below, and where possible will address ways to mitigate these risks.

**Older Workers and Technology Use.** Given that blended working requires extensive use of ICTs, it is essential that workers have the skills and confidence to use these technologies. Unfortunately, older people sometimes lack computer experience as computers were not yet available during their formal education (Elias et al. 2012). Because of this, older workers report a lower use of technology, more anxiety to start using these technologies, and are more likely to have a negative attitude towards technologies relative to younger workers (Elias et al. 2012). Whereas positive attitudes and successful experiences would result in better implementation of these technologies, anxiety often results in a negative attitude towards these technologies, and lower intentions to use these technologies (Elias et al. 2012). Research indicates that within cohorts of age 50 onwards, people are less likely to own a computer, or to use the internet or computers in general (Cutler 2006). Of those aged 65 years and

over, only about 40% uses the internet (Charness et al. 2010).

Older workers need more time to perform a computer-interactive task and make more errors while doing so relative to younger workers (Sharit et al. 2004), but this disadvantage mainly arises due to a lack of experience with these technologies rather than from chronological age itself (Hedge et al. 2006). As an increasing amount of future older workers will already have built up experience with computer technologies, this difference will probably diminish over time (Thompson and Mayhorn 2012). However, as older workers often face perceptual, physical, and cognitive declines, it may remain difficult for them to adopt rapidly changing technological innovations. Because of this, a lag in technological knowledge may continue to exist (Thompson and Mayhorn 2012).

#### **Stereotypes: Older Workers and Technology.**

Problematically, the low rate of technology use among older workers is reinforced by negative beliefs and stereotypes about them, and older people may be less likely to use new technologies because of the social expectation that their age group is less willing to do so (Cutler 2006). Stereotypes about older workers as well as age biases against older workers are often present in the workplace, and can negatively affect both the individual older worker and the organization in general (Hedge and Borman 2012; Ng and Feldman 2012). Age biases can result in age discrimination when implicit biases affect decision making and hence the opportunities given to older workers with regard to employment, promotions, or training opportunities (Hedge et al. 2006) (also see below).

Typical stereotypes about older workers and technology use (such as the belief that these workers lack the right technological experience and newest technological skills, are afraid of new technologies, and are less willing and able to accept and adapt to new technologies (Hedge and Borman 2012; Ng and Feldman 2012)) are already applied to individuals of age 40 (Elias et al. 2012). Also, older workers are thought to need more time to learn and to be slower and more forgetful. Because of this, training programs are assumed to be less effective and more costly for

older workers, which often results in denying them the right training opportunities (Hedge and Borman 2012). As older people in fact often do have less experience with new technologies, denying them training opportunities can result in their avoiding the use of new technologies altogether. The result is a self-fulfilling prophecy and a risk of stereotype threat: Their skills and knowledge in the job become outdated, which reinforces the stereotypes about older workers (Hedge et al. 2006).

**Training Older Workers.** The (possible) lack of computer experience highlights the importance of providing appropriate training opportunities for older workers, in order for them to become more familiar with computer technologies, to overcome anxiety, and accrue positive experiences with technology. Unfortunately, organizations are often resistant to provide older workers with training opportunities. This is not only because of the above-mentioned negative beliefs and stereotypes about older workers and technology use (Sharit et al. 2009; Thompson and Mayhorn 2012), but also because older workers provide fewer years in which organizations can reap the benefits of their training investments. In fact, the shorter future tenure is irrelevant, because training investments are likely to pay off within a few years. Hence, providing training to older workers who do not retire within 2–3 years or so, prevents organizations from the loss of expertise when losing these workers. As older workers are known to show low rates of absenteeism and turnover in the job, and high levels of organizational citizenship behavior, it is cost effective for organizations to give older workers the appropriate training opportunities and to retain them in the organization (Czaja and Moen 2004; Ng and Feldman 2008).

Although research indicates that older workers are somewhat resistant to engage in training activities (Ng and Feldman 2012), this is not the case for technological training (Ng and Feldman 2012). In fact, older workers are very willing to learn the technological knowledge and skills required for their job, and their experience of success when using new technologies results in favorable attitudes towards it (Czaja and Moen 2004; Cutler 2006; Ng and Feldman 2012).

To enable these positive outcomes, it is important to give the right type of training (Cutler 2006) and to include familiar tasks in the training program (Czaja and Moen 2004). Possible physical and cognitive declines need to be taken into account, and the training program must be aligned with the needs of older workers (Thompson and Mayhorn 2012; Sharit and Czaja 2012). When older workers have successful experiences with computer technologies, they experience these technologies as reducing the effort and time required to fulfill job tasks and as increasing their job performance, enabling them to keep working effectively and productively (Mitzner et al. 2010).

**Work–Home Interference.** As explained above, blended working has the potential to meet older workers' desire for a better work–home balance, because it allows them the discretion to schedule their work activities and work location as they see fit (Van Yperen et al. 2014; Hedge et al. 2006). Paradoxically, however, blended working practices also introduce the risk of increased work–home interference, as workers may feel an expectation to be constantly available and may experience a blurring of work and private life; this can put a strain on workers themselves and on their relations with partners, family members, and friends (Van Yperen et al. 2014; Mazmanian et al. 2005). This may be particularly problematic for older workers. First, older workers have a stronger need to adequately balance work and private life (and tend to put a stronger emphasis on leisure time) (Hedge et al. 2006). Secondly, older workers are more likely to face health issues, both regarding their own health (which may mean that they need more opportunities to recover from work) (Thompson and Mayhorn 2012) and the health of their partner or other family members (which means that they may need more time to fulfill caring duties) (Czaja and Moen 2004; Hedge and Borman 2012).

Successful implementation of blended working practices among an aging working population requires that these issues are explicitly addressed. The perceived pressure resulting from constant connectedness is found to be contingent on the presence or absence of a shared notion that different workers might use ICTs differently

(Mazmanian et al. 2005). Thus, it is important that older workers are not simply trained and encouraged to use new ICTs but also that they are encouraged to use them in the way that best fits their personal situation.

## Integration and Practical Implications

Blended working practices can fulfill important psychological needs, some of which are particularly salient among older workers (such as the need for a distraction-free environment or a better work–home balance), but also introduces new pitfalls – some of which, again, may be particularly relevant to older workers (such as intensive use of new technologies and having to deal with negative stereotypes). If this brief review shows anything, it is that a *contingency approach* (Bailey and Kurland 2002) is essential when it comes to the implementation of blended working practices. Older workers' job performance can increase when the work environment is changed so as to fit more closely with their needs. They prefer a work environment that does not entail many changes, that allows for a flexible approach in conducting tasks, and in which they feel supported and receive the appropriate training (Hedge and Borman 2012). Taking workers' age, needs, and motives into account will help determine how blended working can best be put into practice for each individual worker, and can give insight in what aspects would require (additional) training opportunities (Van Yperen et al. 2014).

However, as noted, negative age stereotypes often result in excluding older workers from learning and training opportunities and lower their comfort to use these technologies. It should be stressed that such stereotypes are counterproductive and inconsistent with research evidence (Thompson and Mayhorn 2012; Ng and Feldman 2012). Organizations should become aware of these (implicit) biases and start changing their knowledge about older workers in accordance with what has been shown in the literature (MacDermott 2014; Ng and Feldman 2012).

The aging workforce is a fact, not an option. Therefore, the challenge is to implement blended

working in a way that matches older workers' needs and motives, while minimizing the associated risks. While technological training can be particularly helpful in this regard, it is not simply a matter of teaching older workers new tricks. Coworkers and supervisors will need to change along with their older colleagues – not just for the benefit of their colleagues and the organization but also with an eye to their own future. After all, the world of work will continue to change, and every worker and organization should prepare for these changes as well as they can.

## Cross-References

- ▶ [Age Stereotypes in the Workplace](#)
- ▶ [Age-Related Changes in Abilities](#)
- ▶ [Job Crafting in Aging Employees](#)
- ▶ [Organizational Strategies for Attracting, Utilizing, and Retaining Older Workers](#)
- ▶ [Technology and Older Workers](#)
- ▶ [Training at Work and Aging](#)
- ▶ [Work Design and Aging](#)
- ▶ [Workplace Mentoring, Role of Age](#)

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## Age and Intraindividual Variability

Becky I. Haynes, Sarah Bauermeister and David Bunce

School of Psychology, Faculty of Medicine and Health, University of Leeds, Leeds, UK

### Synonyms

Inconsistency; Reaction time variability; Within-person variability

### Definition

Intraindividual variability is broadly defined as the fluctuation in an individual's cognitive performance over time. This can refer to the moment-to-moment fluctuation in reaction time on a single task, variation across multiple tasks in a cognitive battery, or a single task repeated over a period of days, months, or years.

### Background

While cognitive and experimental psychologists have long been interested in age differences as reflected by mean level of performance on a particular task, there has been increasing recent interest in the way that individuals vary over time. This intraindividual variability (IIV), also referred to as within-person variability and inconsistency, is not only of interest to researchers in ageing but also to researchers in several other fields (e.g., schizophrenia, attention deficit hyperactive disorder) as it may provide valuable insights into a variety of issues including personality, cognitive performance, neurological status, and a range of other individual differences.

Within geropsychology, interest in IIV has stimulated an expanding volume of research in areas including personality development, health behavior, stress and anxiety, and medical rehabilitation (see Diehl et al. 2015), for a broad

overview of current work). The present article, however, focuses on cognitive and neuropsychological work relating to IIV in older adulthood and provides an introduction to the construct, its theoretical and empirical basis, and potential not only to provide important insights into healthy and neuropathological brain ageing but also to help assessment of neurological disorders in clinical contexts. IIV can refer to within-person variability at the “macro” level (e.g., over days, months, or even years) or at the “micro” level (e.g., moment-to-moment variation recorded in milliseconds). Although variability at the macro and micro level may be related, distinctions have been made between them. For example, whereas external factors such as stress or fatigue may influence variability at a more macro level (e.g., across assessment sessions), endogenous factors related to, for instance, neurobiological disturbance may have greater influence on moment-to-moment variability as captured by successive trials of a cognitive task (Hultsch et al. 2008). A further distinction has been made between moment-to-moment variability on a single cognitive task (referred to as “inconsistency”) and variation across different cognitive tasks (referred to as “dispersion”) (Hultsch et al. 2002). As there is evidence that both types of IIV are associated, it is thought that they may capture similar underlying constructs. However, as an impressive body of work has built up around the “micro inconsistency” operationalization of the construct, and measures arising from this work have considerable potential in clinical practice, the present entry will primarily focus on intraindividual variability in reaction times (IIV<sub>RT</sub>) obtained from trial to trial for a given neurocognitive task.

IIV<sub>RT</sub> data are generally collected for an individual by recording response times (normally in milliseconds) from a series of computer-generated stimuli presented in either the visual or audio modes. Researchers have historically tended to quantify performance on such tasks by computing accuracy or calculating measures of “central tendency” such as mean or median RT. However, it has long been recognized that such within-person series of RTs exhibit varying degrees of variability

for a given cognitive task and are frequently punctuated by either phasic shifts in response speed or intermittent slower responses. Although largely ignored within experimental psychology, Nesselroade (1991) has pointed out that such within-person variation is likely to convey important information beyond that conferred by measures of central tendency. In the context of neurocognitive ageing, this has generated considerable interest as it has been suggested that IIV<sub>RT</sub> may reflect attentional lapses, or relatedly fluctuations in attentional and executive control mechanisms (Bunce et al. 1993, 2004; West et al. 2002), or at a biological level, neurobiological disturbance (e.g., Hultsch et al. 2008). Recognition that IIV represents more than random error variance has generated an expanding body of empirical research and theoretical comment, and the interested reader is directed to several authoritative sources for further information (e.g., Diehl et al. 2015; Hultsch et al. 2008).

The present entry, however, will provide an overview of the main theoretical perspectives that have been used to understand IIV<sub>RT</sub> and then, given space limitations, provide a selective review of cross-sectional and longitudinal empirical research in the ageing area. Given the importance of work demonstrating that IIV is not simply error variance, examples are provided of neuroimaging work suggesting that IIV<sub>RT</sub> varies systematically in relation to the integrity of neuroanatomical structures (e.g., white matter connective tracts) and functional brain activity. As IIV measures have the potential to provide quick-to-use assessment tools in clinical contexts, issues are then highlighted that research should address in developing the measures for possible practitioner use. In the final section, some of the broader issues are emphasized where research effort is needed to increase our understanding of IIV.

## Theoretical Perspectives on IIV<sub>RT</sub>

Theoretically, how has IIV<sub>RT</sub> been viewed? As the answer to this question is central to the interpretation of empirical research and its implications

for clinical practice, this section will briefly summarize the main perspectives and interpretations of IIV<sub>RT</sub>. Broadly, perspectives fall within methodological, cognitive, neurocognitive, or neurobiological domains.

*Error variance:* As indicated earlier, IIV, and particularly IIV<sub>RT</sub>, until recently has largely been ignored by experimental and cognitive psychologists as being random noise related to error variance attributable to a variety of sources such as accidental key presses and computer logging errors. However, the rapid development of computing power with millisecond accuracy together with the recognition that IIV varies systematically according to a range of individual differences (e.g., age) and the complexity of the cognitive task and experimental condition has largely dispelled this idea and led to the body of research forming the focus of this entry.

*Faster and slower responses reflecting similar underlying cognitive operations:* A second interpretation stems from the idea that faster and slower RTs for a given cognitive task qualitatively reflect exactly the same underlying cognitive operations, but simply take differing lengths of time to initiate and complete. However, such interpretations appear limited as (a) conceptually, they ignore the question of why a succession of trials for the same cognitive task should vary over relatively short periods of time, and (b) they do not take into account the accumulating empirical experimental, neuroimaging and clinical work that clearly demonstrates IIV to systematically vary according to a variety of individual differences and task-related factors.

*Attentional lapses and variation in attentional and executive control mechanisms:* An alternative explanation for IIV within the context of ageing has its roots in cognitive psychology and holds that response speed variation over the course of a cognitive task reflects age-related attentional lapses or, relatedly, the strength of engagement of attentional or executive control mechanisms (Bunce et al. 1993, 2004; West et al. 2002). One way to think of this is to imagine an attentional spotlight, whereby RTs of different durations reflect the extent to which the individual is focused on the task in hand; faster RTs indicate a

greater level of attentional engagement with a narrower, more focused spotlight, whereas slower RTs reflect a broader less focused attentional spotlight. Layered onto these phasic shifts in the focus of the attentional spotlight are intermittent and unusually slow RTs reflecting attentional lapses where inhibitory failure has allowed task irrelevant information (e.g., internal momentary daydreaming or external environmental disturbance) to interfere with information processing. Although such interpretations have been contentious, recent functional brain imaging work (e.g., Weissman et al. 2006) in younger adults is consistent with the view that trial-to-trial responses of differing speeds may reflect the extent to which attentional or executive control mechanisms are engaged.

*Neural noise:* An approach that integrates neurobiological perspectives proposes that age-related increases in neural noise are responsible for the broader cognitive decline observed in old age. The idea that reductions in neural signal to noise arising from age-related dopamine (one of several neurotransmitters responsible for efficient neural communication) depletion may explain behavioral increases in IIV in old age is central to recent theoretical accounts. For example, using computational modeling techniques, Li and colleagues (2001) demonstrated that modifying model parameters that simulate age-related dopamine depletion lead to more random activation during signal processing. Computationally, this parallels age-related reductions in signal to noise that compromise the distinctiveness of cortical representations. The authors argue that a behavioral consequence of this is an increase in the within-person variation of cognitive performance. Functional imaging work demonstrating a link between dopamine modulation and behavioral IIV in older adults supports the view that age-related reductions in this neurotransmitter may be one of the neurobiological mechanisms underpinning increased IIV in old age (MacDonald et al. 2012).

*Neurobiological disturbance:* Whereas later accounts of the neural noise perspective link increased IIV to a specific mechanism, dopamine depletion, this account is more generic in that it

proposes that more general age-related deterioration of the central nervous system is responsible for increased IIV in old age (e.g., Hultsch et al. 2008). Such deterioration might be related to specific neuropathology associated with, for example, the development of dementia or the consequence of major trauma such as brain injury. Evidence consistent with this view comes from work showing that increased IIV is associated with mild dementia (e.g., Hultsch et al. 2000).

## Empirical Research into Healthy and Neuropathological Ageing

Given the foregoing theoretical perspectives, what does the existing empirical literature say about age and IIV<sub>RT</sub>? The bulk of research tends to be cross-sectional, normally looking at individual differences and/or the effects of experimental manipulations of task condition. Although this work provides important insights into a range of influences on within-person variability, it says little of causal or temporal factors related to IIV. Such issues are addressed by longitudinal investigations which by comparison are in the extreme minority. Here, the main findings from cross-sectional and longitudinal studies investigating age and IIV<sub>RT</sub> are selectively reviewed.

### Cross-Sectional Studies

There are a number of cross-sectional studies that suggest a reliable increase in variability across the adult lifespan. For example, in a meta-analysis of studies taking age into account (Dykiert et al. 2012), increased IIV was found for simple or choice reaction time (RT) tasks in older (age 60+) relative to middle-aged (40–59) and younger (age 20–39) adults. As pooled effect sizes were larger for contrasts between older and younger participants than for older and middle-aged participants, the findings suggest that increased IIV is not restricted to older age, but increases gradually across the lifespan. The association between IIV and age has also been shown in more complex tasks such as memory tests and

tasks requiring attentional or executive control (e.g., Hultsch et al. 2002). Across a variety of tasks, the evidence suggests that age differences in IIV are increased with greater cognitive demands.

In addition to increases in within-person variability in healthy ageing, elevated IIV has also been shown in persons exhibiting mild cognitive impairment. As noted earlier, IIV is thought to be a marker of neurobiological disturbance and increased variability has been shown in individuals with mild dementia compared to neurologically intact controls or individuals with arthritis but no cognitive impairment (Hultsch et al. 2000). Because mild dementia is a disease of the central nervous system while arthritis is not, this study was one of the first to suggest that  $IIV_{RT}$  may be particularly sensitive to central nervous system integrity. Similarly, increased  $IIV_{RT}$  has also been shown in patients with Parkinson's disease relative to healthy controls (de Frias et al. 2012), and that this difference increases with task complexity.

## Longitudinal Studies

Although there is much less longitudinal work in the area, there is evidence that  $IIV_{RT}$  increases with age and is predictive of future cognitive decline and also of future neuropathology. For example, a large-scale study tested three age cohorts (20s, 40s, and 60s) at 4-year intervals over 8 years on simple RT and more complex choice RT tasks (Bielak et al. 2014). Multilevel modeling adjusting for a range of potential influences including education level, health background (e.g., diabetes, hypertension), anxiety, and depressive symptoms showed an increase in simple RT variability over time in the older group. Consistent with the view that more marked age effects are generally found in more complex tasks, increases were also found over time for both the 40s and 60s groups for a choice RT task, although this trend was stronger in the older group.

There is also longitudinal evidence that increased IIV may be an early marker of age-related neuropathology and is predictive of

subsequent cognitive decline. For example, one study (Lovden et al. 2007) had participants (aged 70–102 years at baseline) complete cognitive tasks, including perceptual speed and category fluency, on five occasions over a 13-year period. The results showed that longitudinal change in  $IIV_{RT}$  was highly correlated with change in level of performance. Increased  $IIV_{RT}$  temporally preceded cognitive decline, whereas lower cognitive performance had a negligible influence on subsequent change in variability. Importantly, this is one of the first studies to suggest that increased IIV may serve as an early marker of future cognitive decline.

Longitudinal evidence also indicates that increased  $IIV_{RT}$  may be an early marker of age-related neuropathology (Bielak et al. 2010). Over a 5-year period, community-dwelling older adults aged 64–92 years at baseline were grouped according to four classifications of CIND (cognitive impairment no dementia). Over the course of the study, participants either (i) remained cognitively intact, (ii) remained stable CIND, (iii) fluctuated between CIND and cognitively intact, or (iv) transitioned into CIND. Baseline  $IIV_{RT}$ , computed from multi-trial computerized tasks, not only differentiated between participants who were consistently intact and those who were stable CIND over time, but importantly identified those who transitioned into CIND.

Further evidence that IIV can predict future neuropathology comes from a longitudinal study that investigated whether change in variability distinguished between Parkinson's disease patients who did or did not develop dementia (de Frias et al. 2012). This study followed Parkinson's disease patients aged 65–84 and 43 matched controls. Participants were assessed at three time points: baseline (T1), 18 months (T2), and 36 months (T3). All participants had normal cognition at T1 and T2; however, at T3 10 Parkinson's disease patients were diagnosed with either dementia or cognitive impairment.  $IIV_{RT}$  measures were obtained from simple and choice RT tasks at T1 and T2. Change in variability differentiated the Parkinson's with dementia group from the Parkinson's patients who

remained cognitively intact and the healthy control group. Specifically, the Parkinson's with dementia group showed an increase in variability from T1 to T2, whereas the other groups did not.

$IIV_{RT}$  also predicts falls and gait impairment in old age. A recent systematic literature review (Graveson et al. 2015) identified five studies (two prospective) reporting statistically significant associations between IIV measures and falls. A further four studies investigated the association between IIV and gait impairment finding more mixed evidence of an association although this may have been due to methodological differences between studies. However, this review clearly underlines the potential of IIV measures to identify older persons at risk of falling, although more prospective studies are required in the area.

Finally, several studies have shown that in older adults, increased IIV predicts all-cause mortality at least 12 years in the future (e.g., MacDonald et al. 2008). The findings from these mortality studies are of note as they suggest that the neurological disturbance that may be related to eventual death is present more than a decade in advance of the event. These studies highlight the potential of IIV measures to identify individuals at an early stage in the course of age-related decline thereby opening possibilities for intervention.

Although a selective review, the examples of individual studies detailed above, and evidence assimilated from qualitative and quantitative reviews of the literature, are representative of the broader body of research in that IIV increases over time with age and also predicts future cognitive decline and neuropathology.

### Is IIV Systematically Related to Brain Structure and Activity?

A key part of our understanding of IIV stems from brain imaging work that suggests that  $IIV_{RT}$  is not simply random noise, but rather is systematically associated with either neuroanatomical structures or brain processes such as neurotransmitter modulation. Several studies, for example, have described the relationship between IIV and brain structural integrity reflected in magnetic

resonance imaging (MRI) measures of white matter hyperintensities (WMH, microscopic white matter lesions) or diffusion tensor imaging. For instance, a recent MRI study (Bunce et al. 2013) investigated WMH in relation to RT variability in healthy middle-aged adults. Consistent with the view that elevated IIV is associated with neurobiological disturbance, greater frontal WMH burden was related to increased  $IIV_{RT}$ . Such associations between frontal WMH and  $IIV_{RT}$  are of interest as they are consistent with the idea that attentional mechanisms supported by the frontal cortex play a key role in the degree of RT variability. As noted earlier, there is also evidence that the neurotransmitter dopamine influences the level of  $IIV_{RT}$  in old age. Positron emission tomography has been used to assess dopamine  $D_1$  binding potential in younger (mean age 25 years) and older (mean age 70 years) adults relative to  $IIV_{RT}$  on an interference task (MacDonald et al. 2012). Increased variability was associated with older age and diminished  $D_1$  binding in brain regions that form part of the attentional network (e.g., dorsolateral prefrontal cortex and anterior cingulate gyrus). The findings suggest that dysfunctional dopamine modulation in attentional networks may contribute to increased RT variability in older adults. (Although conducted in younger adults, the functional imaging study (Weissman et al. 2006) mentioned earlier also provides some interesting functional MRI evidence of the brain activity associated with IIV.)

Although several imaging studies support a systematic association between IIV and brain structures, processes, and activity, a particularly interesting insight into that association is provided by recent work suggesting that an inverse relationship may exist between behavioral measures of  $IIV_{RT}$  and variability in brain activity as measured by the blood oxygen level-dependent (BOLD) response (a measure of brain activity obtained in MRI investigations). For example, Garrett and colleagues (2011) examined the relationship between BOLD variability and IIV on three cognitive tasks (perceptual matching, attentional cueing, and delayed match to sample) in younger (aged 20–30 years) and older (aged 56–85 years) adults. Across tasks, being younger

and behaviorally faster and less variable was associated with greater BOLD variability relative to older, poorer-performing adults. This study not only provides important evidence that BOLD activity is functionally associated with IIV but also suggests that (a) BOLD variability decreases with age and (b) greater BOLD variability is related to superior behavioral performance (in this case, lower IIV). Therefore, increased variability at the neural level may reflect greater signal to noise (i.e., more distinct signal) that, in turn, feeds into higher behavioral performance marked by less within-person variability.

In sum, the accumulating evidence suggests that the level of IIV is related to the structural integrity of the brain and that behavioral IIV varies systematically as a function of brain processes and activity. Interestingly, early evidence also suggests that greater functional brain activity may be inversely related to behavioral performance and that this association may change with age.

### **What Does RT Intraindividual Variability Convey Beyond Mean RT?**

A key question concerns whether  $IIV_{RT}$  measures from a given cognitive task provide information beyond that obtained from measures of mean or median RT (i.e., measures of central tendency). Because mathematically, shifts in the intraindividual RT standard deviation are closely linked to shifts in mean RT, researchers have concerned themselves with disentangling the effects of the two measures. One approach involves adjusting for mean RT in order to confirm that IIV effects are independent. Several studies have been published in older adults relating to various outcomes that demonstrate that IIV has independent effects. For example, the aforementioned meta-analysis (Dykiert et al. 2012) investigated age effects in variability and generated pooled effect sizes for studies that adjusted variability for mean RT in contrast to studies that were not adjusted. For both simple RT and choice RT, pooled effect sizes were smaller when using mean-adjusted IIV but

remained statistically significant. This suggests that although some of the age-related increase in IIV was associated with age-related response slowing, a portion of the variance arises from other sources.

Another insight into this question comes from studies that show a dissociation between IIV and mean RT measures from the same cognitive task. That is, significant effects in relation to outcome are obtained for the IIV measure but not mean RT. For example, Hultsch and colleagues (2000) found that IIV was uniquely predictive of neurological status (mild dementia compared with healthy older adult or arthritic control groups), and structural MRI studies also indicate a dissociation between IIV and mean RT in relation to, for example, frontal white matter hyperintensities (WMH) (Bunce et al. 2013).

Together, this accumulating evidence suggests that IIV does provide unique information that measures of mean RT from the same task do not capture. Given theoretical accounts that link increased IIV to neurobiological disturbance and empirical evidence supporting the association, a key question is whether IIV measures have the potential to supplement commonly used neuropsychological assessment measures to help identify age-related neuropathology. Indeed, is it the case that these measures are particularly sensitive to the subtle early manifestations of neurological disorders and therefore have potential as early warning devices? This issue is considered in the next section.

### **Clinical Implications and Practice**

Some of the empirical studies reviewed clearly suggest that IIV measures can provide an early marker of future cognitive decline or neurological disturbance (e.g., Lovden et al. 2007; Bielak et al. 2010). This raises the possibility that the measures may have potential in clinical practice either as supplements to neuropsychological assessment batteries or as stand-alone metrics. Use of variability measures is attractive for several reasons. First, they can be administered on commonly available PCs, laptops, or tablets using

responses to stimuli appearing on a screen requiring minimal linguistic content. The measures may, therefore, possess advantages when used with individuals from culturally and linguistically diverse backgrounds. Second, administration requires minimal neuropsychological training, and assuming appropriate normative data, the measures may have considerable potential in primary healthcare. Finally, IIV measures are quick to administer. For example, a recent study in cognitively intact community-dwelling middle-aged persons (Bunce et al. 2013) found statistically reliable predictions of potential neuropathology (frontal cortex burden of WMH) were obtained from as few as 20 RT trials taking approximately 52 s to administer. Although it is not clear whether the WMH in this sample were indicative of future neuropathological disorders such as mild cognitive impairment (MCI) or dementia, the potential of  $IIV_{RT}$  measures to provide quick and simple identification of persons at risk of such disorders is clear. An important direction for future work, therefore, is to explore the potential of IIV measures in clinical contexts.

### Future Research: Gaps in Knowledge

Clearly, IIV measures may not only provide important insights into ageing neurocognitive processes but, as the foregoing section has highlighted, also provide a potential neuropsychological assessment tool in clinical contexts. Against this background there are some important gaps in our knowledge that future research needs to address.

First, to date, studies investigating  $IIV_{RT}$  have used a wide variety of cognitive tasks ranging from fairly straightforward psychomotor tasks (e.g., simple or choice RT) to more complex attentional or executive control tasks (e.g., Stroop and Flanker tasks). Although tasks of varying complexities have been shown to be significantly associated with various outcomes, a key question is what type of task and level of complexity is most suited to identifying which condition and under which circumstances. Indeed, is it possible to develop one ubiquitous “catch all” task, or are

different tasks best suited to different clinical conditions and contexts?

Relatedly, in quantifying the intraindividual standard deviation ( $SD$ ) measures used to estimate IIV, investigators have used a range of metrics including the raw  $SD$ , the coefficient of variation (intraindividual  $SD$ /intraindividual mean), ex-Gaussian parameters (i.e.,  $\mu$ ,  $\sigma$ ,  $\tau$ ), fast Fourier transformations, and procedures that statistically partial out potentially confounding effects that inflate IIV such as time-on-task effects (e.g., practice, fatigue) and individual differences (e.g., age). Though all of these measures have been found to be significantly associated with a range of outcomes, important questions again concern what is the most appropriate metric and under what circumstances. Although existing research (e.g., Lovden et al. 2007; Bunce et al. 2013) suggests that different metrics produce similar outcomes, issues such as psychometric specificity and sensitivity are important as well as the practicalities of computation and interpretation by time-pressured practitioners working in busy clinics. Research is clearly required regarding the suitability and rigor of different computations of IIV. Further evidence is also needed of the number of trials that should be administered in order to produce a reliable predictor of outcome.

Third, as noted earlier, to what extent do IIV measures provide information beyond that present in mean RT measures obtained from the same task? Although numerous studies have either adjusted for mean level of performance (either statistically or in the computation of the IIV measure itself) or demonstrated a dissociation between  $IIV_{RT}$  and mean RT tasks where the former but not the latter significantly predict outcome, more evidence is required of the independence of  $IIV_{RT}$  relative to mean RT.

Fourth, most of the research to date has been cross-sectional in nature, and so temporal relations between  $IIV_{RT}$  and outcome need to be better understood. Although research has shown IIV to be predictive of future cognitive decline, MCI, mild dementia, falls, and all-cause mortality, it is important that research provides more evidence of the measure’s predictive utility.

Finally, if clinicians are to use well-developed measures of within-person variability, metrics need to be normed while taking into account individual differences such as age and education. Importantly, consideration needs to be given to linguistic ability and cultural background. Although, in theory, straightforward psychomotor tasks involving visual stimuli may appear suitable for a range of linguistic and cultural backgrounds, research has yet to demonstrate that this is actually the case. With the multicultural profile of many cities around the world, and also reports that undetected MCI and dementia prevalence is greater among ethnic minority and immigrant groups, answers to this question are obviously of pressing importance.

## Conclusions

In summary, this selective review has described research showing that increased IIV<sub>RT</sub> is associated with a range of outcomes including greater age, MCI, mild dementia, falls in old age, and all-cause mortality. Associations have been demonstrated in both cross-sectional and longitudinal research although there is a need for more investigations in the latter category. Against this background and given that the measure is relatively straightforward and quick to administer and requires little training for practitioners, it obviously has considerable potential for neuropsychological assessment in clinical contexts. It is therefore important that further research adds to an already impressive body of evidence underlining the measure's potential as a neuropsychological assessment tool.

## Cross-References

- ▶ [Age-Related Slowing in Response Times, Causes and Consequences](#)
- ▶ [Aging and Attention](#)
- ▶ [Aging and Inhibition](#)

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## Age and the Psychological Contract

P. Matthijs Bal

School of Management, University of Bath, Bath, UK

### Synonyms

Aging workers; Employee motivation; Employment relationship; Older workers

### Definition

Psychological contracts describe the exchange relationships between employees and

organizations. It consists of the unwritten mutual obligations between the two parties. In the current chapter, three ways through which age has an impact on the psychological contract are described. First, age can have an impact on the type of obligations employees exchange with their employers. Secondly, age can have an effect through influencing the type of psychological contract (i.e., transactional or relational) employees have with their organization. Finally, age influences the responses employees show towards breach and violation of the psychological contract.

### Introduction

The aging population has important implications for workforces, organizations, and employees (Bal et al. 2015; United Nations 2009). Throughout the Western world, the average age of the populations is increasing due to decreased fertility rates, increased longevity and the baby boom generation that is currently approaching their retirement age. As a consequence, workforces will be composed more and more of older workers, and with many governments increasing the statutory retirement age, the available pool of potential employees will increasingly be consisted of older workers (Truxillo and Fraccaroli 2013). As a consequence of these changes in the workforce constitution, organizations have to adjust their policies and practices to facilitate older workers to stay and remain motivated, productive, and healthy contributors in the organization. However, very few organizations actually manage to successfully implement policies and practices to retain and motivate their older workers (Bal and Jansen 2015). One way the employment relationship between employee and organization can be understood is through the lens of the psychological contract. The psychological contract describes the exchange relationship between employees and the organization (Rousseau 1995), and is essential to understand the attitudes and behaviors of employees in their organizations. This chapter

explores how age may affect the psychological contract between employees and organizations, and explores the theoretical processes through which age has an impact on psychological contract dynamics. I describe three ways how the psychological contract is influenced by employee age. First, age can have an impact on the obligations employees exchange with their employers. This means employers and employees develop different expectations of each other when the employees become older. Secondly, age can have an effect by influencing the type of psychological contract employees have with their organization. Research has distinguished between transactional and relational contracts (Rousseau and McLean Parks 1993; Zhao et al. 2007), and previous studies have shown that age may be related to the type of contract one has with the organization (Vantilborgh et al. 2015). Finally, age influences the responses employees show towards breach and violation of the psychological contract (Bal et al. 2008). Below, each of the pathways through which age may impact the psychological contract will be outlined.

## The Psychological Contract

The psychological contract has been developed as a scientific construct in the early 1990s (Rousseau 1989, 1995), while being introduced in the early 1960s in the research of Argyris (1960) who described it as a relationship that developed between employees and their foremen at work. The relationship consisted of expectations of employees and managers about each other's behavior beyond what is traditionally defined in contracts such as the number of working hours and the remuneration. Argyris (1960) referred to this relationship as a psychological contract between the two parties, and subsequent work by Rousseau (1989, 1995) developed the construct more thoroughly. Rousseau defined the psychological contract as the employees' perceptions about the mutual written and unwritten obligations between them and their organizations. In other words, the psychological contract is a mental model about what the employee thinks the

organization should do for the employee, and what the employee should do in return. These mutual obligations may have arisen from preemployment experiences, but are also communicated via recruitment processes, communication from the organization (such as employer branding), and promises made by managers to the employee (Rousseau 1995). Key to understanding the psychological contract is its subjectivity: employees form perceptions of the mutual obligations between them and their organizations, and these perceptions lead their attitudes and behaviors (Zhao et al. 2007). Psychological contract research typically distinguishes between three ways the psychological contract can be approached; first research has focused on the *content* of the psychological contract, or the perceptions of the employee about what is exchanged between employee and organization (Conway and Briner 2005). Second, research focused on the type of psychological contract that employees have negotiated or formed with their organization, and has distinguished between transactional and relational contracts (Rousseau and McLean Parks 1993). Finally, the majority of research on psychological contracts has focused on the breach of the psychological contract and its consequences on various outcomes, such as motivation and performance (Zhao et al. 2007; Bal et al. 2008). Each of these elements of the psychological contract may be related to employee age and will be discussed in greater detail below. However, to do so, first a discussion will follow on the theoretical development of the concept of age in organizations in relation to psychological contracts.

## Theories of Age and the Psychological Contract

Research on the role of employee age in the workplace can be traced back to the early 1980s (Maehr and Kleiber 1981; Rhodes 1983). While initial interest primarily was on the direct effect age has on various work outcomes, such as job satisfaction and job performance (Avolio et al. 1990), during the last year scientific work on the role of employee age in the workplace has advanced substantially (see e.g., Kooij et al. 2008). More specifically, theory of aged heterogeneity

(Nelson and Dannefer 1992) postulates that the older people become, the more heterogeneous they become as well. Hence, recent work on aging in the workplace has acknowledged that the predictive value of employee age with respect to job attitudes and behaviors is very marginal (Bal and Jansen 2015; Kooij et al. 2008; Bal and Kooij 2011). Because the aging process is associated with various changes, including changes in personality, life styles, health, organizational experiences, and psychosocial perceptions, it has been argued that the older people become, the more different they become from their peers. Hence, older workers will also be more different from each other and therefore also show more complex patterns in relation to work-related experiences, including psychological contract perceptions, job attitudes and job behaviors. Hence, it is important to ascertain the underlying changes that cause psychological contract perceptions and job attitudes to change with age. Therefore, theories of gerontology and development psychology shed more light on the changes that people experience when aging at work. Especially the Socioemotional Selectivity Theory (SST; Carstensen 2006), and the Selective Optimization with Compensation model (SOC-model; Baltes and Baltes 1990) may inform theory about aging and psychological contracts.

Socioemotional selectivity theory states that in young adulthood time is perceived as expansive (Carstensen 2006). Young people prepare for a long and unknown future and therefore primarily focus on growth and knowledge-related goals. For older people, however, the experience of approaching the end of life causes a shift towards present-related emotional goals over knowledge goals, and a focus on emotional well-being. Older people increasingly focus on the present, and in particular on maintaining positive feelings and avoidance of negative feelings (Carstensen 2006; Carstensen and Mikels 2005). Although older people may be sensitive to emotional situations, they are more focused on maintaining positive feelings (Carstensen and Mikels 2005). The central idea of SST is that with increasing age, people have a different time perspective, and these changes in time perspective are predictive of how they perceive their psychological contract

should be, and how they react to psychological contract experiences. Time perspective causes people to shift from knowledge-related goals to emotional goals and well-being, and this also has implications for psychological contracts.

The SOC-model of aging (Baltes and Baltes 1990) postulates that people experience losses in their capabilities when they age. To cope with these losses, they will use a number of strategies to adapt to their environment, namely selection, optimization, and compensation. People select by narrowing their range of activities to fewer but more important or rewarding goals. For instance, employees may give up job responsibilities or involve others in their less central tasks because the overall workload becomes too high. Optimization refers to acquisition of, and investment in, means and abilities to achieve the goals people set in their work. For instance, people who perceive that their competencies are becoming obsolete may search for alternative strategies to maintain their performance. Finally, people compensate for losses through employing alternative means to maintain a desired level of functioning. For instance, people use pragmatic means (e.g., how they present themselves to others; Abraham and Hansson 1995) to make up for losses they experience. More specifically, people act in ways that “minimize the effects of developmental losses on the evaluation of their performance in the workplace” (Abraham and Hansson 1995, p. 96). Previous research has shown that people who are successful in employing their SOC-strategies obtain a more satisfactory level of performance at work (Kooij et al. 2008). Hence, the SOC-model may play an important role in explaining how older workers cope with age-related losses in forming their psychological contracts with the organization. Below, the chapter discusses how aging may impact the three elements of the psychological contract, based on the main theoretical notions of aging.

### **Age and Content of the Psychological Contract**

The content of the psychological contract is the first element that can be affected by employee age.

The content of the psychological contract refers to the employee's beliefs about what the employer is obligated to the employee and what the employee owns in return (Rousseau 1995). Research has shown that obligations that employees expect their organizations to deliver include financial rewards, interesting jobs, a nice working atmosphere, career development, and work-life balance (De Vos et al. 2003). Conversely, perceived employee obligations include inrole behavior, such as job performance, extra-role behaviors, flexibility, loyalty and ethical behavior (De Vos et al. 2003). Surprisingly, there is not much research on the role of age in the development of these obligations. Schalk (2004) reported that in general, employee obligations tend to increase with age, while employer obligations show a more complex pattern. Based on findings that older workers become more benevolent, Schalk (2004) concluded that older workers form a psychological contract that emphasizes the employee's contributions over that of the organization. Hence, a first conclusion is that over the life course people will expect less from their employer, while their perceptions of their own obligations may be stable even increase with aging.

Theoretically, SST predicts that older people have a more constraint future time perspective and therefore prioritize emotional goals over knowledge goals (Carstensen and Mikels 2005), and the SOC-model states that in order to cope with age-related losses, older people become more prevention-focused (Baltes and Baltes 1990). As a consequence, older workers should be less focused on employer obligations such as development, and more on obligations such as work-life balance and social atmosphere, as they are more aligned with emotional goals. However, research on the direct impact of age on perceived obligations is scarce. Bal (2009) reported a negative correlation between age and developmental obligations, but found no significant relation of age with other employer obligations. Hence, there is some tentative evidence for an effect of age on content of the psychological contract, indicating a decrease of employer developmental obligations over the life course, and increase of employee obligations with age.

## Age and Psychological Contract Types

Type of psychological contract refers to the nature of the relationship between employee and organization, and instead of describing the specific obligations which are part of the exchange relationship, types define the more generic nature of the relationship. The most often studied psychological contract types are transactional and relational contracts (Rousseau 1995). Transactional contracts refer to the short-term monetizable aspects of the relationship where there is little mutual involvement in the lives and activities of each other (Rousseau and McLean Parks 1993). The focus is purely materialistic. Relational contracts, however, entail aspects of the relationship that focus on mutual agreement with both exchanges of monetizable elements and socioemotional elements, including career development. The focus is on establishment of a long-term and open-ended relationship (Rousseau and McLean Parks 1993). Because of the focus of relational contracts on career development, it could be argued that older workers over time develop a more transactional and less relational contract. However, given the emotional nature of relational contracts, it can also be argued that older workers develop a more relational contract over time and given older workers' longer average tenure in organizations, they might also develop less transactional contracts. Research shows inconsistent patterns of relationships. A meta-analysis of Vantilborgh and colleagues (Vantilborgh et al. 2015) showed that age was negatively related to transactional contracts, while it was unrelated to relational contracts. Another study by Bal and Kooij (2011) found that the extent to which age has an impact on type of contract, depended upon how central the role of work in the lives of older workers was. While work centrality did not matter for younger workers, they found that for older workers, the centrality of work in their lives determined whether they were willing to invest in the relationship with the organization and develop a relational contract. In contrast, older workers with low work centrality were more likely to have a transactional, tit-for-tat relationship with their

organization. However, given the complex nature of the meaning of age as well as type of psychological contract, there is no definitive answer to the question whether older workers have more transactional or relational contracts.

Other research on the relation between age and types of psychological contracts has focused on the degree of balance in employer versus employee obligations (Vantilborgh et al. 2013). Vantilborgh and colleagues (2013) found that in line with the benevolence hypothesis, older workers tend to report more under obligations, while younger workers were more likely to report over obligation. This means that older workers perceived their own obligations to the organization to be higher than what the organization should do for them, while younger workers reported that the organization owed them more than they owed the organization. This indicates that while younger workers, who have more expanded future time perspectives (Carstensen 2006), focus on learning and development and consequently expect the organization to deliver upon these obligations. Older workers, however, have a lower future time perspective and therefore have lower expectations concerning what the organization should do for them, and they may fulfill their emotional goals through different means than the organization. In sum, there is mixed evidence of the relationships of age with type of psychological contract. While meta-analytic evidence suggests that older workers have less transactional contracts, there is also evidence that hints at the contingent nature of the relation between age and relational contracts, with a potential moderating effect of work centrality. Hence, the extent to which older workers develop different types of psychological contract depends upon how they experience the aging process, the role of work in their lives, and the goals they have in their lives and at work.

### **Age and Psychological Contract Breach and Violation**

The majority of studies on psychological contracts have focused on breach and violation of

the contract (Zhao et al. 2007; Bal et al. 2008). Contract breach is defined as the cognition by the employee that the employer has failed to fulfill one or more elements in the psychological contract (Morrison and Robinson 1997). Contract violation is subsequently defined as the emotional reaction following a breach. Previous meta-analytic work has shown that contract breach and violation are associated with a range of outcomes, including lower work motivation, job satisfaction, organizational commitment, and job performance, and higher employee turnover (Zhao et al. 2007; Bal et al. 2008). Hence, psychological contracts become salient for employees and organization when there is a disruption, and employees perceive a breach, since this may have severe consequences for employee attitudes and behaviors, which may be related to negative consequences for the organization as well. It is not surprising given the importance of breach that most of the research on the role of age in psychological contracts has focused on how age influences breach and reactions to breach.

The first published study on the role of age in psychological contracts was in fact a meta-analysis looking at the moderating role of age in the relations between contract breach and job attitudes (Bal et al. 2008). Based on SST, the authors argued that when workers become older, they are more focused on emotional goals and maintenance of emotional well-being, and hence when they are confronted with a negative emotional experience such as a breach, they are focused on maintaining their existing relationships. Hence, it was expected that older workers would react less intensely when a contract breach occurred as it would disrupt their relationship with the organization. Bal et al. (2008) found overall support for this hypothesis, and found that younger workers reacted more strongly to breach in relation to trust and organizational commitment. However, they also found that older workers reacted more strongly in relation to job satisfaction, and hence, more research was needed to ascertain the specific relationships.

Theoretically, SST proposes that older people have fewer future opportunities, and therefore concentrate on emotional well-being, and the

SOC-model proposes that in order to cope with age-related losses, people become more focused on prevention of losses and maintenance of well-being and current functioning (Carstensen 2006; Baltes and Baltes 1990). Hence, it is to be expected that age may have different effects on breach and violation, and in particular the way people react to breach and violation. Following these theoretical notions, a number of studies have focused on explaining the different reactions people show in response to breaches. A study of De Lange and colleagues (2011) investigated the relations between breach and work motivation, and in particular they ascertained the role of age-related factors as moderators. Based on the idea that the aging process entails different changes, they looked in particular at the role of future time perspective and regulatory focus. Their study indicated that older workers indeed experienced a lower future time perspective as well as a lower promotion (i.e., learning and development) focus. Moreover, they found that people with high future time perspective and a low prevention focus reacted more strongly to contract breach in relation to work motivation. Their study shows evidence for a mediated moderation effect: the relations of contract breach with outcomes are dependent upon employee age, but via future time perspective and regulatory focus. Taking this idea further, Bal and colleagues (2013) tested a model where the relations between breach and organizational commitment were moderated by two age-related factors: future time perspective and occupational expertise. The authors showed that while age was related to lower future time perspective, it was related to higher occupational expertise, as people develop their expertise over time. They showed that while high future time perspective (i.e., younger workers) was related to stronger reactions of breach on commitment, they also showed that high occupational expertise (i.e., older workers) also related to stronger reactions to breach. Thus, they concluded that the overall effect of age on the reactions to breach may be nullified through the differential effects age has on time perspective and expertise. Thus, by disentangling the effects age has on how people experience their environment and themselves,

the reactions to breach can be studied in greater detail. Finally, a study of Bal and Smit (2012) focused on the emotion regulation aspect of SST, and proposed that older workers may be better in regulating their emotions once a breach has occurred. They found support for this notion; the relations of psychological contract breach with positive and negative affect were moderated by age, and in line with their predictions, emotion regulation strategies were also important in relation to breach. While in general suppression of emotions is negative, the study showed that because older workers are better in expressing their emotions, suppression has adverse effects for older workers in response to breach, while it was beneficial for younger workers in response to breach. Their results show that younger workers do not yet have developed the appropriate emotion regulation strategies and therefore should be careful with expressing what they feel, while older workers in general have better skills to express themselves after a breach has occurred.

In sum, these studies show that age has a strong effect on how people react to psychological contract breach and violation. In general, older workers tend to react less intensely, but these reactions are dependent upon age-related changes people experience over their lives. Because people when they become older have fewer opportunities in their future, are less promotion-focused and more prevention-focused, they are inclined to react less intensely when they experience a contract breach. However, older workers also have accumulated skills and expertise, through which they feel more entitled and show stronger reactions to breach. Moreover, they have developed more appropriate emotion regulation skills and therefore their reactions may also be qualitatively different from those of younger workers. However, future research is needed to further ascertain how younger and older workers differ in their reactions to breach and violation.

## Conclusion

This chapter explored the role of employee age in psychological contracts. Psychological contracts

describe the unwritten, mutual obligations between employees and their organizations, and are subjectively experienced by employees. Research has shown that psychological contracts, and in particular perceptions of breach and violation, are profoundly related to various outcomes, including lower motivation, commitment and performance, and higher employee turnover (Zhao et al. 2007; Bal et al. 2008). There are three elements of the psychological contract that can be influenced by age: the content, the type, and the reactions to breach and violation. Building on theoretical notions of SST (Carstensen 2006) and the SOC-model (Baltes and Baltes 1990), age can have a three-folded effect on the psychological contract.

First, age can impact the obligations that employees perceive their organization has towards them and the obligations that employees themselves have towards their employer. While there is some research on this, indicating some benevolence of the older worker, there is still much left to be investigated. More specifically, there is little known on whether obligations become less or more important as employees grow older, and whether obligations will change more qualitatively. For instance, while work–life balance may be important for younger workers to have flexibility to develop themselves in other areas outside their work, for middle-aged workers work–life balance can be important to be able to fulfill demands from work, family, and other domains, while for older workers work–life balance may be important to balance the demands of the job with the decreased physical capabilities that are associated with the aging process (Lub et al. 2011). Hence, there may be no main effect of age on these types of obligations, but the reasons why people think their employer is obligated to deliver something may differ substantially according to someone's age, or needs resulting from age-related changes, including time perspective and prevention focus.

Second, age may have an impact on the type of relationship one has with the employer. Meta-analytic evidence shows a decline of transactional contract with age (Vantilborgh et al. 2015), but this effect may also be due to a selection of

survivors within organizations. Perhaps employees with more relational and less transactional contract may be more likely to stay in the organization, while others with a more transactional contract leave or are made redundant more easily. Hence, a negative correlation could be due to employees leaving the organizations, and older workers being the survivors within the organization. Theoretically, there are multiple reasons why older workers should have more transactional and more relational contracts, and it is through research looking at contingency factors that we obtain more understanding of the process through which older workers develop their psychological contracts over time. For instance, Bal and Kooij (2011) showed that work centrality may be an important factor that determines whether older workers still invest in their relationship with the organization, or just accept a transactional agreement that only entails a number of hours and salary in exchange for work. Hence, future research can also shed more light on the relationships between age and type of psychological contract.

Finally, age can have an effect on how people respond to psychological contract breaches. Meta-analytic work (Bal et al. 2008) and primary research has shown that older workers may show different reactions to contract breaches, but these reactions may differ depending on the age-related changes that people experience with the aging process. For instance, research of Bal et al. (2013) showed that future time perspective and occupational expertise may have contrasting effects for older workers on the relationships of breach with organizational commitment. Moreover, Bal and Smit (2012) showed the importance of emotion regulation strategies for younger and older workers, and De Lange and colleagues (2011) showed the important of time perspective and regulatory focus. In sum, these studies show that it is important to assess the underlying changes associated with age that actually cause people to perceive their psychological contract differently, and react in a different way to contract breach and violations. Age can thus have differential effects on the psychological contract, and thus via influencing the exchange relationship

between employee and organization, may have important effects on employee attitudes and behavior in the workplace. A final note should be made about the majority of research on psychological contracts, which has been primarily cross-sectional in nature, or has used limited longitudinal designs. Therefore, it is impossible to separate aging effects from generational or cohort effects in the psychological contract literature. Hence, future research should also take into account the possible generational impact on psychological contracts at work (Lub et al. 2011).

## Cross-References

- ▶ [Age Diversity At Work](#)
- ▶ [Age Stereotypes in the Workplace](#)
- ▶ [Job Attitudes and Age](#)
- ▶ [Recruitment and Selection of Older Workers](#)
- ▶ [Work Design and Aging](#)
- ▶ [Work Motivation and Aging](#)

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## Age and Time in Geropsychology

Nanna Notthoff and Denis Gerstorf  
Institute of Psychology, Humboldt University,  
Berlin, Germany

### Synonyms

Biological age; Biological clock; Historical time; Life course; Social age; Subjective age; Time perspective; Time-to-death

### Definition

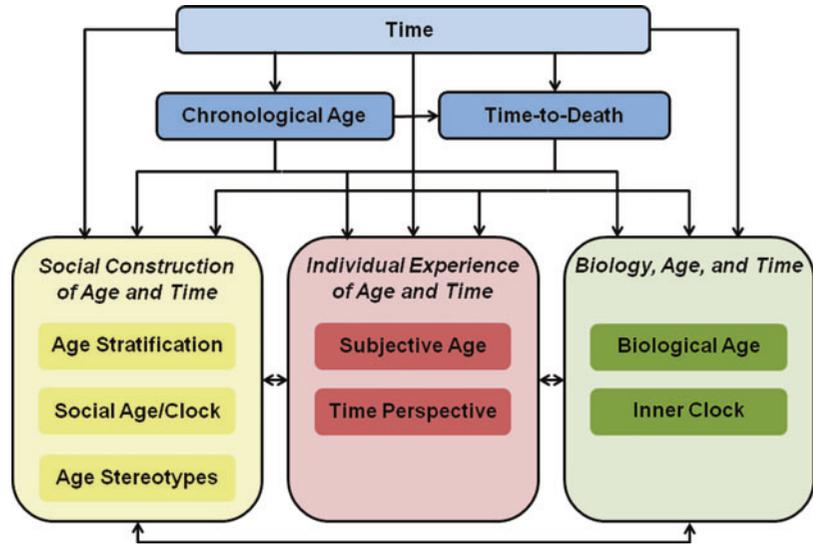
Following the Merriam-Webster dictionary, we define age (in a geropsychological context) as

“one of the stages of life,” paying particular attention to “an individual’s development measured in terms of the years requisite for like development of an average individual” (Age 2015). Similarly, we define time (in a geropsychological context) as “a nonspatial continuum that is measured in terms of events which succeed one another from past through present to future” or “the measured or measurable period during which an action, process, or condition exists or continues” (Time 2015). In this contribution of the *Encyclopedia of Geropsychology*, we illustrate the multifaceted and interwoven nature of age and time.

### Overview

Age and time are intricately intertwined. Processes of aging are often a product of the passage of time. Although human beings are highly adaptable and human development is defined by a high degree of plasticity, many functions decline with increasing age. At the same time, the finite nature of lifetime becomes progressively more salient. The goal of this contribution is to provide an overview of the various concepts and definitions related to age and time, consider how these develop as people go through life, discuss reciprocal associations between age and time (Fig. 1), and outline various approaches aimed at disentangling age- and time-related processes. First, the authors briefly review demographic developments over time that have contributed to the growing societal and scientific interest in age and aging; particular attention is paid to differences in life expectancy, health outcomes, and psychological functioning of members of different birth cohorts. The authors then explain how chronological age and time-to-death are used to situate individuals within the life course. Next, the authors turn to the influence of age and time on people’s societal embeddedness, individual experience, and biology and consider interrelations between these concepts. Additionally, relevant theories that are concerned with associations between age and time and touch on methodological challenges are presented. To conclude, the authors return to the issues revolving around the

**Age and Time in Geropsychology,**  
**Fig. 1** Interrelations between age and time and associated concepts



interrelations between age and time and deliberate to what extent scientists have been successful at disentangling the two and suggest future avenues on this quest.

## Historical Time and Age-Related Outcomes

### Aging, Life Expectancy, and Life Span in Historical Context

Although aging encompasses processes that occur throughout life and do not start at a particular number of years past birth, aging is generally associated with the later years of life. Systematic research on aging is a relatively new field. Until the 1980s, “old age” was not really recognized as part of the life course (Kohli 1986). Life expectancy or average life span, which refers to the age at which 50% of individuals are still alive, has risen dramatically over the past century. Whereas average life expectancy worldwide in 1840 was approximately 45 years in the longest-lived group of people (Swedish women; (Oeppen and Vaupel 2002)), in 2012 it was 84 years in the longest-lived country (Japan) and 70 years worldwide (World Health Organization 2014), and it seems to be continuously increasing (Oeppen and Vaupel 2002; Vaupel 2010). Thus, it is no surprise that being a certain age today means something

entirely different than it did 150 years ago. Originally, rising life expectancy could be attributed to decreases in childhood mortality. Subsequently, survival rates at higher ages grew (Vaupel 2010), meaning that death has become more concentrated in later life (Kohli 1986). Thus, mean age at death has increased, whereas variability in age at death has decreased. In contrast, the maximum life span or the age of the longest-lived human being has remained essentially the same.

About 30 years ago, Fries (1980) proposed that increases in life expectancy would be accompanied by a greater delay in the age of onset of morbidity than in the age of death; thus, the proportion of lifetime that is spent in good health would increase; this idea was referred to as compression of morbidity and has been the subject of studies in various fields over the past decades. Whether it can be concluded that morbidity has been compressed into the later years of life seems to depend on its definition. If the number of medical diagnoses of physical health conditions is considered, there is little evidence for a compression of morbidity. The age of first occurrence of various health conditions (e.g., heart attacks) has remained largely the same (Crimmins and Beltrán-Sánchez 2010). However, if morbidity is viewed as level of disability as indicated by impairments in activities of daily living (ADLs), evidence from several longitudinal studies

suggests that morbidity has, indeed, been postponed (Fries et al. 2011). There is some controversy around whether this truly constitutes a compression of morbidity because outside factors such as environments conducive to living with chronic disease and better medical treatments seem to underlie the lower incidence and prevalence of disability (Crimmins and Beltrán-Sánchez 2010). However, other experts argue that the focus should be on disability-free life expectancy, which has, indeed, increased historically (Cutler et al. 2013).

Historical improvements can also be observed in psychological measures that are related to or relevant in old age. Evidence is accumulating that compared to earlier-born cohorts, later-born cohorts have better cognitive performance and also report higher levels of well-being (Gerstorf et al. 2015). These developments are thought to be the result of a myriad of secular advances, including improvements in material and economic environments, medical practice, educational and media systems, as well as psychological resources such as reading, writing, and computer literacy.

### **Time and Organization of the Life Course**

The passage of time marks individuals' moving through the life course. People experience certain (prototypical) changes at different points of the life course; e.g., the later years of life often are associated with declines in physical functioning and gains in life experience. Time-based metrics are used to place individuals with regard to their progression throughout life.

#### **Chronological Age**

Chronological age or time since birth is still the most popular marker of situating people in the life course, even though it may not reveal "how old" an individual really "is" or "how old" an individual feels. People of the same age often show huge individual differences in a given domain of functioning; lifestyle choices and the historical period people are living in are only two of many contributing factors. Decades ago, researchers have

recognized that chronological age alone is a poor predictor of health and psychological outcomes (Neugarten 1982). Although biological factors are thought to determine the maximum life span of the human species, genetics seem to play a relatively minor role in determining individual life span, explaining only about 25–30% (Slagboom et al. 2011); they may become increasingly important in people who have survived into advanced age (Vaupel 2010). Gerontologists acknowledge that chronological age is only of limited utility for understanding individual aging, but they continue to utilize chronological age frequently in empirical research, for example, to select and describe target groups.

#### **Time-to-Death**

One approach to dealing with the huge individual differences in a given domain of functioning for people of a certain chronological age has been to focus on time-to-death or the time left in life. Compelling evidence has accumulated to indicate that the last years of life are accompanied by steep deteriorations in levels of functioning across a myriad of life domains, including physical health, sensory functioning, cognitive fitness, emotions, and well-being (Gerstorf and Ram 2013). As a consequence, time-to-death seems to be a valid predictor for healthcare expenditures and is sometimes used to determine whether certain services for older people such as hospice or palliative care should be awarded. A shift to awarding benefits and services in old age based on remaining life expectancy has its own challenges, among other things, because estimates rely on population statistics rather than individual statistics. Further operational definitions of the general time-to/from-event logic to track event-related changes in certain domains of functioning include menopause, retirement, disability, onset of a given pathology, etc. (Ram et al. 2010).

### **Social Construction of Age and Time**

People's position in the life course shapes their embeddedness within society. Chronological age is present in frameworks to formally organize the

population. Furthermore, it seems to affect social perceptions.

### Age Stratification and Social Age

Chronological age plays a big role in structuring society. Many policies are age based, meaning they only apply to people who have lived a certain number of years; the most well-known concern formal schooling and entry into retirement. In fact, retirement is frequently viewed as a marker of entering “old age.” Retirees can expect to receive a range of benefits that are based primarily on their chronological age. In recent decades, however, the call for a system that awards benefits and services based on needs has become louder because the group of retirees is by no means homogeneous (Neugarten 1982). At the same time, retirement is beginning to be a less clear-cut transition because some people work beyond the mandated retirement age, some gradually reduce their work, and still others return to work for a while after their official retirement. Still, the proportion of people who benefit from retirement pensions has increased greatly since its formal creation (Kohli 1986), and protests arise at discussions of raising retirement age by even a few years or months.

The age-group or age stratum that someone belongs to can also influence the social roles that the individual is willing or expected to play, similarly to social class. Unlike social mobility, all people move through different age strata and the associated roles; they can experience stress or stigma if they adopt or are forced into a role that is not commonly viewed as belonging into a particular age stratum (e.g., men becoming fathers at 60+ years). A relatively “normative” model of the life course allows others (e.g., employers) to judge whether someone is following an orderly progression (Kohli 1986). These types of “norms” can differ by cohort. For example, the role of grandparents has changed significantly over time. First of all, due to increased life expectancy, it is now more likely for grandparents to be alive well into their grandchildren’s childhood and youth, sometimes adulthood. Secondly, grandparents tend to be healthier than they were historically and are better able to step in to help with the care of their

grandchildren (Datan et al. 1987). Although people tend to affiliate with others of similar age outside the family and policy systems contribute to age stratification (Kohli 1986), the clear segmentation of the life course into schooling, work, and retirement is slowly dissolving (Von Maydell et al. 2006). Still, in many regions of the world, age-based policies such as a mandatory retirement age are being upheld, and attempts to eliminate or even alter them slightly tend to result in significant public opposition and reluctance.

Another way of understanding the roles that are associated with distinct times in the life course is the idea of a social clock (Helson and McCabe 1994). According to this model, a set of social norms related to age is superimposed onto the biological clock, which is supposed to reflect biological processes related to aging per se; most of these concern family and work. In the Western world, it is typically expected that people enter the workforce in their (early to mid) twenties after they have cognitively matured and completed formal schooling. Social clocks can differ between cultures. For example, expectations regarding the age at which people should enter the workforce differ between developed and developing nations.

With the surge of research on age and aging, age stratification can be observed here, too, as a way to understand the increasingly heterogeneous time of “old age.” Attempts are being made to stratify based on characteristics other than chronological age, but even among aging researchers this approach is not always implemented consistently. Neugarten (1982) was perhaps one of the first to argue for a distinction by “quality,” rather than by age. She defined the “young old” as those older adults who are still healthy and active in society; the “old old,” on the other hand, correspond to those older adults who fit traditional views of aging by showing declines in physical, mental, or social functioning and by being in need of help and care. The “young old” are also referred to as people in the “third age” and the “old old” as people in the fourth age (Baltes and Smith 2003). Third versus fourth age can be defined based on the population or the individual. In the former case, the transition from third to fourth age happens when 50% of a birth cohort have died (i.e., at

average life expectancy). Some argue for a slight modification, specifically that the transition occurs when 50% of a birth cohort who had made it to 50–60 years have died. The person-based definition, in contrast, is based on estimates of an individual's maximum life span; the shift from third to fourth age is thought to occur at the point at which future potential in terms quality of life is predominantly negative with dysfunctions and steep declines across a broad spectrum of areas of life. However, the proportion of people that reaches the fourth age has begun to grow as well. As a result, further subdivisions of “old age” have emerged, but they continue to be defined by chronological age, with young old referring to those roughly 65–74 years, middle old to those roughly 75–84 years, old old to those over age 85, and centenarians to those of at least 100 years of age.

### **Age Stereotypes: Associations with a Time Period in the Life Course**

Although “old age” is a heterogeneous time period, people most often have negative associations with it (Hummert 2011). The content of these associations ranges from views regarding physical characteristics to social status/roles and behavior; for example, “old age” is often viewed as a period of declines in physical and cognitive functioning, illness, frailty, and loneliness. Images of old age or age stereotypes can be both explicit and implicit. Positive age stereotypes also exist; they concern, for example, a gain in wisdom and experience. Age stereotypes are found across cultures, although specifics around content may differ. Older people hold age stereotypes, too; when these stereotypes are internalized and people act in accordance with them, they can have long-term consequences. For example, positive views of one's own aging are associated with increased longevity (Levy et al. 2002). Similarly to social policies, age stereotypes may also contribute to demarcation of “old age” as a special time in the life course.

### **Individual Experience of Age and Time**

Individual differences exist in the experience of both age and time. These personal views are

influential for outcomes in the health, cognitive, and social domains. Although subjective perceptions of age and time are related to chronological age, there is no one-to-one correlation.

### **Subjective Age**

The concept of subjective age considers individuals' own understanding of age. Research in this field has arisen from examination of change versus stability in personality; researchers wanted to know whether people see themselves as changing with age (Ryff 1986). Generally, study participants are asked to indicate how old they feel, and this subjective perception is linked to other domains of life, be it as antecedent or outcome. People tend to feel younger than they actually are, and the discrepancy between subjective and chronological age increases the older people are.

Subjective age is shaped by demographic developments in a given society, i.e., perceptions about aging tend to differ between societies with longer compared to shorter life expectancies (Settersten and Hagestad 2015). Additionally, subjective age is influenced by cohort membership; for example, the mentality that social class membership predetermines progression through the life course (e.g., with members of lower social classes experiencing “old age” earlier than those of higher social classes) seems to be more prevalent in earlier- compared to later-born cohorts. Societal factors continue to contribute to the evolution of subjective age. Nowadays, “age” is increasingly attributed to individual agency, which can be experienced positively when it comes to age-related gains, but can also have negative consequences in the case of age-related losses.

The concept of subjective aging has been extended by Diehl and Wahl (2010), who developed a framework of awareness of age-related change (AARC). AARC refers to an individual's awareness of changes that are the result of his or her aging; these changes can be experienced as either positive or negative. What distinguishes AARC from traditional subjective age is that it does not simply ask individuals to put a potentially arbitrary number on how old they are feeling. According to Diehl and Wahl (2010),

individuals are aware that age-related changes occur in multiple domains (health and physical functioning, cognitive functioning, interpersonal relations, social-cognitive and social-emotional functioning, and lifestyle and engagement). Measures assessing AARC therefore ask for individuals' subjective experience of changes in the form of gains or losses they have noticed in the various domains as they move through the life course. Factors influencing these subjective experiences, for example, personality traits, are currently under study. Experiences may not necessarily converge, with gains experienced in some domains and losses in others.

### Time Perspective

Time perspective captures individuals' subjective experience of time. It can be manipulated by outside factors; for example, situations that are experienced as interesting or pleasant appear to pass more quickly than boring or unpleasant situations (Schües 2014). Personal values and experiences in the present constitute the basis for interpreting the past and imagining and anticipating the future (Chappell and Orbach 1986). The experience of time emerges gradually over the course of development and is thought to be unique to humans (Wallace and Rabin 1960).

As people age, more and more life events accumulate and mark the passage of time, and thus, the sense that one is closer to the end of life is heightened (Kennedy et al. 2001). Philosophers maintain that being confronted with the finite nature of one's own life is a hallmark of age (Schües 2014). According to socioemotional selectivity theory (Carstensen et al. 1999), time perspective influences the goals that people strive for, such that those who have a relatively open-ended future time perspective (usually, younger people) prepare for that open-ended future by expanding their social networks and acquiring information, whereas those who have a more limited future time perspective (usually, older people) savor the present by seeking out meaningful relationships and situations. An additional reason for the shift in socioemotional goals associated with a reduced time perspective may be the desire or necessity to avoid losses because temporal

resources to compensate for the losses are diminishing (Brandstädter and Rothermund 2003).

The idea that meaning-making becomes increasingly important as lifetime becomes limited is also subject of other developmental theories, e.g., Frankl's theory of logotherapy and Erikson's developmental theory of psychosocial values. In Frankl's and Erikson's theories, a focus on recognizing and seeking meaning was attributed to facing death and advancing through the life course, respectively. Socioemotional selectivity theory posits that it is tied to subjective experience of time left, but the experiences that prime the fleeting nature of time do not necessarily have to be related to the end of life. Although time perspective tends to be correlated with age when comparing younger, middle-aged, and older adults, other factors can also lead to constraints in time perspective, for example, terminal illness, end of a life stage marked by a significant geographic relocation, and events that serve as reminders that life is finite (e.g., September 11 attacks, SARS epidemic). As a consequence, age and time perspective are often only moderately interrelated when solely examining older adults.

Empirical evidence has begun to accumulate that future time perspective might differ by domain. For example, people might have a constrained time perspective with regard to their occupation, but an open-ended one with regard to their health. In addition, time perspective has been shaped by historical developments (Schües 2014). Before the industrial revolution, humans depended greatly on the temporal rhythms dictated by nature, e.g., the seasons and the day-and-night cycle; nature governed when people could pursue various activities. With industrialization, people started to be able to operate relatively independently of these natural forces. The experience of time pressure became more prevalent, and nowadays, there even seems to be value placed on it. Developments in the realm of communication that permit instant exchange between people have accelerated the pace of life. Simultaneously, norms have changed such that people are expected to always be reachable. Various programs and

apps that allow their users to track their time use also promote the hastening of life's pace and the optimization of time use. However, old age might not be conducive to keeping up with this ever-increasing pace. On the one hand, some degree of slowing in physical and cognitive functions with advancing age can objectively be observed. On the other hand, the value placed on a fast-paced lifestyle would mean that older adults would be rushing toward the end of life and may not be compatible with their constrained time horizons.

## Biology, Age, and Time

More and more, attention is being devoted to figuring out the biology behind life-span developmental trajectories. The ultimate goal is to disentangle age and time.

### Biological Age

The concept of biological age is an attempt to understand age per se. Biological age is not as firmly linked to the passage of time as chronological age (Ludwig and Smoke 1982). However, it is often impossible to resolve whether degenerative processes are due to the passage of time, age, or disease. The concept of biological age acknowledges that the rate at which aging occurs varies between organs and functions, i.e., some organs age more rapidly than others, and some functions deteriorate sooner than others. For example, activities of daily living (ADLs) can be categorized by the time at which they are lost; dressing and personal hygiene fall into the early loss category, whereas toilet use, transfer, and locomotion fall into the middle loss category, and finally, bed mobility and eating are contained in the late loss category (Morris et al. 1999). "Differential development" can also be observed in the cognitive domain, meaning that different functions have divergent developmental trajectories. Specifically, crystallized intelligence (e.g., knowledge of vocabulary) is stable into old age, whereas fluid intelligence (e.g., reasoning, working memory, processing speed) starts to decline in young adulthood already (Anstey 2014). Additionally, the variability in the aging of organs differs between individuals.

An agreed-upon definition of biological age does not seem to exist (Ludwig and Smoke 1982). Some interpretations are based on manifestations of physical diseases, whereas others focus on cellular processes. Existing definitions also differ in that some rely on one indicator and others on multiple. One way to understand biological age is the notion that the more vulnerable an organism is to environmental pressures, the older the organism is biologically, presumably because underlying aging processes make the organism more susceptible. In another approach, overall morbidity is considered a proxy for biological age. A third interpretation suggests that the accumulated genetic error in somatic cells is an index for biological age. Genetic error can accrue as a result of environmental factors (physical, chemical, or biological) and of DNA replication errors. A recently developed framework (López-Otín et al. 2013) has expanded upon this latter definition and suggests that indications of age can be observed in nine areas: (1) genomic instability, (2) shortening of telomeres, (3) epigenetic alterations, (4) loss of proteostasis, (5) deregulation of nutrient sensing, (6) mitochondrial dysfunction, (7) cellular senescence, (8) exhaustion of stem cells, and (9) deregulation of intercellular communication. Regardless of which definition one adopts, biological age is measured most accurately by autopsy, looking for the types of cellular changes that are described above.

It is important to recognize that degenerative processes that are associated with biological age are influenced by behavior (Siegler and Davey 2012). Engaging in behaviors that are considered risk factors (e.g., inactivity, dwelling on negative emotions) can speed up deterioration, whereas engaging in behaviors that are considered protective factors (e.g., physical activity, seeking social support) can slow it down. This is not only true with regard to physical health, but also applies to the cognitive domain (Anstey 2014). The degree to which these risk and protective factors influence declines seems to change throughout the life course; some behaviors are more influential early on, and others kick in at the very end of life (Siegler and Davey 2012). In some cases, the biological mechanisms that underlie the link

between risk factors and health or cognition outcomes are known. For example, chronic inflammation occurs with many chronic diseases such as diabetes and impacts the functioning of the organism. Protective health behaviors may lead to the development of a “reserve capacity” that protects against behavioral and environmental risk factors. The concept of reserve capacity is not fully understood, e.g., it is unclear whether it has to be established by a certain age. The heterogeneity in the aging process points to its existence. Scientific evidence is available in some domains, e.g., cognition, where the link between cognitive engagement and preserved cognitive functioning is relatively well established. However, in many areas (e.g., link between positive social support and cognitive functioning), mechanisms linking lifestyles and outcomes remain elusive (Anstey 2014).

The concept of biological age also appears in a popular scientific context. The perhaps most well-known example is the RealAge test developed by Roizen (1999). Widgets to calculate one’s own biological age have caught on in the general public. They rely on equations that take into consideration statistics on average life expectancy at the individual’s specific age, genetic predispositions (e.g., gender, age of grandparents), health-promoting behaviors (e.g., physical activity, fruit and vegetable intake, smoking), and psychosocial factors (e.g., stressful life events, social support). Departing from an individual’s actual age, time is added for favorable genetic predispositions and lifestyles and subtracted for unfavorable ones.

### Inner Biological Clocks

Being oriented in time seems to be an important marker of functioning, and is therefore frequently used to evaluate cognitive and psychosocial status (Hendricks 2001). Many biological functions, e.g., breathing and heartbeat, only operate normally in a specific rhythm. The most obvious manifestations of the “timing” of the human organism are sleep-wake cycles or circadian rhythms. Although some individual differences exist in circadian rhythms, for example, some people operate better in the morning and others in the evening, all reasonably healthy human beings have a circadian rhythm.

Interestingly, circadian rhythms change as people get older; they shift from being monophasic in younger years to being polyphasic in older age (Chokroverty 2009). Several factors seem to contribute to this shift. First, the suprachiasmatic nucleus and the brainstem hypogenic neurons – the “inner time keepers” – change with increasing age. Second, social activity tends to transform with age. Third, older people who live in institutions such as nursing homes may be exposed to different external time cues than older adults living in the community.

Age is associated with a phase advance in the circadian rhythm such that older people wake up and sleep earlier than younger people (Chokroverty 2009). During sleep, there is a reduction of amplitude and incidence of delta waves in slow-wave sleep; a decrease in non-REM stages 3 and 4; a decrease in frequency, amount, and amplitude of sleep spindles; and a reduction in eye movements per minute in REM sleep. The cyclic pattern between REM and non-REM sleep is preserved, but the first cycle is often reduced. Although the total amount of REM sleep is shorter at advanced ages, its proportional contribution to the total amount of sleep remains the same because overall nighttime sleep amount diminishes as well.

Shifts can also be observed in body temperature rhythm, which is advanced and attenuated in older age and influences the circadian rhythm, and in EEG measures. During waking, a slowing of the alpha rhythm and an increase of fast activities, diffuse slow activity, and focal slow waves is evident. To the best knowledge of the authors, the effects of these age-related changes on psychological outcomes have not been studied systematically to date. It would, however, be highly interesting to examine if changes in EEG during waking are associated with age-related cognitive declines.

### Links Between Concepts

Time emerges as the overarching link between the concepts discussed in our contribution. The progression of time determines a person’s place

within the life course, which can be described by chronological age or time-to-death. Beyond individual lifetimes, passage of time is associated with demographic developments at the population level and with differences in significant historical events experienced by particular groups of individuals (cohorts) at distinct points in their lives. Historical time is accompanied by an evolution of norms and values, which in turn shapes societal embeddedness and individual experience of age and time. The time-based measures chronological age and time-to-death affect how individuals are perceived by society and how they perceive themselves. Interrelations between social and self-perceptions are also being uncovered, but the mechanisms explaining them are not yet well understood. Biological developments are related to chronological age and time-to-death. What remains unclear to date is how biological developments and social and self-perceptions of age and time are related.

## Methodological Issues

The interconnectedness of age and time is represented in methods used in life-span developmental research. A move toward the longitudinal study of development reflects the realization that cross-sectional comparisons do not allow us to disentangle the effect of age itself versus time (influence of the historical period or a specific cohort's reactions to historical events) on group differences (Alwin and Campbell 2001). Despite these obvious advantages, longitudinal studies to date also have a limitation in that most of them are purely observational and cannot employ any experimental manipulations (Anstey 2014). With technological evolution in the form of high-capacity computing, modeling of longitudinal change has become much more feasible.

For quite some time, life-span developmental research has employed both event-based and process-based strategies. In an event-based approach, the consequences of certain life events are examined, whereas a process-based approach focuses on gradual changes over time (Alwin and Campbell 2001). One caveat with research that

focuses only on consequences of events without considering process-based change is that it may miss the influence of factors that led to the event and the outcome of interest.

Another advance in life-span developmental research concerns the consideration of different time spans. In addition to examining outcomes over long time frames such as lifetime or years, scientists in this field are now concerned (again) with variations over shorter time frames such as days and hours. Such advances have been aided and made possible by technology. Investigations of short-term variability rely on experience sampling. Here, participants are provided with a device (e.g., smartphone, tablet) that allows them to complete self-report questionnaires (e.g., time use, emotional experience) and objective assessments (e.g., cognitive performance) on the go. An ever-growing number of activity monitors that rely on accelerometry also allows for the objective measurement of behaviors such as physical activity and sedentary behavior.

## Conclusion and Outlook

The association between age and time has been examined and described in a variety of ways. It is reflected in methodological approaches and theories in life-span developmental research and is also present in everyday life. Society dictates many age-related expectations that may have nothing to do with how old an individual feels or how old an individual "is" according to measures that are not based on the passage of time since birth. In this contribution, methods aimed at measuring "age" objectively and accurately and disentangling it from time were described, and the associated challenges were identified. The authors conclude that to date, age and time continue to have to be viewed as highly interrelated. Furthermore, approaches acknowledging high degrees of variability in individuals' subjective experience of age and time were highlighted. Future research should pinpoint how and when the various operational definitions of age and time (see Fig. 1) do and do not overlap. For example, when or for whom do biological and subjective

age converge, and how do the predictors and outcomes of different facets of age and time coincide versus diverge? In the quest to further understand the heterogeneity of “old age” and independent contributions of age and time to human development, the examination of linkages between objective measures and subjective experience seems to be the logical next step.

## Cross-References

- ▶ [Age Stereotyping and Views of Aging, Theories of](#)
- ▶ [Attitudes and Self-Perceptions of Aging](#)
- ▶ [Distance-to-Death Research in Geropsychology](#)
- ▶ [History of Longitudinal Statistical Analyses](#)
- ▶ [Life Span Developmental Psychology](#)
- ▶ [Time Perception and Aging](#)

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## Age Discrimination

Justin Marcus

Ozyegin University, Istanbul, Turkey

## Synonyms

Age Bias; Age Prejudice; Ageism

## Definition

Age discrimination refers to behaviors that unfairly discriminate against individuals and groups, either positively or negatively, on the basis of actual or perceived age, acting either implicitly or explicitly, and expressed at either the individual or institutional level. Age discrimination may thus be conceptualized as the behavioral component of the broader attitudinal variable that is ageism, whereas age prejudice represents the countervailing affective component.

## Key Concepts and Components

The definition of age discrimination in this chapter incorporates five concepts, including the ways that the age construct may be operationalized, the valence of ageist outcomes, the target's age, the ways by which ageist outcomes may be measured, and the level at which age discrimination may be expressed. These five concepts are summarized in Table 1 and further delineated by components.

## Target Age

Although ageism and age discrimination most commonly concern the study of attitudes toward older adults, and possibly because of early focus on research in age discrimination to include only older adults, recent scholarship recognizes the notion that ageism may be directed toward any individual along the spectrum of age on the basis of actual or perceived age. Most comprehensively,

**Age Discrimination, Table 1** Key Concepts and Components

Concept	Components
Target age	Young Old
Age operationalization	Objective Subjective
Outcome valence	Positive Negative
Measurement	Implicit Explicit
Level of expression	Individual Institutional

research by Finkelstein et al. (2012) has documented type and prevalence of both positive and negative stereotypes and meta-stereotypes toward both younger and older adults.

### Age Operationalization

Age may be either objective chronological age or subjective perceived age – the age that an individual, or others, view him or her to be (Kooij et al. 2008). Illustratively, some older individuals may appear younger than their age, and may therefore be subjectively perceived as younger than the typical individual in their age-group; vice versa for younger individuals who appear older than their age.

### Outcome Valence

In line with evidence establishing older adults to fall into the incompetent but warm quadrant of the stereotype content model (Fiske et al. 2002), the definition recognizes that age discrimination may be either positive (benevolent ageism) or negative (hostile ageism).

### Measurement

Explicit age discrimination refers to conscious and controllable behaviors elicited toward individuals on the basis of their age. In contrast, implicit age discrimination refers to such countervailing behaviors that exist and operate without conscious awareness, intention, or control (Levy and Banaji 2002). Whereas explicit age discrimination is most commonly measured through self-report or observation, implicit age discrimination may be measured via measures of

implicit social cognition, such as the implicit-association test (IAT), or via stereotype priming (see Levy and Banaji (2002) for a review).

### Level of Expression

Age discrimination may be expressed interindividually, by individual actors toward other individuals and acting on the basis of their actual or perceived age, or may be expressed at the broader institutional level, in terms of governmentally regulated social policy, normative social conventions within an industry or sector, or organizational practices (see Iversen et al. (2009) for a review). Illustratively, institutional age discrimination may include events such as governments denying scholarships for graduate education for individuals above a certain age, birthday cards poking fun at individuals on the basis of their age, or organizations denying promotions to individuals on the basis of their age.

### History and Evolution of Definitions

Early research on age discrimination took place during the 1950s and focused exclusively on attitudes toward older adults (i.e., individuals advanced in chronological age). In what was perhaps the very earliest study of the phenomenon, Tuckman and Lorge (1952) examined age discrimination against older workers by graduate students. Other early researchers studying age as a facet of group identity in the 1950s, 1960s, and 1970s likewise followed suit and studied only older adults and workers. The term “ageism” was first introduced by Robert Butler to describe this topic of study in the mid-twentieth century (Butler 1969, 1975, 1980). Over two dozen formal definitions of ageism have since appeared in the extant literature. A comprehensive review of all definitions of ageism, excepting the newest definitions, such as those provided by Bal et al. (2011) and Posthuma et al. (2012), may be found in Iversen et al. (2009).

### Target Age

Perhaps as a result of the early focus in the mid-twentieth century on exclusively older adults

and workers, Butler's (1975, 1980) definitions indicated ageism as applying only to "older adults" and the "elderly." Surprisingly, Butler's original 1969 definition recognized ageism as existing toward all age-groups, but his later definitions became, for no apparent reason, narrower. Concomitantly, conceptualizations of age discrimination have been mixed with regard to the operationalization of age, with some authors defining age discrimination as applying to both younger and older adults (e.g., Finkelstein et al. 2012) and some authors defining it as the exclusive province of older adults (e.g., Iversen et al. 2009; Posthuma et al. 2012).

To an extent, this inconsistency may reflect debate within the scientific community itself, with the result being that the question of whether age discrimination applies only to older adults, or to both younger and older adults, remains unsolved. The definition provided in this chapter argues for the latter, by specifying no particular age-group as being the sole target of age discrimination, for categorical membership is the immediate precursor of prejudice (Gaertner and Dovidio 2000), and because the category of age logically includes members within all categorical points.

### Age Operationalization

All extant definitions of ageism and age discrimination, both the earliest and the latest, narrowly constrict age to only the realm of objective chronological age, either explicitly through reference only to chronological age or by way of omission with regard to perceived (subjective) age. This is an unfortunate omission, because chronological age fails to represent the life-span perspective on aging, which is better represented by other subjective facets of age, such as psychosocial or psychological age (see Kooij et al. (2008) for a review). Recent advances in the theory of aging have expanded the definition of age to include four subjective facets in addition to chronological age, including functional age (the extent to which chronological age limits the capabilities of any particular individual), psychosocial age (the age that one is socially perceived to be), organizational age (the extent to which an individual is

considered old given the normative distribution of age in a particular institution), and life-span age (an individual's current life stage or family cycle; Kooij et al. 2008).

All of these latter definitions of age may be conceptualized as subjective age, by way of reference to subjective perceptions regarding an individual or group's physical capabilities, physical appearance and social conduct, normative age within an institution, or normative age within the life-span standards of a given society. It is thereby necessary to explicitly address the fact that age discrimination may occur on the basis of either actual (objective/chronological) or perceived (subjective) age. The definition provided in this chapter addresses this gap in the literature, by clearly defining age as being both objective and subjective.

### Outcome Valence

Butler's original definitions of ageism incorporated only negative attitudes on the basis of age. Most authors defining ageism in the 1980s and 1990s followed suit and discussed only negatively valenced outcomes, until the seminal work of Palmore (1999). On the basis that ageist attitudes could be either hostile or patronizing (benevolent ageism and age discrimination), Palmore (1999) first defined age discrimination as a phenomenon that could be either positively or negatively valenced. Following him, Cuddy and Fiske (2002) and Fiske et al. (2002) categorized older adults as falling into the incompetent but warm quadrant of the stereotype content model and similarly recognized the existence of both hostile and benevolent ageism. Thereby, most researchers studying ageism within the last decade (as of this writing) have recognized the existence of both positive and negative age discrimination. The current definition follows these recent advances in the study of ageism and recognizes that age discrimination may be valenced either positively or negatively.

### Measurement

Almost all definitions of ageism and age discrimination are explicit; work on implicit ageism was largely lacking until the seminal work of Becca

Levy, Mahzarin Banaji, and colleagues (cf., Levy and Banaji 2002). Nevertheless, some recent definitions of ageism have begun to recognize the role of unconscious and implicit attitudes in directing human behavior (e.g., Iversen et al. 2009). The definition provided in the current chapter follows these recent advances and defines age discrimination as occurring both implicitly and explicitly.

**Level of Expression**

Perhaps resultant of a lack of computer technology to statistically model multilevel relations between phenomena, early work on age discrimination focused only on the individual level of analysis and failed to incorporate the possibility of ageism occurring at the broader institutional level. More recently, beginning in the late 1990s, and carrying forward to the current decade, researchers have begun to largely recognize the existence of age discrimination at the institutional level. The current definition follows suit and expresses age discrimination as occurring at both the microlevel of the individual and at the broader level of societal, sectoral, industrial, and organizational institutions.

**Nomological Net**

A nomological net depicting the relations between age discrimination and its antecedents,

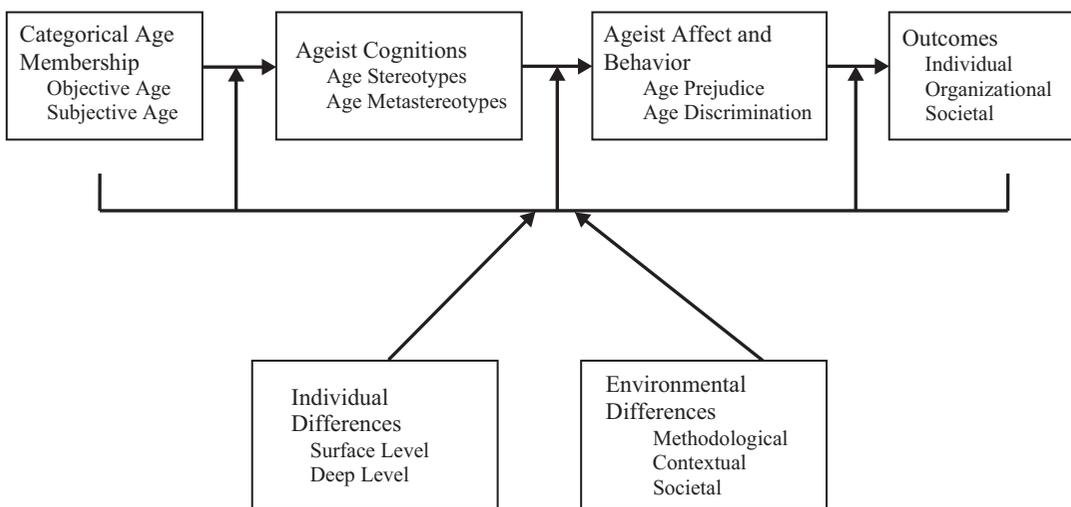
consequences, moderators, and mediators is displayed in Fig. 1. The figure does not causally distinguish between age prejudice and age discrimination, as these latter components of the broader attitudinal variable that is ageism are commonly understood to occur together, with age prejudice representing emotive responses that go hand in hand with the countervailing behavioral responses that represent age discrimination.

**Antecedents**

Prejudice begins with group membership, whereby membership in a devalued or out-group category gives rise to prejudice in the form of affective, cognitive, and behavioral responses (Gaertner and Dovidio 2000). Categorical age membership, be it objective or subjective, is thereby understood to be the ultimate antecedent of age discrimination.

**Mediators**

Ageist cognitions, including age stereotypes and age meta-stereotypes, represent the mediating mechanisms between categorical age membership and age prejudice/discrimination. Meta-analytic evidence indicates that relative to their younger counterparts, older adults and workers are viewed more stereotypically in general and are stereotyped as being less competent, less motivated,



**Age Discrimination, Fig. 1** Nomological net of age discrimination

less trusting, more vulnerable to work-family imbalance, having less potential for training and professional/career development, being less adaptable, less interpersonally skilled, less healthy, more reliable, and more stable (Bal et al. 2011; Gordon and Arvey 2004; Kite et al. 2005; Ng and Feldman 2012). The prime dimensions of stereotypes for older adults include perceived incompetence and perceived warmth (Fiske et al. 2002), and these two prime dimensions have been identified to significantly mediate relations between categorical age membership and age prejudice/discrimination (Krings et al. 2011). Less is known about age meta-stereotypes, but the interested reader is referred to Finkelstein et al. (2012) for a discussion.

### Age Prejudice and Age Discrimination

For age prejudice, meta-analytic evidence indicates that relative to their younger counterparts, older adults and workers are evaluated as less attractive and are given more negative overall evaluations (Bal et al. 2011; Gordon and Arvey 2004; Kite et al. 2005). For age discrimination, meta-analytic evidence indicates that relative to their younger counterparts, older adults and workers are more likely to be recommended professional evaluation after experiencing memory failure, are less likely to be helped, are given poorer assessments based on observed interactions, experience more adverse selection outcomes, and are given poorer performance evaluations (Bal et al. 2011; Kite et al. 2005). Less is known about age prejudice and age discrimination specifically targeted toward younger adults and workers, indicating the need for future research to investigate ageism at the lower end of the age spectrum. Less is also known about age prejudice and age discrimination based upon purely subjective age. For example, would an older adult who looks young experience similar outcomes related to age prejudice/discrimination? Future research is needed to disentangle the effects of objective vs. subjective age on ageism.

### Outcomes of Age Discrimination

Individuals who are the targets of age discrimination experience detrimental affective, cognitive,

and behavioral outcomes (Marcus and Fritzsche 2015). These may include, but not be limited to, lowered life and job satisfaction, less positive and more negative affect, higher turnover, reduced job and organizational commitment, lower self-esteem and self-efficacy, greater incidence of job burnout, reduced well-being, reduced standards of living, limitations in career advancement, lower income, limitations in personal and professional development, isolation, and poorer mental health. At the institutional level, age discrimination may result in the economic and social marginalization of age-stigmatized groups.

### Individual Difference Moderators

Individual differences include surface-level moderators and deep-level moderators. Surface-level moderators include all demographic variables, including sex, gender, tribe (defined as those groupings of individuals based upon communal affiliation, such as race, religion, and ethnicity; Marcus and Fritzsche 2015), education, marital status, socioeconomic status, and disability status. Additionally, subjective age may also be conceptualized as a moderator of relations between objective age and outcomes. Deep-level moderators include all psychological variables, such as affectivity, attitudes, cultural orientation, and personality. As depicted, individual differences may moderate relations between age and ageist stereotypes (“upstream moderators”), ageist stereotypes and age prejudice/discrimination (“downstream moderators”; Posthuma et al. 2012), or age prejudice/discrimination and outcomes of ageism.

Very little is known about the confluence of age and other surface- or deep-level moderator variables in predicting outcomes; the study of age discrimination sorely needs research on disentangling complex relationships, interactive effects, and effects of multiple group memberships (Posthuma and Campion 2009). To that end, recent theoretical advances identify the existence of unique archetypes for different types of older adults and workers (e.g., older White females vs. older White males) and specify differing patterns of outcomes for older adults and workers depending upon multiple group memberships (Marcus and Fritzsche 2015).

### Environmental Difference Moderators

As depicted, environmental differences may also moderate relations between age and ageist stereotypes (“upstream moderators”), ageist stereotypes and age prejudice/discrimination (“downstream moderators”; Posthuma et al. 2012), or age prejudice/discrimination and outcomes of ageism. Environmental differences may be broadly divided into three classes of moderators: moderators stemming from differences in sampling, design, measurement, and analysis (methodological), moderators stemming from the larger study context (contextual), and moderators stemming from overarching societal cultures and institutional policies (societal).

Meta-analytic evidence is plentiful when it comes to methodological moderators. The largest effect sizes of age discrimination are observed when ratings are provided by middle-aged respondents, older women rather than older men are targets, job applicants rather than job incumbents are targets, within-subject designs are utilized, negative information is presented, potential for development ratings is considered, lab rather than field studies are conducted, minimal information is presented, and the overall generalizability of the data decreases (Bal et al. 2011; Gordon and Arvey 2004; Kite et al. 2005).

The prime contextual moderator variable in relations between age and outcomes has been identified to be contextual age salience. In terms of older workers, contextual age salience includes the extent to which the current job matches one’s prior work experiences, the age type of the job, the level of the job, and the normative age distribution in the job (Marcus and Fritzsche 2015). The role of context remains an emerging area of research on age discrimination – although well-grounded theory exists, there is not much empirical evidence on the issue, indicating the need for future research.

The least amount of theory and evidence exists for societal moderators. Very little is known about the ways by which national culture moderates the relations between age and age discrimination (Posthuma and Campion 2009). Likewise, very little is known about the moderating role of broader institutional-level policies on relations

between age and institutional level outcomes. Hence, future research examining the roles of societal culture and other macrolevel variables on relations between age and outcomes would benefit the study of age discrimination.

### Conclusion

It has been almost half a century since Robert Butler first coined the term “ageism.” On the positive side, consensus now exists on the notion that age discrimination refers to the behavioral component of the broader attitudinal variable that is ageism, with ageist stereotypes and age prejudice representing the accompanying cognitive and affective components, respectively (Bal et al. 2011). Yet, half a century on, debate still seems to persist within the scientific community regarding the exact nature of the concept of age discrimination itself, with no consistency found in specifications regarding its valence, measurement, level of expression, potential targets of ageism, and even the nature of age as a construct itself. The definition provided in this chapter addresses this issue and represents the most comprehensive definition of age discrimination within the extant literature, incorporating all of the key concepts and components. Such a definition is arguably needed in order to expand the study of age discrimination to individuals of varying stripes and across the life cycle and to gain a nuanced understanding of the phenomenon as it occurs across methods, contexts, and cultures.

Poorer still is our understanding regarding the mediating processes and boundary conditions of age discrimination. Little research on age discrimination has been done to investigate mediating age-stereotype processes (see Krings et al. (2011) for initial evidence); no research has been conducted to investigate mediating age–meta-stereotypes processes; no research has investigated more complex mediating relationships such as mediated moderation or moderated mediation. Despite a wealth of meta-analytic evidence, concomitantly little research has investigated the moderating roles of either individual or environmental differences, with all meta-analyses to date

on the issue largely focusing on methodological variables and ignoring broader societal or contextual variables. To an extent, this may reflect a lack of primary studies on interactive relations between variables within the nomological net of age discrimination.

Summarily, primary and secondary research is pressingly needed in order to advance the study of age discrimination beyond crude main effects at the individual level and that are largely obtained via self-report. It is the hope here that explication of these and other related issues within this chapter, via clarification of the definition of the term and its accompanying nomological net, will help push the study of age discrimination forward and into a less obfuscated tomorrow.

## Cross-References

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- ▶ [Recruitment and Selection of Older Workers](#)
- ▶ [Technology and Older Workers](#)
- ▶ [Training at Work and Aging](#)

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## Age Diversity at Work

Amy C. Pytlovany<sup>1</sup> and Donald M. Truxillo<sup>2</sup>

<sup>1</sup>Department of Psychology, Portland State University, Portland, OR, USA

<sup>2</sup>Department of Psychology, Portland State College of Liberal Arts and Sciences, Portland State University, Portland, OR, USA

### Synonyms

Age differences; Age heterogeneity; Multi-generational workforce

### Definition

In general, diversity is defined as difference, or a composition of, different elements. Age diversity at work, therefore, refers to differences in age distribution among employees and is used to describe composition of the organization as a whole or composition of workgroups within an organization.

Diversity is often described using social identity theory (Tajfel 1974) and social-categorization theory (Turner 1985). These frameworks explain how people categorize themselves and others according to prominent demographic characteristics (e.g., age, race, gender), aligning themselves with similar others and distinguishing themselves from dissimilar others.

In the age and work literature, age groups are usually discussed in terms of “younger,” “middle-aged,” and “older” workers. Categorization is not dependent on chronological age alone; numerous contextual factors influence the designation of an employee into these categories. Conceptualizations, in addition to chronological age, include subjective age, relative age (age in comparison to work context), cultural and professional norms, and societal regulations (Truxillo et al. 2014).

### Key Concepts

Globally, there is an upward trend in the percentage of older employees in the industrialized

workforce. Explanations include increased mortality, decreased fertility rates, and economic conditions, requiring older workers to delay retirement (Eurostat 2013; Toossi 2012). This has led to increased age heterogeneity within organizations and teams, meaning that people of different ages are now working side-by-side more than ever before. This trend has important implications, as research indicates both positive and negative effects of diversity at all organizational levels.

This entry will focus on the theoretical explanations and current research relating to age diversity at work. Future directions will also be recommended.

### Theoretical Frameworks and Current Research

Although some research has consistently demonstrated effects related to age diversity, such as increased turnover and absenteeism, studies examining the direct effects of age diversity on other outcomes, including performance, have revealed conflicting results (Williams and O'Reilly 1998). This has highlighted the need to examine the processes through which age diversity influences outcomes and under what conditions positive (or negative) effects occur.

As discussed above, social identity theory (Tajfel 1974) and self-categorization theory (Turner 1985) are two key frameworks for understanding diversity. Expanding on this, and with application of the similarity-attraction paradigm (Byrne 1971), *relational demography* research investigates how individual differences relating to age (and other demographic characteristics) influence attitudes and behaviors. The similarity-attraction paradigm helps explain why individuals are more likely to have a favorable bias to similar others (positive evaluations, increased attraction) and an unfavorable bias to dissimilar others (negative evaluations, decreased attraction). Age diversity has the largest impact on employees who are most different from the group. For example, employees with greater age differences in relation to the rest of the team have reported higher

absenteeism and turnover and have received lower supervisor ratings of performance and promotability (Truxillo et al. 2014; Williams and O'Reilly 1998).

**Group Processes.** Related to relational demography, research on *fault lines* investigates subgroup divides that occur when multiple personal attributes are shared among team members (e.g., similar in age and race, similar in age and gender). Divides are perpetuated by desires to achieve balance between belonging (to the in-group) and distinction (from the out-group). Attempts to achieve this balance encourage positive interactions among group members and negative interactions between groups. The most commonly studied constructs in relation to fault lines include results indicating increased conflict, decreased team cohesion, reduced team performance, and diminished team satisfaction (Thatcher and Patel 2011).

Fault line strength depends on a variety of factors including the number of shared characteristics (e.g., similar across multiple categories), how the particular similar characteristics align among group members (e.g., percentage of each demographic representation within the group) and group size, and the number of potential subgroup possibilities. Characteristics other than demographic information can influence formation of fault lines. However, because demographic attributes such as age are immediately visible, these have a stronger influence on categorization (Thatcher and Patel 2011), at least initially.

*Stereotypes* (generalized characteristics assumed to be true of someone based on their group membership) are also used to classify and categorize others and thus influence how employees of different ages work together. Although research on middle-aged stereotypes is limited, this group is generally considered the referent to which young and old are compared. Older worker stereotypes include perceptions that they are resistant to change but also that they are dependable (Posthuma and Campion 2009). Younger stereotypes include perceptions that they are lazy and unmotivated but also that they are enthusiastic and energetic (Finkelstein et al. 2013). Although stereotypes are often

inaccurate, they persistently influence attitudes and behaviors.

Currently researchers are investigating stereotypes through a variety of lenses. One method investigates stereotype content on the dimensions of perceived warmth and perceived competence (stereotype content model; Fiske et al. 2002), in which older people are perceived to be warm but not competent; however, what is meant by "older" in this framework may be in very late life, beyond when most people are typically working. This model articulates that stereotype content can fall into one of four categories, and according to the behavior from intergroup affect and stereotypes (BIAS) map, the category a stereotype is associated with then predicts how others behave toward individuals in that group. Resulting behaviors are active facilitation (high on warmth, e.g., helping) active harm (low on warmth, e.g., harassment), passive facilitation (high on competence, e.g., cooperation), or passive harm (low on competence, e.g., neglect). These dimensions also influence affect. For example, evaluations of low warmth and low competence trigger contempt, perceptions of high warmth and low competence elicit pity, appraisals of low warmth and high competence cause envy, and appraisals of high warmth and high competence foster admiration (Cuddy et al. 2008).

Building on stereotype research, another developing framework for investigating intergenerational relationships is metastereotypes. *Metastereotypes* refer to how a person believes others perceive them based on their group membership (Vorauer et al. 1998). For example, older workers may believe others stereotype them as out-of-touch, and younger workers perceive they are stereotyped as unreliable (Finkelstein et al. 2013). When framed around older and younger age groups working together, these beliefs, positive or negative, are likely to influence interactions and group processes. However, workplace research on metastereotypes is scant, and thus the outcomes of these workplace age metastereotypes are unknown.

Fortunately, research based on *intergroup contact theory* (Allport 1954) has demonstrated how negative attitudes associated with intergroup bias

(e.g., stereotypes and prejudice) can be reduced through increasing the positive interpersonal contact between members of different groups. This effect is enhanced when the contact is structured according to four optimal conditions: equal status among groups/members, common goals, intergroup cooperation, and institutional support. Over time, as more information becomes available, surface-level (demographic) assessments of others become less important, and categorization becomes based on deeper-level traits (e.g., personality, skills; Harrison et al. 2002). Although the optimal conditions outlined do boost this effect, they are not absolutely necessary. The positive effects of contact over time have been demonstrated across a wide range of contexts and generalize beyond just those out-group members involved in the contact scenario (Pettigrew and Tropp 2006). Specifically relating to age differences, intergenerational contact positively impacts stereotype content and facilitation behaviors and reduces intentions to quit. Dual identity, which refers to categorization according to two different attributes, such as a group identity (e.g., age group) and collective identity (e.g., common goals), has been shown to be the linking mechanism. When two identity-related categorizations intersect, one is more likely to have a stronger influence; therefore, promoting a collective identity can help reduce negative intergroup relations (Iweins et al. 2013).

*Information and decision-making theories* are also important contributions for examining interactions within age-diverse groups. Diverse individuals contribute a broad range of knowledge, skills, abilities, information, experiences, and networks that help strengthen team and organizational processes. Numerous factors influence the likelihood that a diverse team will be able to capitalize on this diversity. First, information and resource-sharing is most relevant when teams work on tasks that are complex and/or nonroutine. Second, age differences may lead to avoidance behavior, misunderstandings, or conflict, thereby mitigating the possible benefits of having diverse resources available. Finally, levels of task- and goal-interdependence influence the likelihood that team members will develop a

collective identity that allows them to overcome differences in age (Williams and O'Reilly 1998).

**Individual Differences Due to Age.** Investigating changes across the life span is another important element of workplace age diversity research. This includes changes in cognitive and physical capabilities, motives, and personality. It is important to note that numerous factors (e.g., genetics, personal experiences, generation) influence the aging process, so although research looks at statistical averages, there is a great deal of variation between individuals in how quickly they age and in what ways.

Aging is generally associated with physical and cognitive declines. *Physical changes* that have been reported include eyesight and hearing loss, reduced muscle strength and flexibility, and decreased immune response. Age is also related to clinical health indicators, including elevated blood pressure and cholesterol levels; however, meta-analytic results have revealed no declines in mental health, or self-reported physical health problems, and there is limited research linking physical declines to changes in work performance (Truxillo et al. 2015).

In general, *cognitive abilities* related to crystallized intelligence increase across the life span and, on average, only begin to decline around age 60. Between age 60 and age 80, modest losses occur, but substantial differences are not exhibited until after age 80. These abilities include inductive reasoning, spatial orientation, verbal ability, and verbal memory. Losses in numerical ability begin somewhat earlier, starting to decline in the 50s. Abilities associated with fluid intelligence, such as processing speed and working memory, begin to decline much earlier in life, with loss beginning around age 25. It is interesting to note cognitive decrements associated with age are significantly attributed to changes in perceptual speed (Schaie 1994). These effects can be minimized for older employees through consideration of workplace and goal conditions, especially time pressure.

*Personality traits* are commonly studied in work literature and are related to outcomes including performance and social interactions (Barrick

and Mount 1991). Although personality traits have historically been considered stable over time, research demonstrates mean-level changes do occur across the lifespan. Conscientiousness, emotional stability, and social dominance (a dimension of extraversion) show an increase between age 20 and age 40; agreeableness begins to decline in the 50s. Openness to experience and social vitality (another dimension of extraversion) increases throughout adolescence and then begins to decrease in the 60s (Roberts et al. 2006).

One theory used to explain how these changes influence behavior is *selective, optimization, and compensation (SOC) theory* which posits that older adults react to age-related changes by reallocating their resources toward minimizing losses and maximizing gains (Baltes and Baltes 1990). Selection occurs when individuals prioritize specific goals that best match utilization and maintenance of current resources. Optimization indicates strategies used to allocate effort and resources toward goal achievement, and compensation involves processes aimed at off-setting age-related losses. For example, an aging worker may reduce their number of tasks to focus on those for which they have the greatest skill and that can be most efficiently attained with current resources.

Another commonly used framework for explaining differences across the life span is *socioemotional selectivity theory (SST)* (Carstensen et al. 1999). This theory describes how the salience of social goals fluctuates over time according to one's perception of time, thereby influencing motivational and behavioral change. Younger individuals perceive time to be limitless. They are more likely to spend energy-building knowledge and networks, focus efforts on expanding their experiences, and work toward accomplishing goals such as work-related advancement and achievement. Work behavior is more strongly related to growth- and extrinsic motives. Older individuals perceive their time to be more limited. As a response, energy and efforts are more likely allocated toward maintenance of close relationships and having meaningful experiences. At work, motivation becomes more intrinsically linked (Kooij et al. 2011).

## Higher-Level Influences on Age Diversity

As previously discussed, context has a critical impact on the processes and outcomes associated with age diversity at work. This includes influences beyond the group and individual level, including organizational-, occupational-, and industry-related factors. At these levels, categorization and stereotypes again come into play. *Job or industry stereotypes* develop when a specific workforce is comprised of primarily one demographic group (e.g., young-typed or old-typed) and employees not in the majority group face negative biases. This occupational demography also influences the boundaries of age group categorization. For example, a middle-aged person in an industry or occupation that is primarily young (e.g., high-tech gaming) will be perceived as "old" in comparison. The same middle-aged person working in a setting dominated by older workers (top management in a corporation) would be perceived as "young." Fortunately, job-age stereotypes are fairly susceptible to change (Truxillo et al. 2014).

*Organizational age climate* also has a significant effect on determining if diversity operates as a strength or weakness. Organizational age climate refers to the shared perceptions about an organization's diversity-related attitudes and expectations, as communicated through policies, procedures, and rewards. If human resource (HR) practices communicate that differences are valued, benefits such as information- and resource-sharing are more likely to occur. Researchers have only recently begun to examine age diversity climates specifically, but initial findings are encouraging. Age diversity climate has been demonstrated as a linking mechanism between age-inclusive HR practices and both company performance and collective turnover intentions (as explained by collective perceptions of social exchange; Böhm et al. 2014b). Additional empirical evidence links diversity climate and workgroup performance through the effects of diversity climate on discrimination (Böhm et al. 2014a).

Age diversity climate is therefore important not only for business-related outcomes but also

for preventing discrimination and the accompanying litigation. Despite laws protecting older workers, research reveals they still face discrimination related to hiring and layoff decisions, training opportunities, and performance appraisals (Truxillo et al. 2014). In 2013, monetary payouts related to the Age Discrimination in Employment Act totaled \$97.9 million (Equal Employment Opportunity Commission 2014) in the U.S.A. Although research on younger workers is less common, it is likely that younger employees experience bias, and due to lack of protections, this discrimination may be even more blatant.

## Conclusion and Future Directions

In conclusion, workplace age diversity has important implications for individual, group, and organizational processes and outcomes. However, as noted earlier, results are not always consistent, and thus more research is needed to identify the conditions under which age diversity is most likely to have an impact and through what mechanisms these effects occur.

As described above, fault lines provide a useful framework for examining group processes and outcomes. Given the complexity involved, there are many opportunities for further investigation. A clarified understanding of how group composition promotes fault line formation and strength would be useful. For example, how does the number of shared attributes (in addition to age) and the alignment of age with other non-demographic attributes factor in? Additionally, differences in the distribution of power among groups may help explain inconsistent findings in relation to outcomes. Further, it is likely that certain conditions promote or discourage fault line formation. Developing a collective identity and encouraging positive diversity attitudes are two possible strategies that may hinder subgroup divides and facilitate intergenerational collaboration. Initial research relating to this looks promising (Iweins et al. 2013).

Stereotype research can also help to explain how age diversity operates in the workplace. Researchers should continue to explore the

content and accuracy of stereotypes. According to the stereotype content model, older people are perceived to be warm and incompetent. However, this content appraisal may be more directly related to older people beyond working age who fall into the category “elderly.” Stereotype content is likely to differ within a work context; research in this area suggests that older workers are seen as having a number of positive attributes (Truxillo et al. 2012; Bertolino et al. 2013) such as higher conscientiousness and organizational citizenship. Additionally, little attention has been paid to stereotypes about younger or middle-aged workers (Truxillo et al. 2014). Future research should examine these and also explore how content impacts processes and outcomes. These contributions would aid in understanding age-diverse workers and their interactions.

Metastereotypes research is one area that has begun to explore younger and middle-aged stereotypes, as well as older stereotypes (Finkelstein et al. 2013). Understanding how an employee’s behavior is influenced by how they believe others perceive them provides an exciting new lens for which to examine workplace relationships. This nomological net is still being developed and thus provides bountiful opportunities for future research. Investigations into if, how, and when metastereotypes impact intergroup behaviors and outcomes would be very informative. For example, a belief that others hold negative stereotypes could result in avoidance and conflict, thereby influencing performance.

Although most stereotype research examines explicit attitudes, there is a growing interest in exploring implicit stereotypes (automatic responses of which an individual may not be cognizant of). Implicit responses can be measured using a range of indirect self-report assessments including word fragment completions, response latency measures of association (e.g., the Implicit Association Test, IAT; Greenwald et al. 1998), and even by examining brain activity responses (e.g., functional magnetic resonance imaging). At this point, very little research has examined implicit age stereotypes at work, and such research into unconscious age stereotyping may

provide guidance for how to promote positive outcomes related to workplace age diversity.

Future research should continue to explore how to structure the workplace and develop training programs to best address motivational and cognitive differences among an age-diverse workforce. Environmental factors that influence personality and motivational changes should also be examined. Further, efforts should be made to answer the call for advancement in measures assessing the various dimensions of motivation (e.g., achievement motivation, motivation to retire; Kanfer et al. 2013; Kooij et al. 2011).

As the workforce continues to become more age-diverse, identifying the best strategies for managing diversity will become increasingly relevant. As discussed above, promoting a positive age diversity climate can be beneficial and should be researched further. One suggestion is to investigate which HR practices and policies are most influential on both diversity climate and desired outcomes (cf. Böhm et al. 2014b). Researchers should also consider how individuals, groups, and the organization differentially relate to age diversity climate as both antecedents and outcomes. Finally, leadership is likely to relate to age diversity climate in multiple ways and should be included in the research as age diversity climate continues to be explored.

Leadership, in general, warrants more attention in the age diversity arena. Given that leaders are often the most common targets for creating change within the workplace, there is surprisingly little research looking at how leadership and age diversity interact to influence outcomes. Studies that have looked at this relationship reveal age differences between leaders and followers are associated with role ambiguity (Tsui and O'Reilly 1989) and decreased perceptions of leader effectiveness (Zacher et al. 2011). Additionally, when transformational leadership is low, a negative relationship between age diversity and performance has been found. When transformational leadership is high, age diversity is associated with increased collective identity and, through this, increased sharing of information and resources (Kearney and Gebert 2009). These findings have important implications for management of an

increasingly age-diverse workforce. More conclusive research and a wider scope are needed.

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## Age Stereotypes in the Workplace

Eileen C. Toomey and Cort W. Rudolph  
Saint Louis University, Saint Louis, MO, USA

### Synonyms

Age bias; Ageism

### Definition

Age stereotypes refer to overgeneralized expectations and beliefs about the characteristics and traits of individuals on the basis of age. In the workplace, age stereotypes often take the form of distorted and usually inaccurate perceptions of worker characteristics on the basis of age.

As the workforce becomes more age diverse, interpersonal exchanges between members of this multigenerational workforce will become more frequent. Considering this, understanding the mechanisms that contribute to positive and negative interpersonal interactions between individuals at different stages of the work-life span is essential (Rudolph and Zacher 2015). In this vein, a great deal of scholarship has focused on how work-related age stereotypes affect the success of the interpersonal interactions between different age groups and the treatment of individuals across the work-life span. Understanding the nature, function, and effects of age stereotypes in the workplace is important for both individual level and organizational level outcomes, as stereotype endorsement and application can lead to age discrimination and negatively impact employees by creating barriers to employment, promotion, and training opportunities (Bal et al. 2011).

In general, stereotypes refer to the overgeneralized expectations and beliefs about the characteristics and traits of social outgroup members (Fiske 1998). Stereotypes represent negative, distorted, and usually inaccurate perceptions of individuals due to their membership in a

particular group, and the inference that all members of that group hold or display these same characteristics. From a cognitive perspective, age stereotypes represent mental schema through which characteristics and expectations of a particular individual are based on his or her age group membership (Hamilton and Sherman 1996). Stereotype endorsement can lead to biases in information processing (e.g., biased judgments that lead to discriminatory behavior during decision-making processes in selection, promotion decisions, and training identification (Bal et al. 2011). A great deal of research on age stereotypes in the workplace focuses on beliefs and expectations about older workers rather than middle-aged or younger workers (Posthuma and Campion 2009; Ng and Feldman 2012; Hassell and Perrewe 1995). Moreover, research typically examines overgeneralized beliefs about the abilities of older workers in comparison to those of younger workers (Posthuma and Campion 2009; Finkelstein et al. 1995). In addition to evidence for age stereotypes that characterize older workers, research has also begun to focus on characteristics indicative of younger workers (Perry et al. 2013).

### Defining Age in the Workplace

Before reviewing the literature on the content of common age stereotypes that characterize older workers, it is important to define the term *older worker*. Age can be conceptualized in a chronological sense or as a continuous stage in one's lifespan or careerspan. Lifespan perspectives on age argue that young, middle, and older ages represent unique stages of development, which include distinct events that shape identity, as well as personal and professional relationships. Moreover, each stage is marked by its own set of challenges and goals. As experiences occur and shape these stages at different chronological time points for individuals, there is not one set age range to define these stages (Kooij et al. 2008). Thus, there is a reluctance to establish or place boundaries on specific chronological ages when examining groups of individuals from different

life stages (e.g., when studying characterizations of younger, middle-aged, or older workers). However, in past research, age ranges for older workers vary from 40 years and above (Ng and Feldman 2012; Hassell and Perrewé 1995) to 55 and above (Finkelstein et al. 1995).

### Common Workplace Age Stereotypes

Recent scholarship has reviewed the most common age stereotypes against older workers relative to younger workers, presented evidence refuting some of these beliefs as mischaracterizations, and discussed boundary conditions surrounding the endorsement of age stereotypes (e.g., the presence of job relevant information, perceived “correct age” for a job position, and supervisory status, (Posthuma and Campion 2009; Finkelstein et al. 1995). One of the more common age stereotypes is that older workers are poorer performers relative to their younger coworkers (Ng and Feldman 2012; Posthuma and Campion 2009). Considering this stereotype, related miscategorizations suggest that is commonly expected that older workers are less capable, productive, motivated, and competent than their younger counterparts, resulting in lower average job performance. However, a great deal of evidence has been presented to refute the notion that performance declines with age (Posthuma and Campion 2009). On the contrary, empirical evidence suggests that job performance ratings increase with age, any decreases in cognitive ability are not significantly related to performance due to various compensation and coping strategies, and that health and well-being are more important indicators of performance than chronological age (Posthuma and Campion 2009).

Another common age stereotype is that older workers are resistant to change. Related stereotypes characterize older workers as harder to develop, less flexible, and more difficult to train (Posthuma and Campion 2009; Ng and Feldman 2012). Moreover, older workers are perceived as being less willing to participate in training and/or career development programs (Ng and Feldman 2012). This can lead to the belief that older workers

represent a lower return on investment in terms of training efforts (Posthuma and Campion 2009). Despite this belief, research suggests that there is no empirical evidence to support the notion that older workers are more resistant to change (Ng and Feldman 2012). However, there is some evidence to suggest that older workers may be less willing to partake in training and career development opportunities (Ng and Feldman 2012).

Older workers are commonly perceived as having a lower ability to learn, develop themselves, and master new skills and concepts required of their jobs than younger workers (Posthuma and Campion 2009). Evidence for the validity of this perception is inconsistent. For example, some research indicates that older workers need no more training than their younger coworkers and do have the ability to learn and develop (Broadbridge 2001), while other research supports the belief that older workers are slower at mastering skills and concepts (Kubeck et al. 1996). However, it is important to note that research supporting this belief reports relatively small effects (Kubeck et al. 1996).

Another common age stereotype towards older workers is the belief that older workers will retire or turnover faster resulting in shorter job tenure (Posthuma and Campion 2009). This belief is based on the notion that older workers are, by definition, later in their careers than younger workers. Relatedly, it is often incorrectly assumed that older workers are less healthy, more at risk for work/family conflict, and closer to retirement than their younger counterparts. As a result, it is assumed that older workers possess lower potential return on investment for training, development, and retention initiatives (Hedge et al. 2006; Ng and Feldman 2012). In line with this stereotype is the belief that due to higher wages, increased need for health benefits, and later career stage, older workers are more costly to the organization (Posthuma and Campion 2009). However, evidence suggests that older workers are less likely to turnover than younger workers, refuting the idea that they represent lower returns on investment (Hedge et al. 2006).

It is important to note that not all age stereotypes of older workers are inherently negative

(Posthuma and Campion 2009; Hassell and Perrewe 1995; Broadbridge 2001; Bal et al. 2011). Older workers are frequently perceived as being more dependable, honest, reliable, loyal, trustworthy, and committed to the organization and job (Hassell and Perrewe 1995; Broadbridge 2001). There is some research to support these stereotypes as evidence does suggest that older workers are less likely to engage in counterproductive work behaviors such as overt theft and absenteeism (Broadbridge 2001; Hedge et al. 2006). Additionally, older workers are often characterized as possessing higher levels of institutional knowledge and accrued wisdom associated with extended tenure and job experience.

While a majority of research has focused on stereotypes towards older workers, there is some evidence for stereotypes towards younger workers (Perry et al. 2013). This evidence suggests these stereotypes are not merely the opposite of the stereotypes against older workers (Perry et al. 2013). For example, common age stereotypes that characterized younger workers are that they tend to be more productive, creative, ambitious, eager, and efficient. Additionally, younger workers are seen as better able to cope with job stressors more likely to seek immediate feedback on performance (Perry et al. 2013). Overall, there is an abundance of evidence examining stereotypes towards older workers with comparatively little focusing on the beliefs against individuals in other age groups such as younger and middle-aged workers (Perry et al. 2013; Posthuma and Campion 2009).

Research suggests that the extent to which workplace age stereotypes are endorsed and influence decision-making processes is affected by a number of factors (Hassell and Perrewe 1995; Posthuma and Campion 2009). For example, research indicates that hourly workers hold more positive attitudes towards older workers than supervisors, and that these attitudes become increasingly positive with age (Hassell and Perrewe 1995). Additionally, research has found that age and supervisory status interact, such that as supervisor age increases so do the negative stereotypes held against older workers (Hassell and Perrewe 1995). This research also underscores

the influence of ingroup bias on the strength of age stereotypes. Evidence suggests that older workers who identify with and consider themselves a part of their own age group hold more positive beliefs about themselves than do younger workers. On the other hand, some older workers hold the same beliefs about members of their own age cohort and these judgments can affect their decision making (Hassell and Perrewe 1995; Posthuma and Campion 2009). Again, the effect of negative stereotypes is ameliorated when older workers identify with these individuals as part of their ingroup (Posthuma and Campion 2009).

The extent to which age stereotypes bias information processing in the workplace is also diminished when job-relevant information is present and used during decision-making processes. Evidence suggests that stereotype endorsement is reduced when information about the job is used to evaluate applicants during employment interviews (Kite et al. 2005). When information specific to the qualifications and abilities of the applicant and aspects of the job position are available and used during selection processes, the effects of age stereotypes towards older workers are less likely to affect employment decisions (Fiske and Neuberg 1990). Lastly, research suggests that the effects of age stereotypes are stronger when there is a perceived “correct age” of an applicant for a job role (Hassell and Perrewe 1995; Posthuma and Campion 2009). Thus, applicants are viewed negatively if there is an inconsistency between the age of the applicant and the “correct age” of the job (Finkelstein et al. 1995; Hassell and Perrewe 1995; Posthuma and Campion 2009). Moreover, evidence suggests that there are particular jobs, professions, and industries that seem more appropriate for different age groups (Finkelstein et al. 1995; Posthuma and Campion 2009).

## Contemporary Perspectives on Stereotyping

### Descriptive Versus Prescriptive Stereotypes

Age stereotyping in the workplace represents a socialcognitive process in which cognitive

schemas guide beliefs and judgments about older workers based on their membership in a particular age group. Moreover, due to the inherent inaccuracies of stereotypes, endorsement of these mischaracterizations can lead to discriminatory workplace behavior. In line with social-cognitive perspectives, recent scholarship has made a distinction between descriptive and prescriptive age stereotypes and explicated more relational mechanisms behind perceptions and beliefs towards older workers on the basis of their age (North and Fiske 2013). Traditional perspectives on age stereotypes focus on the descriptive perceptions about what older individuals typically do. Prescriptive age stereotypes, on the other hand, describe beliefs about what older workers should do in regard to their use of social resources (North and Fiske 2013). Theory would suggest that there are three ways in which younger workers expect their older coworkers to use social resources (North and Fiske 2013): (1) *succession* of their employment position, political influence, and wealth, (2) limitation of their *consumption* of public and shared resources (e.g., pension and social welfare funds), and (3) prevention of *identity* transgressions (e.g., older workers acting in ways typically conceptualized as “young”).

This age-specific prescriptive stereotype model proposes that younger workers may judge older workers more harshly if they act in ways that are at odds with these prescriptive stereotypes. In regards to the succession prescriptive stereotype, older workers delaying retirement may pose a threat to younger workers, as this limits their own progress toward professional goals and opportunities (Hassell and Perrewe 1995). Additionally, older workers would violate the consumption prescriptive stereotype if they abused their access to pension funds (North and Fiske 2013). In summary, individuals may become biased in their judgments and evaluations of their coworkers based on these descriptive or prescriptive age stereotypes (North and Fiske 2013).

### Metastereotyping

While the majority of research focuses on other-referenced stereotypes towards older workers (i.e., perceptions of the characteristics and

behaviors of a member of a certain group), recent scholarship has examined metastereotypes and their presence and rate of endorsement in the workplace (Finkelstein et al. 2012). Age metastereotypes refer to expectations that individuals feel other age groups hold about people of their own age (Finkelstein et al. 2012). This is a relational concept, which arises from the tendency to be concerned about how individuals are viewed by others. As humans, we tend to think more about our social reputations and behavior from other people’s point of view rather than our own (Finkelstein et al. 2012). Much like research suggesting the inaccuracy of aging stereotypes in general, research suggests that metastereotypes might not be indicative of what individuals in the referent outgroup actually think about individuals in the ingroup (i.e., age metastereotypes are themselves likely to be quite inaccurate; (Finkelstein et al. 2012).

The content and accuracy of age metastereotypes in the workplace has been examined empirically (Finkelstein et al. 2012). Evidence suggests that older workers are viewed positively by both younger and middle-aged workers (i.e., both age groups report age stereotypes towards older workers that are mostly positive; (Finkelstein et al. 2012). In regards to metastereotypes towards younger and middle-aged workers, older workers are more likely to report negative characteristics (i.e., older workers tend to believe workers from other age groups view them negatively; (Finkelstein et al. 2012). Additionally, research indicates that younger workers tend to believe others (in particular, their middle-aged coworkers) will stereotype them negatively. Evidence also suggests that middle-aged workers are more likely to report negative characteristics towards younger workers. Moreover, younger workers’ metastereotypes about middle-aged workers reflect these findings – younger workers expect middle-aged workers to list few positive traits when describing their age group and hold expectations in line with negative stereotypes more often (Finkelstein et al. 2012). However, research indicates that despite evidence that older workers view younger workers in terms of both negative and positive

stereotypes, younger worker metastereotypes towards older workers are generally negative (i.e., younger workers tend to expect older workers to describe them in terms of negative stereotypes).

Some important conclusions can be drawn from this evidence. For example, it could be that younger workers expect middle-aged workers to view them negatively based off of social consensus cues in their work environment. Middle-aged workers may feel threatened by the potential for competition with younger workers for similar jobs and may endorse these negative stereotypes to protect themselves psychologically (Finkelstein et al. 2012). On the other hand, older workers may not feel as threatened by younger workers as they rarely compete for similar jobs or roles. Additionally, older workers may have children the same age as younger workers and due to their more frequent exposure to that age group, view younger workers in a more positive light (Finkelstein et al. 2012). Moreover, older workers seem to be unaware that younger workers see them in a positive light due to the evidence that suggests their metastereotypes of younger workers are negative (Finkelstein et al. 2012).

There are several unanswered questions with respect to the nature of age metastereotypes at work. For example, it is necessary to understand how age metastereotypes affect cross-age group interactions in the workplace. Similar to the bias inherent within age stereotypes, age *metastereotypes* could similarly affect information processing and communication between individuals of different age groups (Finkelstein et al. 2012; Posthuma and Campion 2009). Additionally, more research is needed to examine how these metastereotypes increase the presence of confirmation bias (i.e., the tendency to seek, interpret, and/or recall information in a way that serves to egoistically confirm one's beliefs or hypotheses) and its influence on job performance and interpersonal interactions. There is also a need to examine contextual factors that have been previously considered as boundary conditions to the influence of stereotypes to examine their corresponding effects on metastereotypes (e.g., the presence of job-relevant information,

supervisory status, level of exposure to different age groups, possible "correct age" for a position; (Posthuma and Campion 2009). As the age composition of the workforce continues to diversify, it is necessary to better understand the nature of both other-referenced age stereotypes and age metastereotypes in an effort to facilitate effective interpersonal interactions.

### Generational Stereotyping

Another emerging area of research examines other-referenced stereotypes surrounding the three generational groups that make up the current workforce. While there is a substantial research on age stereotypes, there is relatively little research on the nature and content of generational stereotypes in the workplace (Perry et al. 2013). A generation refers to a group of people who have similar "birth years, age, location, and significant life events at critical developmental stages" (Kupperschmidt 2000, p. 6). Researchers also make distinctions between generations and cohorts, which generally refer to generations by their range of dates in which members were born (Parry and Urwin 2011). The three main cohorts identified in previous research and theory include: (Bal et al. 2011) Baby Boomer (1943–1960) (Broadbridge 2001), Generation-X (1961–1981), and (Finkelstein et al. 1995) Generation-Y/Millennial (1982–present). Previous research in this domain focuses on the differences between generational groups in terms of their values, preferences, and behaviors in the workplace (Twenge 2010). Moreover, the majority of scholarship on generational differences exists in practitioner literature focusing on the perceived differences in beliefs, attitudes, and behaviors. Indeed, there is very little compelling evidence to support the notion of generational differences across a variety of work outcomes and research indicates that perceived differences between generational cohorts likely arise from stereotypes that overgeneralize characteristics of different generational groups (Rudolph and Zacher 2015).

Recent evidence from systematic examinations of the academic and practitioner literatures has uncovered common stereotypes to describe each generational group (Perry et al. 2013). Evidence

suggests that stereotypes between Generation-X and Generation-Y are not clearly differentiated. However, there are distinct differences in generational stereotypes between the Generation X and Baby Boomer cohort as well as between the Millennial and Baby Boomer cohort (Perry et al. 2013). Evidence suggests that Baby Boomers are commonly described as hardworking, loyal, not technology savvy, resistant to change, and valuing monetary rewards from their jobs. Workers from Generation-X were most commonly described as lazy, technology savvy, valuing work/life balance, disloyal, hardworking, and well educated. Lastly, recent scholarship indicates that common stereotypes towards workers from Generation-Y suggest these workers are seen as technology savvy, preferring to use technology to communicate, multitaskers, valuing work/life balance, and entitled (Perry et al. 2013).

Lastly, evidence reveals both similarities and differences between the common older worker and younger age stereotypes with the above generational stereotypes (Perry et al. 2013). Stereotypes towards Baby Boomers overlap the most with those towards older workers (e.g., dependable, resistant to change, lower ability to learn; (Posthuma and Campion 2009) although Baby Boomers are also perceived as career driven, achievement oriented, hardworking, competitive, and having a strong work identity (Perry et al. 2013). Additionally, stereotypes towards Generation-X are different from younger worker stereotypes (e.g., feedback seeking, eager, productive) as workers from Generation-X are seen as lazy, self-centered, socially responsible, and having more balanced work needs than younger workers (Perry et al. 2013). Lastly, younger worker stereotypes typically focus these workers' ability to do work and openness to learning while the content of stereotypes towards Generation-Y seems to focus on technology (e.g., the use technology and knowledge new technology), impatience (e.g., the desire or need for instant gratification and short attention spans), and negative traits (e.g., entitlement and arrogance; (Perry et al. 2013). While recent scholarship helps

uncover the content of stereotypes towards generations, more evidence is needed to further clarify the characteristics with which individuals use to describe generations and how these stereotypes affect workplace processes.

## Conclusions

Here, current theories and empirical evidence on age stereotypes in the workplace were reviewed and several overarching conclusions were drawn. Age stereotypes in the workplace are largely conceptualized as the overgeneralized beliefs and expectations of the behaviors and characteristics of an employee based on his or her age. Additionally, evidence suggests there is a coherent set of common age stereotypes towards older workers (e.g., poor performers, resistant to change, shorter tenure, more costly, dependable) and younger workers (e.g., productive, efficient, creative, feedback oriented, entitled) present in the workplace. Despite their prevalence and ubiquity, there is very little evidence to suggest that workplace age stereotypes are valid generalizations. Moreover, evidence suggests that contextual and workplace factors can affect the extent to which age stereotypes are endorsed (e.g., supervisory status, exposure to age groups, in-group bias, job relevant information, positions with "correct age" bias).

Contemporary perspectives suggest that age stereotypes are both descriptive (i.e., describing what individuals actually do) and prescriptive (i.e., describe what individuals of a certain age should do) in nature and it is likely that both processes can affect the evaluations and judgments made of workers (North and Fiske 2013). Recent scholarship on the nature of metastereotypes (i.e., beliefs that individuals expect members of other age groups hold about their own age group) provides opportunities for further research on the content and effect of workplace age stereotypes on work-related variables. Lastly, research suggests age stereotypes also exist towards different generational groups (Perry et al. 2013). While there exists myriad

research on the topic of age stereotypes in the workplace in general, future research is needed to clarify the nature and influence of age stereotypes and the factors that mitigate the effects of stereotypes on cognitive, affective, and behavioral outcomes in work contexts. As the workforce continues to age and diversify in its age composition, understanding the mechanisms that prevent workplace age stereotypes from affecting information processing, affective reactions, and overt behavioral expressions of age bias is integral to creating and maintaining a workplace environment that supports its individuals across the lifespan.

## Cross-References

- ▶ [Age Diversity At Work](#)
- ▶ [Affect and Emotion Regulation in Aging Workers](#)
- ▶ [Age-Related Changes in Abilities](#)

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## Age Stereotyping and Discrimination

Alison L. Chasteen, Lindsey A. Cary and  
 Maria Iankilevitch  
 Department of Psychology, University of  
 Toronto, Toronto, ON, Canada

### Synonyms

Age prejudice; Ageism; Stigma

### Definition

Researchers distinguish between stereotypes, prejudice, and discrimination. Stereotypes are defined as the mental representations people have about different social groups. Stereotypes have been described as “beliefs and opinions about the characteristics, attributes, and behaviors of members of various groups” (Whitley and Kite 2006, p. 6). In contrast, prejudice is depicted as the feelings people have toward different social groups. Prejudice is “an attitude directed toward people because they are members of a specific social group” (Whitley and Kite 2006, p. 7). Discrimination is conceived of as the behavior people enact toward members of different social groups. It has been defined as “treating people differently from others based primarily on membership in a social group” (Whitley and Kite 2006, p. 8). Note that stereotypes, prejudice, and discrimination can be either positive or negative in valence, as people may have positive or negative mental representations and feelings and act positively or negatively toward others based on their social group membership. The majority of research on this topic, however, has focused on negative stereotypes, prejudices, and discrimination directed at different social groups.

Ageism was first defined as age-based stereotyping, prejudice, and discrimination (Butler 1969). In its original conception, age bias was conceptualized as bias directed at older adults, but prejudice toward young people also exists. The present entry focuses on ageism

directed toward older people. Compared with research on other types of bigotry (e.g., racism, sexism), far less research exists on ageism (Chasteen et al. 2011; North and Fiske 2012). The majority of research that has been done on ageism has focused on negative age stereotypes, prejudice, and discrimination.

### Age Stereotypes

One of the primary features of age stereotypes is that they are complex, consisting of both positive and negative elements. This complexity was first proposed by Neugarten in 1974 (Neugarten 1974). It was suggested that there are at least two age groups of older adults: the young-old and the old-old. The young-old are conceived of as relatively active, healthy, and educated and the old-old as less active and healthy. Since that time, the complexity of age stereotypes has been further characterized by a number of researchers. For example, Hummert (2011) found a total of seven specific age stereotypes of older people that were shared by young, middle-aged, and older adults. The seven stereotypes consisted of four negative – severely impaired, despondent, shrew/curmudgeon, recluse – and three positive – golden ager, perfect grandparent, and John Wayne conservative. Kornadt and Rothermund (2014) suggest that there is even greater complexity to age stereotypes, such that the content and valence vary as a function of context, specifically, the life domain in which older people are being considered at that time. They found evidence that evaluations of older adults could vary across eight different life domains: family, friends, religion, leisure, lifestyle, money, work, and health.

Other researchers also contend that stereotypes of older adults are not simply negative but consist of positive and negative components. The stereotype content model (SCM) suggests that most groups are evaluated along two fundamental dimensions: warmth and competence (Cuddy et al. 2008). Stereotypes about groups are based on the degree to which members of those groups are seen as warm and as competent. In the case of

older adults, they are viewed as warm but incompetent. According to the SCM, this combination of perceptions can lead to feelings of pity toward older people and to paternalistic prejudice.

Most of the research on the content of age stereotypes has been done in Western cultures such as the United States and Europe. Studies that have compared Eastern and Western cultural perspectives have produced somewhat inconsistent findings. Some research found that individuals from Eastern cultures held more positive views of older adults, whereas others found that age stereotypes of older adults were more negative in Eastern cultures, such as in Asia (Hummert 2011). Despite these inconsistencies, however, there has been some agreement across Eastern and Western samples about the general content of age stereotypes, such that the age stereotypes found in some cultures (e.g., stereotypes about age-related cognitive and/or physical impairment) have also been identified in others (North and Fiske 2012; Hummert 2011). Instead, culture seems to influence what domains people emphasize within the general content of age stereotypes, such that individuals from Western cultures tend to focus more on age stereotypes about mental and physical traits, whereas individuals from Eastern cultures focus more on social and emotional traits (Hummert 2011). Overall, though, there is a great deal of convergence between Eastern and Western perspectives on the content of age stereotypes.

As noted earlier, context can determine how older people are stereotyped and perceived. Most of the research on age stereotypes has focused on descriptive stereotypes, or depicting the content of people's beliefs about how older people are. More recent work has shown that prescriptive age stereotypes are also applied toward older people. Prescriptive stereotypes refer to beliefs about how older people should behave and involve expectations that are used to control what older people do (North and Fiske 2012). Three types of prescriptive age stereotypes have been posited to exist: *succession*, *identity*, and *consumption* (North and Fiske 2012). For *succession*, the prescriptive age stereotype is an expectation that older adults will relinquish resources such as jobs to younger generations, who wish to succeed

them. A prescriptive stereotype about *identity* pertains to the expectation that older adults “act their age” and engage in age-appropriate behavior. For *consumption*, the prescriptive stereotype refers to concerns that older adults will consume more than their fair share of resources such as health care or pensions. The researchers suggest that when older adults violate any of these three prescriptive age stereotypes, they are more likely to face hostile prejudice rather than paternalistic prejudice, as posited by the SCM (North and Fiske 2012).

### Age Prejudice and Discrimination

Several reviews and meta-analyses have been conducted on attitudes toward older adults. The majority of studies have found that older adults are viewed negatively more often than positively (Chasteen et al. 2011; Hummert 2011; Kite et al. 2005). The context surrounding the assessment of age-related attitudes, however, can make a difference. For example, within-subject designs in which young and older adults are directly compared tend to produce more negative assessments of older adults than when a between-subject design is used. As well, when older adults are depicted as behaving in stereotypically consistent ways, such as being forgetful, they are rated more negatively (Hess 2006).

Consistent with the results for explicit evaluations described above, results of studies that have used implicit assessments of attitudes toward older adults have also found more negative than positive reactions (Hummert 2011). For example, research using the implicit association test (IAT) found that people implicitly preferred younger over older adults. Respondents demonstrated these preferences not only in Western countries but in Eastern nations as well (Hummert 2011).

Although a great deal of research has found negative attitudes toward older adults, expressed both explicitly and implicitly, findings from the SCM suggest that there should be instances in which attitudes toward older adults are ambivalent. Based on the SCM, Cuddy and colleagues developed the BIAS (behaviors from intergroup affect and stereotypes) map in order to capture the

different types of prejudice and discriminatory behaviors that various social groups might face (Cuddy et al. 2008). They propose that discriminatory behaviors can be predicted systematically from both the stereotypes and emotions (prejudices) perceivers hold of various social groups. In their BIAS map, Cuddy and colleagues contend that two dimensions explain a wide scope of discriminatory behaviors toward various groups, including older adults: (1) the intensity of the behavior (i.e., active or passive) and (2) the valence of the behavior (i.e., facilitative or harmful) (Cuddy et al. 2008). The intensity dimension refers to the amount of effort a person puts into a behavior. Active behaviors are straightforward, explicit, intense, and purposeful, whereas passive behaviors are indirect, implicit, and relatively less intense and purposeful. The valence dimension helps to explain whether the intended consequences of active and passive behaviors will be positive or negative. Facilitative behaviors are prosocial and help others achieve their goals, thus leading to positive outcomes. In contrast, harmful behaviors are antisocial and impede others from reaching their goals, thus leading to negative outcomes for the target group. In combination, these two bipolar dimensions produce four categories of discriminatory behaviors:

1. *Active facilitation*. Behaviors that fall under this category are overtly intended to benefit members of a group. Examples of these are providing aid or offering an older adult a seat on public transportation.
2. *Active harm*. Behaviors classified in this category are overtly intended to disadvantage a group. Examples include physical or verbal abuse.
3. *Passive facilitation*. Behaviors categorized this way involve cooperating with another group with the intention of benefitting the self. Notably, however, both groups benefit from this behavior. An example would be providing companionship to an older family member in order to receive an inheritance from him or her.
4. *Passive harm*. Behaviors falling under this category involve hurting another group by

distancing oneself from that group. This is achieved by ignoring or socially excluding others. An example is choosing not to hire an applicant because of his or her age.

In order to predict whether individuals will act in an active or passive manner that is either helpful or harmful, Cuddy and colleagues argue that the perceived warmth and competence of a particular group must be considered. Importantly, they contend that the warmth dimension is more important than the competence dimension, because the warmth judgment is based on the extent to which people believe that a target group's goals threaten the self. Thus, the level of warmth attributed to a group predicts whether perceivers will act in an active facilitative or in an active harmful manner toward that group. That is, groups stereotyped as high in warmth evoke active helping behavior from others and groups stereotyped as low in warmth evoke active harmful behavior from others. Conversely, competence stereotypes of a group are predictive of whether others will act in a passive facilitative or in a passive harmful manner toward members of that group. People will behave in a passive facilitative way toward groups perceived as highly competent and in a passive harmful way toward groups perceived as low in competence. Findings supporting the SCM show that older adults are stereotyped as warm but incompetent and are often treated in active facilitative and passive harmful ways (Cuddy et al. 2008). For instance, institutionalization can be intended to help an older adult; however, it also isolates that individual from society and can lead to neglect.

Emotions mediate the link between combinations of the warmth and competence stereotypes and behavior. *Admiration*, based on the stereotype that a target group is high in both competence and in warmth, leads to both active and passive facilitation. *Contempt*, based on the stereotype that a target group is low in both competence and in warmth, leads to both active and passive harm. *Envy*, based on the stereotype that a target group is high in competence but low in warmth, leads to active harmful and passive facilitative behaviors. *Pity*, based on the stereotype that a target group is

low in competence but high in warmth, leads to active facilitative and passive harmful behaviors. Given that older adults are stereotyped as highly warm yet not very competent and are a pitied group, they are often treated with paternalistic or benevolent prejudice (Cuddy et al. 2008). Such behaviors convey the message that older adults are subordinate, weak, and incapable.

While pity is the default emotion associated with older adults, there are instances in which they may face other kinds of discriminatory behavior. As noted earlier, when older adults violate prescriptive age stereotypes, they are more likely to face hostile forms of prejudice. For example, when older adults violate age prescriptions about succession (i.e., yielding desired resources like jobs to younger age groups), they are more likely to face envious prejudice (North and Fiske 2012). If older people violate the prescriptive age stereotype concerning consumption (i.e., using only one's fair share of common resources such as health care), feelings of contempt and anger may ensue. But if older adults violate age prescriptions about identity and do not "act their age," they will likely face distancing and rejection. When any of these three prescriptive age stereotypes are perceived to be violated, it is more likely that older people will face some types of hostile ageism (envy, contempt, rejection) than paternalistic or benevolent ageism.

### Examples of Age Discrimination

*Patronizing speech.* Benevolent ageism is often manifested through people's communication patterns with older adults. Patronizing speech, called elderspeak, is often used with older adults in order to attempt to actively facilitate communication and is characterized by over-accommodation and baby talk (Whitley and Kite 2006; Bugental and Hehman 2007). People unconsciously over-accommodate when communicating with elders by being excessively polite and expressive while speaking in a loud and slow manner with great enunciation. Baby talk is an extreme form of overcompensation in which a person uses simplified language, a higher register, and exaggerated

intonation when communicating with older adults as well as physical behaviors such as patting older adults on the head (Whitley and Kite 2006; Bugental and Hehman 2007). Both the verbal and the physical behaviors involved in baby talk convey assumptions about older adults' limited cognitive and hearing abilities as well as situate older adults as subordinate (Whitley and Kite 2006; Bugental and Hehman 2007). Importantly, this form of ageism is used by a variety of communicators such as nurses in nursing homes, strangers, and family members (Whitley and Kite 2006).

*Elder abuse.* Hostile ageism, including elder abuse, can often be seen within the family. The most common forms of elder abuse within families include physical abuse, neglect, financial exploitation, and discrimination in the area of sexuality (Palmore et al. 2005). These forms of abuse are especially common when older adults live with their children and are seen as a burden (Palmore et al. 2005). During physical abuse, physical force is used and may result in bodily harm. Neglect involves a lack of attending to older adults' needs. Financial exploitation includes misusing older adults' money, property, and other assets. Finally, when older adults express a desire for sexual intimacy, they may face criticism from younger family members because such desires are seen stereotypically as abnormal for an older population. This can have negative implications for relationships both within and outside of the family, leaving older adults vulnerable to social isolation.

*Ageism in health care.* Medical professionals may express ageist behaviors and attitudes, which can be observed early on in medical professionals' careers. For instance, medical, nursing, and social work students have reported that they think more positively about the idea of interacting with younger adults and more negatively about interacting with older adults (Carmel et al. 1992). Consequently, these students find that they are least likely to want to work with older adults compared to other age groups and compared to other types of patients (such as drug addicts, heart disease patients, psychiatric patients, etc.) (Palmore et al. 2005; Carmel et al. 1992). This can have

implications for the quality of service that doctors, nurses, social workers, and other health-care professionals provide to older adults. For instance, believing the stereotype that illness is natural in old age may lead students and doctors to misdiagnose physical and psychological ailments and can affect communication with older patients (Whitley and Kite 2006; Hess 2006; Palmore et al. 2005). Doctors and other medical professionals may appear to be less respectful, less informative, and less responsive and to afford less time to older patients than to young and middle-aged patients (Whitley and Kite 2006; Hess 2006).

*Ageism in the workplace.* The workplace is another area in which people may behave in discriminatory ways toward older adults. Many older workers report experiences of being ignored, being excluded from important decisions, and being talked down to by coworkers and bosses (Blackstone 2013). Additionally, younger workers may socially exclude older adults and make offensive jokes about their age (Blackstone 2013). A strong bias exists in the hiring, promoting, and termination processes that favors younger adults. This bias is driven by the incompetence stereotype that people tend to hold of older adults. People prefer to hire and to promote younger candidates, perceiving them as more competent than older candidates. At the same time, people are more likely to terminate jobs filled by older workers, who are more likely to have higher salaries (Whitley and Kite 2006; Palmore et al. 2005). These decisions are often justified with the stereotypic view that older adults are unproductive and less capable in the workplace (Whitley and Kite 2006). Older adults are often encouraged to retire and some are asked to continue to perform the same services voluntarily that they did when they were being paid (Palmore et al. 2005).

*Ageism in the media.* Older adults are underrepresented in the media but are portrayed narrowly when they do appear (Whitley and Kite 2006; Palmore et al. 2005). Generally, the media primarily targets younger audiences and neglects older audiences, thus conveying the message that older adults are of low importance. Even in

magazines which target older adults, such as AARP's *Modern Maturity*, older adults appear in less than half of the advertisements (Whitley and Kite 2006). When older adults are included in the media, negative images primarily depict them as unattractive, out-of-date, and having poor health (Bugental and Hehman 2007). For instance, in a number of magazines, such as *Time*, older adults primarily appear in pharmaceutical advertisements (Whitley and Kite 2006). Magazines and advertisements illustrate aging as an unwanted process and offer a number of solutions to reverse the process, such as Botox injections to smooth wrinkles. Other forms of media, such as comedy shows and birthday cards, insult and make fun of older adults, thus reinforcing negative age stereotypes (Palmore et al. 2005). Furthermore, most people are not aware that such comments may unconsciously intensify people's negative attitudes toward older adults and aging (Palmore et al. 2005).

### **Experiences and Effects of Age Stereotypes and Discrimination**

As discussed earlier, older adults are stereotyped on negative (incompetent, curmudgeon) and positive (warm, perfect grandparent) dimensions. This complexity of age stereotypes creates multiple ways in which ageism can manifest, as highlighted in the BIAS model (Cuddy et al. 2008). Almost all older adults in Canada and the United States experience ageism (Palmore 2004). In fact, 91% of older adults surveyed from Canada and 85% of older adults from the United States reported experiencing at least one form of ageism. Ageist experiences range from severe (e.g., being victimized) to mild (e.g., receiving a birthday card that pokes fun at one's age). Encouragingly, the severe forms of ageism are far less common than milder forms. Only 5% of older adults report experiencing victimization vs. 70% who have experienced jokes based in age stereotypes. However, it is not uncommon for older adults to be patronized (46%), to be ignored (43.5%), or to be met with assumptions of incompetence (35.5%).

Although we know that most older adults will experience ageism, we know relatively little about the effect of ageism on older adults. There is an imbalance in the extent to which the perspectives of those who display prejudice are understood compared with the perspectives of those who experience it. Specifically, more is known about expressions of age stereotypes and prejudice than about what it is like to be the target of those age biases. Of the small amount of research that has documented older adults' ageism experiences, it has been shown that benevolent ageism, such as being patronized, and hostile ageism, such as social exclusion, both have negative impacts on older adults' psychological well-being, cognitive functioning, and health (Hess 2006; Bugental and Hehman 2007). Examples of the deleterious impact of age stereotypes and ageism on older adults include research on the provision of unwanted help (specifically, patronizing speech), age self-stereotypes, and stereotype threat.

*The effects of patronizing speech on older adults.* It is intuitive that hostile ageism will have a negative impact on older adults. It is somewhat less intuitive why benevolent ageism, manifested in helping behaviors, can also negatively affect older people. Patronizing speech, as discussed above, is commonly used when people communicate with older adults. The manner in which older adults experience and respond to patronizing speech depends on their cognitive and functional abilities. Older adults whose functional ability is low are responsive to over-accommodating speech. However, this communication method is often applied to older adults with little or no cognitive decline and is experienced as condescending and patronizing. Specifically, over-accommodation is both insulting and harmful to older adults. It is insulting in that it assumes that all older adults have similarly low cognitive abilities and is a condescending behavior. It is harmful because it is associated with several negative outcomes among older adults including a loss of self-esteem, motivation, and confidence and a loss of feeling in control (Hess 2006). Stereotype-based helping behaviors like this can lead to dependency in older adults by creating a self-fulfilling system of expectations.

Over-accommodation is predicated on beliefs of lowered competency in older adults. With repeated exposure, these beliefs are internalized by older adults and come to be accepted as valid. Once these beliefs are perceived as valid, older adults' expectations about their own abilities are lowered, leading to lower performance, which serves to reinforce the original beliefs of lowered competency (Bugental and Hehman 2007). Thus, the behavior of older adults who experience over-accommodation may not reflect their actual cognitive abilities, but instead be a reflection of the expectations of their caregivers.

*Age self-stereotypes and stereotype embodiment theory.* The extent to which older adults internalize and endorse negative age stereotypes predicts a variety of age-related outcomes, such as for memory function and health. The manner in which this occurs is explained through stereotype embodiment theory (Levy 2009). Stereotype embodiment theory has four main components. The first component explains that age stereotypes are internalized throughout a person's lifetime, forming self-stereotypes among older adults. This highlights a unique aspect of older adults' experiences of ageism (vs. other minority experiences of prejudice). The age group to which a person belongs changes over the life span, with younger adults expecting to age and eventually join the age group of older adults. Thus, over time, older adults go from being outgroup members to ingroup members as people grow older. In contrast, other group identities, such as race, remain constant and membership is stable across one's life span. For most of their lives, people do not perceive older adults as members of their ingroup and are not motivated to challenge age stereotypes (Levy 2009). Thus, when people are first exposed to age stereotypes, often in childhood, they are not motivated to reject these stereotypes like they would be if the stereotypes are applied to an ingroup. Age stereotypes are consistently reinforced throughout adulthood and are internalized after repeated exposure. This process results in age self-stereotypes, whereby older adults apply internalized age stereotypes to their own aging expectations and experiences.

The extent to which age stereotypes influence older adults does not rely on explicit activation or endorsement of these stereotypes. This is the second component of stereotype embodiment theory (Levy 2009), and it is supported with a large body of literature demonstrating that subliminal activation of negative age stereotypes influences older adults' performance on a variety of tasks. Even tasks that are not under conscious control can be affected by subtle activation of age stereotypes. For example, older adults who complete a writing task after exposure to subliminally presented negative age stereotypes have shakier and less steady handwriting than those exposed to positive age stereotypes.

The third component of the stereotype embodiment theory explains that the effects of age stereotypes are only present among people for whom the stereotype is self-relevant. That is, older adults are impacted by internalized and primed age stereotypes but younger adults, for whom the stereotypes are not relevant, are not.

The fourth component of stereotype embodiment theory explains the pathways through which behavioral assimilation to age stereotypes occurs. There are three pathways: psychological, behavioral, and physiological (Levy 2009). The psychological pathway functions through expectations founded in age stereotypes. These internalized stereotypes guide expectations about the aging experience and create self-fulfilling beliefs about the aging process. These expectations limit older adults' ability to perform mental and physical tasks. A second pathway is the behavioral pathway. The behavioral pathway functions primarily through healthy behaviors. A common stereotype about aging is that it is associated with poor health. Internalizing this stereotype leads to the belief that declining health is inevitable and beyond control. This belief prevents older adults from engaging in behaviors to minimize health decline. Thus, the perception that declining health is inevitable prevents older adults from engaging in behaviors that would contradict this belief and a reinforcing pattern of beliefs and behavior is formed. The third pathway, through physiology, is founded in the relationship between stress and various health outcomes. For example, older

adults primed with negative age stereotypes demonstrate larger cardiovascular responses to a stressful situation. Thus, stress, a predictor of health, is a more common experience among older adults holding negative views of aging, leading to more serious health declines, including cardiovascular issues.

*Stereotype threat.* Stereotype embodiment theory (Levy 2009) emphasizes the unconscious relationship between age stereotypes and age-relevant outcomes. A second theory, stereotype threat, focuses on the effects of being aware of age stereotypes (Steele 1997). The extent to which older adults have internalized negative age stereotypes will impact the effect that reminders of their age have on their subsequent performance on age-relevant tasks, including tests of memory (Chasteen et al. 2011). This phenomenon is known as stereotype threat (also conceptualized as social identity threat (Steele et al. 2002)), and it states that concern about confirming a group-relevant stereotype will lead an individual to perform worse on the associated task, thus confirming the stereotype (Steele 1997; Steele et al. 2002). Stereotype threat has been found for memory and cognitive function in tests involving older adults (Hess 2006). When older adults are given instructions emphasizing the memory component of a task, their subsequent memory performance is reduced compared to those who do not experience instructions with this emphasis and compared to younger adults who receive the same instructions. Similar effects are found for recall tasks following a reminder that older adults have poor memory skills.

Stereotype threat functions through multiple pathways to create performance deficits. One path works through reducing older adults' use of memory strategies, such as clustering (Chasteen et al. 2011). A second path functions through reduced performance expectations such that lowered expectations lead to poorer performance. This is similar to what is seen after exposure to benevolent ageism, although the cause of lowered expectations varies. Older adults who value the domain in which they are being evaluated and those who are strongly identified with their age group experience larger stereotype threat deficits (Chasteen et al. 2011).

## Overcoming Age Stereotypes

Age stereotypes contain negative and positive content and are internalized by people across their lives. The impact of negative age stereotypes is demonstrated through stereotype embodiment theory and stereotype threat; however, there are several methods to alleviate these effects. Priming positive stereotypes can facilitate positive outcomes (Palmore 2004; Levy et al. 2014) as can priming incremental (vs. entity) beliefs (Plaks and Chasteen 2013). Successfully completing an age-relevant task can also improve performance on subsequent tasks (Geraci and Miller 2013).

*Positive age stereotypes.* Just as negative stereotypes about aging can lead to poor outcomes for older adults, so can positive age stereotypes facilitate positive outcomes (Levy 2009; Levy et al. 2014). Older adults presented with positive age stereotypes implicitly (subliminally) on a weekly basis for four weeks experienced a variety of positive outcomes. These included increases in the extent to which they endorsed positive age stereotypes, the extent to which they applied positive age stereotypes to their own aging process and their own physical function (Levy et al. 2014).

*Incremental mind-sets.* People who endorse incremental beliefs espouse the view that personal qualities are malleable and that people can improve with effort. In contrast, people who endorse entity beliefs endorse the view that personal qualities are fixed and cannot be improved, regardless of a person's motivation or effort (Plaks and Chasteen 2013). Those who endorse entity beliefs tend to rely more on stereotypes than those who endorse incremental beliefs; they also tend to engage in more self-stereotyping. The extent to which people self-stereotype is particularly relevant to older adults, given the relationship between self-stereotypes and age-associated outcomes discussed in stereotype embodiment theory (Levy 2009). Older adults who endorse incremental beliefs perform better on memory tasks than do older adults who endorse entity beliefs (Plaks and Chasteen 2013). Theories on change may be successfully applied to improve older adults' performance on age-relevant tasks.

Older adults primed with incremental beliefs outperform older adults primed with entity beliefs on measures of free recall and reading span, both measures of memory performance.

*Performance expectations.* The priming effects of exposing older adults to either positive age stereotypes or incremental beliefs operate at an unconscious level to improve older adults' performance on age-relevant tasks. A third means through which the effects of negative age stereotypes can be reduced functions by explicitly changing older adults' expectations about their performance (Geraci and Miller 2013). As discussed above, older people's expectations about age-related outcomes (e.g., memory, health, etc.) impact the extent to which they engage in behaviors to achieve the desired outcome, thus reducing the likelihood of success and ultimately supporting the relevant age stereotypes. Changing older people's expectations can break this feedback cycle. Performing a cognitive task successfully improves older adults' performance on a subsequent memory task by reducing the anxiety associated with the memory task (Geraci and Miller 2013). Interestingly, failing a task produces the same subsequent performance as not performing a prior task: Violating the expectation of failure, not experiencing failure, influences subsequent performance. When older adults expect to succeed, they are more likely to succeed, and it is possible to enhance perceptions of future success through an unrelated prior success.

## Conclusion

Age stereotypes consist of the mental representations people have about older adults. These stereotypes are complex, consisting of both negative and positive content and varying across life domains. Viewing older adults as stereotypically warm but incompetent can lead to patronizing behavior in which older adults face benevolent ageism. When older adults violate prescriptive age stereotypes and do not exhibit expected behaviors, they may face hostile ageism. Benevolent and hostile ageism have been shown to occur in a variety of life domains for older people

and to worsen older adults' emotional, cognitive, and physical well-being. Moreover, older adults may fall prey to aging self-stereotypes because they might have internalized negative age stereotypes earlier in life. Exposing older people to negative age stereotypes, either implicitly or explicitly, can worsen their cognitive and physical function. Fortunately, the deleterious impact of negative age stereotypes on older people can be mitigated through exposure to positive age stereotypes or incremental beliefs about the ability to change or by altering older adults' performance expectations through previous experiences of success.

## Cross-References

- ▶ [Age Stereotypes in the Workplace](#)
- ▶ [Age Stereotyping and Views of Aging, Theories of](#)
- ▶ [Age, Self, and Identity: Structure, Stability, and Adaptive Function](#)
- ▶ [Attitudes and Self-Perceptions of Aging](#)
- ▶ [Cognitive Control and Self-Regulation](#)
- ▶ [Emotion–Cognition Interactions](#)
- ▶ [Self-Theories of the Aging Person](#)
- ▶ [Social Cognition and Aging](#)

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## Age Stereotyping and Views of Aging, Theories of

Lauren E. Popham<sup>1</sup> and Thomas M. Hess<sup>2</sup>

<sup>1</sup>Greenwald & Associates, Washington, DC, USA

<sup>2</sup>Department of Psychology, North Carolina State University, Raleigh, NC, USA

### Synonyms

Age stereotypes; Ageism; Explicit stereotypes; Implicit stereotypes; Stereotype threat; Working memory

### Definition

Stereotypes are beliefs regarding the characteristics of people within the same demographic, cultural, or social group. These beliefs influence social interactions with and perceptions of others based on their membership in a stereotyped group. Such generalizations of a group of people can have negative consequences.

### The Importance of Stereotypes

Stereotypes are cognitive representations – or schemata – of beliefs regarding the characteristics of a group of people that are typically shared by individuals within a culture or social group. These representations play an important role in social interactions by influencing our perceptions of others based upon their membership in stereotyped groups, thereby allowing us to draw inferences about their behavior. Of course, the accuracy of such inferences is dependent upon the accuracy of the stereotype and its appropriate application to a specific target individual. Given the relative inaccuracy of many social stereotypes, however, their influence often leads to biased perceptions of others. The information contained in these representations is also evaluative in nature, and thus stereotypes form the basis for attitudes that we may have toward members of

specific social groups. In other words, the content and evaluative components of stereotypes can play an important role in how we perceive and respond to others in social situations, which in turn can influence the nature of social interactions and the behavior of others. Although most early social psychological theory and research focused on such effects, more recent work has addressed self-stereotyping influences reflecting the degree to which stereotypical beliefs or situational activation of stereotypes affects an individual's behavior independent of the behavior of others. Research on self-stereotyping effects forms the bulk of much recent aging research and thus is the focus of this section.

### Nature of Aging Stereotypes

Stereotypes can be examined in many different ways, and researchers studying aging have used a variety of methods. For example, stereotypes can be examined explicitly by asking people to identify the characteristics associated with a specific group or implicitly through devices such as the Implicit Association Test (Greenwald et al. 1998). They can also be assessed directly through the specific assessment of group attributes or indirectly through trait sorting or by examining inferences about individuals and their behavior that are assumed to reflect stereotypical beliefs. It is important to note that each of these methods may offer unique insights about stereotypes and the contexts in which they emerge. For example, consistent with many other studies of stereotypes, research has demonstrated a mismatch between implicitly and explicitly assessed attitudes about aging (e.g., Hummert et al. 2002).

So, what does research on aging stereotypes tell us? Based upon casual observation and attention to media, one might expect that such stereotypes will be rather negative. Although there is much data consistent with such a view, the ultimate picture is more complex. This complexity is illustrated in research examining the content and structure of age stereotypes in which individuals sorted pictures, descriptors, or traits into

categories (e.g., Brewer et al. 1981; Brewer and Lui 1984; Hummert 1990; Hummert et al. 1994; Schmidt and Boland 1986). Based on the results of these studies, Hummert (1999, 2015) identified specific stereotypes of older adults that were relatively consistent across age groups: golden ager, perfect grandparent, John Wayne conservative, severely impaired, recluse, despondent, and shrew/curmudgeon. Whereas the majority of these categories do represent somewhat negative depictions of older adults in our society, they also illustrate two important points. First, aging stereotypes are multifaceted, indicating that the superordinate category of “older adult” does not do a good job of characterizing people’s cognitive representations. Second, and perhaps more importantly, the schemata used for categorizing older adults are not invariably negative. Of further note is the finding that increasing age was found to be associated with a greater number of subcategories (e.g., Hummert et al. 1994), suggesting that the complexity of our representations of aging is influenced by our own experiences as we move through the life span. This last point relates to the somewhat unique status of old age in that most of us will experience this category as both an out-group in young adulthood and as an in-group later in life, perhaps leading to the expectation that our stereotypes of old age will become less severe as we ourselves age. Interestingly, whereas there may be some tempering with age, there is still much consistency in the nature of such stereotypes across adulthood.

Although the existence of some positive subcategories suggests a somewhat more positive view of later life, their consideration within the context of the stereotype content model (Fiske et al. 2002) may qualify this perspective. This model proposes that stereotypes of out-groups can be characterized in terms of their placement along the independent dimensions of competence and warmth. The in-group tends to be perceived as being high on both dimensions, whereas out-groups are viewed as being higher along one dimension than the other based on perceptions of status and competition relative to the in-group. Research based on this model (e.g., Cuddy et al. 2009) suggests that the general stereotype

of older adults is characterized as high in warmth – reflecting low competition to the in-group (i.e., young adults) – and low in competence – reflecting low perceptions of status. Cuddy and Fiske (Cuddy and Fiske 2002) further suggest that the shared stereotypes identified by Hummert (1999) and others can also be characterized in terms of these two dimensions with only one – the *golden ager* – appearing to be high in both warmth and competence. (Notably, the *golden ager* subcategory is seen primarily in studies where the sample generating stereotypes includes middle-aged and older adults.) Other subcategories can be characterized as being low on at least one of the dimensions of competence (*perfect grandparent*, *severely impaired*, *recluse*) or warmth (*John Wayne conservative*, *despondent*, *shrew/curmudgeon*). Thus, whereas the research on stereotypes does indicate that our conceptions of older adults are not all negative, this structural analysis suggests an underlying negative component to most subcategories of older adults.

In addition to examining the perceived characteristics of older adults, researchers have also examined beliefs regarding the nature of change of specific aspects of behavior across the life span as another means for understanding aging stereotypes. For example, Heckhausen and colleagues (Heckhausen and Baltes 1991; Heckhausen et al. 1989) assessed beliefs about the sensitivity of personal traits to change along with the timing and controllability of such change. They found that, regardless of age, adults expected behavioral losses to dominate over gains with increasing age and that desirable, controllable traits were more likely to emerge and cease development earlier in adulthood than were undesirable traits. In other words, the general characterization of the aging process is rather negative in terms of the losses of desirable traits, the advent of undesirable ones, and the perceived inability to control the latter. Similar types of studies that have focused on more specific domains (e.g., memory, language) have obtained results consistent with these (e.g., Camp and Pignatiello 1988; Hertzog et al. 1998; Ryan and Kwong See 1993; Ryan et al. 1992). Although the characterization of aging from this research is

rather gloomy, these studies also demonstrated that not all beliefs regarding aging and cognition are negative, with differences in attitudes being observed as a function of domain. Thus, for example, while old age might be associated with declining physical and cognitive skills, it is also thought to be associated with growth or maintenance of other aspects of functioning, such as those associated with expressive behavior or wisdom (e.g., Heckhausen et al. 1989; Slotterback and Saarino 1996).

Stereotypes have also been assessed in a somewhat indirect fashion using person perception paradigms that focus on observers' responses to the behavior of others. Inferences about aging stereotypes are made based on different interpretations of and attributions for this behavior as a function of the age of the individual performing the behavior. For example, an identical memory failure is typically judged as more serious in an older adult than in a younger adult (Erber 1989) and is more likely to be attributed to internal stable causes (e.g., ability) in older adults, whereas attributions based on internal, unstable causes (e.g., effort) were more prevalent for younger adults' failures (Erber et al. 1990; Parr and Siegert 1993). Another example can be seen in the realm of language performance, where Kwong See and Heller (2004) examined perceptions of different-aged adults who exhibited high and low levels of language performance. They found that poor-quality language performance in older adults was judged less negatively than it was in younger adults, whereas high-quality performance was judged relatively more positively. This variability in judgments across age groups is assumed to reflect age-based stereotypic expectations (i.e., good performance in young adults, poor performance in older adults). Such findings are consistent with the shifting standards model of stereotype-based judgments (Biernat 2003).

These studies of person perception are not only valuable in examining stereotypes but also in illustrating how they are translated into actual responses to other people. Although the stereotypic traits implied in these studies often have a basis in reality (e.g., impaired memory), the responses to these traits are typically somewhat

extreme. Of even greater interest are situations where stereotypes are incongruent with reality, resulting in potentially inappropriate – as opposed to merely condescending – responses to older adults in relevant contexts. For example, several investigations of perceptions of older workers suggest that aging-related biases are conveyed in judgments regarding their capabilities. Relative to younger workers, older workers are perceived as less physically capable, less healthy, lower in productivity, inflexible, resistant to new ideas, and less capable of being trained. These attitudes are subsequently reflected in institutional behaviors that result in, for example, older workers being given fewer opportunities for training and learning of new skills (e.g., Capowski 1994; Finkelstein et al. 1995). The disturbing aspect of such findings is that these attitudes typically fly in the face of reality. There is little relationship between age and job productivity, and absenteeism is actually lower in older than in younger workers (McEvoy and Cascio 1989; Schmidt and Hunter 1998). What is equally disturbing is that these negative perceptions of older workers occur at an earlier age (e.g., 50–65 years) than commonly associated with more general aging attitudes, suggesting that the time frame typically associated with perceptions regarding the development of negative aging-related characteristics is compressed in the workplace.

In summary, several general conclusions can be reached about stereotypes of aging and older adults. First, our views of aging are multifaceted, with the notion of a general stereotype of old age clearly receiving little support. Second, although there are some positive aspects associated with these stereotypes, they tend to paint a rather negative picture of later life. As suggested by the stereotype content model, this negativity could even be seen to underlie some of the more positive stereotypes of aging. Third, as in many cases, the stereotypes that we hold of older adults are not completely accurate. This may bias how we respond to older adults, with such biases being particularly consequential in situations where there is a clear disconnect between the stereotype and reality. Fourth, developmental context does modify our stereotypes somewhat, with older

adults having more complex views of their group. However, these differences are not as strong as one might expect. In a related vein, although there is some variation across cultures in views of later life, a recent review of the literature concluded that there is “. . . broad cross-cultural agreement on the general nature of age stereotypes that subsumes culturally specific beliefs about individual components of those stereotypes” (Hummert 2011, p. 251). For example, although cultures that value filial piety (e.g., China, Japan, Korea) may treat older adults with more respect than those that do not, individuals in these same cultures often express negative views of aging that are similar to those held in Western cultures (e.g., Boduroglu et al. 2006; Yun and Lachman 2006). Finally, stereotypes of aging are sensitive to context (e.g., type of ability [e.g., Heckhausen et al. 1989], domain of functioning [e.g., Kornadt and Rothermund 2011]). For example, both young and older adults’ perceptions of aging are influenced by the domain of functioning being considered (e.g., health vs. social relationships).

### The Impact of Aging Stereotypes on Older Adults

An important question concerns the extent to which aging stereotypes affect our behavior. A growing body of research in the field of gerontology has shown that aging-related stereotypes have the potential to negatively affect older adults’ functioning whether the negative stereotype is “in the air” in a performance situation or becomes internalized over many years.

**Stereotype threat.** How do stereotypes get “into the air”? Stereotypes become salient through situational cues, leading to harmful threat effects on the behavior or functioning of the stereotyped individual. These situational cues can be blatant, moderately explicit, or indirect and subtle (Nguyen and Ryan 2008). One way in which more explicit influences have been investigated is through examinations of stereotype threat. When reminded of negative, self-relevant stereotypes in a performance situation, the targets of these stereotypes often experience performance

decrements on cognitive tests (Steele 1997). Performance disparities between members of stereotyped and non-stereotyped groups disappear, however, when the stereotype is de-emphasized or made irrelevant in a given situation. This phenomenon is called *stereotype threat*, and it has been observed in myriad situations with many different types of stereotyped groups of people.

Several studies have examined the possibility that stereotype threat may be operative in influencing older adults’ behavior, particularly in contexts associated with negative views of aging. For example, Hess and colleagues (Hess et al. 2003) exposed younger and older adults to one of two different articles: one emphasized aging stereotypes and the other article de-emphasized age differences in memory ability. They found that the older group who had read the negative aging stereotype article recalled a smaller proportion of the words than younger adults exposed to the same article. This difference in performance was dramatically smaller, however, in the condition in which participants were exposed to more positive perspectives on aging. Moreover, the more highly invested the older adults were in the stereotyped domain (i.e., memory ability), the worse they experienced threat-related memory decrements. Related to this, older adults who identify strongly with their own age group are most vulnerable to stereotype threat effects on their memory performance (Kang and Chasteen 2009). Although in the gerontology field most stereotype research has focused on the stereotyped domain of memory ability, older adults have also shown threat-related underperformance in the math domain (Abrams et al. 2008) and in contexts such as the workplace (Buyens et al. 2009; Von Hippel et al. 2013). Importantly, there have also been demonstrations of enhanced functioning in situations where more positive images of old age have been activated.

How does stereotype threat lead to underperformance? Two different mechanisms have been explored in the literature. The first relates to the idea that self-relevant stereotypes spur evaluative concerns. These concerns lead to self-regulation processes, including monitoring of one’s facial expressions and attempting to tamp down self-

doubt and worry (Schmader et al. 2008). The cognitive resources required to engage in self-regulation reduce the availability of resources for performing the task at hand, thus resulting in performance decrements. This working memory mechanism of stereotype threat effects has been observed in younger adults (Schmader and Johns 2003). An alternative perspective has a more motivational focus, centering on mechanisms associated with regulatory focus (Higgins 1997). The idea is that negative stereotypes activate a prevention focus, motivating stereotyped individuals to avoid confirming the stereotype about the group to which they belong. When in this prevention-focused state, threatened individuals tend to perform tasks slowly and cautiously. This approach may lead to apparent reductions in performance but in fact may represent differences in the approach to task. Seibt and Förster (2004) found support for this mechanism of threat effects in younger adults.

In research with younger adults, the working memory perspective has dominated much research. However, there is less evidence that the same mechanism is operating to degrade older adults' performance under stereotype threat. For example, Hess et al. (2009a) and Popham and Hess (2015) found little evidence of working memory impairments in older adults subjected to threat, whereas the latter study found evidence of threat-related working memory impairments in younger adults. Popham and Hess also found that emotion regulation abilities play a role in this working memory mechanism in younger adults. Specifically, younger adults with high emotion regulation abilities were less vulnerable to threat effects on working memory than their counterparts with lower emotion regulation abilities. Given that older adults reported high levels of emotion regulation ability, it leads to the question of whether age differences in the mechanism through which stereotype threat negatively impacts performance are rooted in age differences in reports of emotion regulation abilities. Consistent with this idea, several studies have suggested that performance decrements in older adults under threat may reflect adjustments in their performance. For example, Hess et al. (2009b) found

that older adults under threat were more conservative in their approach. Popham and Hess (2015) also demonstrated that threat led older adults to respond more slowly but also with greater accuracy than their positively stereotyped peers. In the same study, younger adults who were exposed to a self-relevant stereotype showed a propensity toward a similar type of response under threat. However, working memory decrements under threat seemed to better characterize their response to the threat manipulation than regulatory focus.

Other research from the regulatory focus perspective has suggested that the degree to which older adults exhibit decrements in performance under threat depends on the match between task structure and focus. A prevention focus is most likely to result in performance decrements in situations where the task reward structure is focused on gains, whereas improvements in performance will be observed when the avoidance of loss is important. Research by Barber and Mather (2013) has shown that older adults are also sensitive to "regulatory fit," suggesting that the specific task context in interaction with stereotype activation will determine the degree and nature of threat-related effects on older adults' performance.

The investigation of the mechanisms underlying threat is important in better understanding how older adults respond to threat. Whereas there is not much support for diversion of resources from working memory (e.g., worry) accounting for threat influences on older adults' behavior, this does not negate the possibility that such a mechanism may be operative in some circumstances. For example, we might expect that evaluation concerns will be more likely to occur in important contexts outside the lab (e.g., work settings) and that certain characteristics of the individual (e.g., high neuroticism) may accentuate such effects.

**Implicit stereotype influences.** Research has also shown that aging stereotypes can influence older adults' cognitive and physical performance even when stereotypic cues are more subtle or even operate beneath conscious awareness. Priming is an indirect and subtle way in which stereotypes become relevant in a situation. For example, research has shown that implicitly priming

(i.e., activating concepts without the individual being aware) older adults with aging stereotypes negatively affects their performance on memory tasks (Hess et al. 2004; Levy 1996), decreases their walking speed (Hausdorff et al. 1999), reduces balance (Levy and Leifheit-Limson 2009), and increases physiological reactivity to the test situation (Levy et al. 2000). Thus, negative stereotypes can operate somewhat insidiously in affecting older adults' behavior.

**Internalization.** Negative stereotypes about older adults may become engrained at an early age, even though the stereotype does not yet apply to oneself (Bennet and Gaines 2010). As the person grows older, the internalization of aging stereotypes manifests itself in way that damages cognitive and physiological systems, as suggested by Levy's (2009) embodiment perspective on aging stereotypes. Levy et al. (2009) observed in a longitudinal study that people who had internalized negative aging stereotypes in middle adulthood were at increased risk of experiencing a cardiovascular event 20+ years later. The mechanism behind this link may relate to people who believe aging stereotypes also believing in the intractability of disability and disease with age, leading them to live a less healthy lifestyle over many decades. Other research has demonstrated similar long-term effects of negative stereotypes on mortality (Levy et al. 2002) and memory (Levy et al. 2012). Thus, negative perceptions of aging that may be operating relatively early in life may have long-lasting effects as they can become self-fulfilling prophecies (Levy 2009).

## Conclusions

There is ample evidence from experimental and longitudinal studies of the harmful effects of ageism and aging stereotypes on older adults' health and behavior. First, aging stereotypes harm older adults when they lead older individuals to not participate in cognitive activities or engage their memory abilities because it seems pointless, thus becoming a self-fulfilling prophecy. Second,

when aging stereotypes permeate a context, such as the workplace, threat-related decrements can start to occur in the stereotyped domain, and this could have consequences for job performance and career longevity. Given these implications, further research is needed to develop interventions aimed at mitigating such negative effects. Most promising are intervention programs which aim to improve the cognitive functioning or cardiovascular health of older adults through emphasizing positive older age stereotypes (Levy et al. 2000), as positive self-stereotypes can actually override implicit reminders of negative old age stereotypes.

Research on stereotype threat and implicit influences has important implications for older adults. There are potentially long-term consequences from exposure to threat in everyday life. Regardless of the level of awareness, older adults exposed to negative aging stereotypes in the workplace may experience unnecessary stress. In addition, when activation of negative stereotypes leads to underperformance outside the laboratory in real life, poor performance may be mistakenly attributed to an aging-related decline in ability rather than the situational and reversible phenomenon that it is. Such influences may also operate within the research setting. For example, investigators who study memory ability ought to be aware of subtle, inadvertent aging stereotype cues, as the test performance of older participants – and thus our inferences about aging-related changes in ability – may reflect stereotype threat effects rather than normative aging declines.

## Cross-References

- ▶ [Age Discrimination](#)
- ▶ [Age Stereotypes in the Workplace](#)
- ▶ [Age Stereotyping and Discrimination](#)
- ▶ [Age, Self, and Identity: Structure, Stability, and Adaptive Function](#)
- ▶ [Attitudes and Self-Perceptions of Aging](#)
- ▶ [Self-Theories of the Aging Person](#)

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## Age, Organizational Citizenship Behaviors, and Counterproductive Work Behaviors

Michael P. O’Driscoll and Maree Roche  
School of Psychology, University of Waikato,  
Hamilton, New Zealand

### Synonyms

Discretionary behaviours; Positive extra-role behaviours, Prosocial organizational behaviours, Constructive contextual performance Synonyms for ‘counterproductive work behaviours’; Negative work behaviours; Deviant work behaviours

### Definition

This chapter reviews the relationships between age and both positive and negative extra-role work behaviors. The basic issue is whether older workers display more (or less) positive and negative discretionary work behaviors. The research evidence suggests that, overall, older workers are more likely to engage in positive work behaviors (citizenship) and are generally more likely to engage in fewer counterproductive behaviors than younger workers.

In recent years there has been considerable discussion of and research on the job performance of workers, along with the factors which contribute, either positively or negatively, to this performance, as well as the consequences of high and low job performance (for a recent review, see Dalal et al. 2014). From an organizational perspective, it is clear that worker performance is paramount to the overall productivity and effectiveness of the organization. Managers (in particular) are highly motivated to optimize worker performance. Performance on the job is also important to individual workers, as it is a salient contributor to their feelings of achievement

at work, work attitudes (such as job satisfaction), and their overall sense of well-being. Numerous studies have illustrated the close association between individuals’ job performance and a raft of relevant outcomes (Dalal et al. 2009, 2014).

In this literature, frequently work performance is categorized as being either “task” performance (i.e., enactment of tasks which are core to the person’s job description) or “non-task” performance (additional activities that are important, albeit not central to the job description). The latter is sometimes referred to as “contextual performance” (Bergman et al. 2008). It is generally recognized, however, that both kinds of job performance are highly relevant to the overall productivity and effectiveness, of both the individual worker and his or her organization. In contrast to task performance, citizenship and counterproductive actions are viewed as “voluntary” behaviors (Fox et al. 2012), that is, they are not prescribed by the person’s job description or formal rules or regulations within the organization.

This entry summarizes research on the relationship between worker age and two forms of non-task or contextual performance, namely, organizational citizenship behaviors (OCB) and counterproductive work behaviors (CWB). OCB are typically defined as behaviors which are helpful to the organization, such as assisting work colleagues, performing jobs that are not necessarily required but are advantageous to the firm or company, positively promoting the organization as being a good employer, and so on. Many empirical studies of citizenship behaviors in work settings have been based upon the typology of OCB dimensions proposed by Organ (1988), who identified five distinct, albeit interrelated, components of OCB – conscientiousness, altruism, civic virtue, sportsmanship, and courtesy. Although Organ did not further differentiate between person-oriented and organization-oriented OCB, there is a conceptual linkage between this distinction and the five components which he described. For instance, conscientiousness and civic virtue are clearly organization-oriented citizenship behaviors, whereas altruism and courtesy fall under

person-oriented OCB Stereotypes and threats. Sportsmanship might be viewed as belonging in both categories. In addition, while some studies have retained the five-component distinction, others have merged them into an “overall” or global index of citizenship, probably to avoid overcomplicating the data analysis and theory testing, although this procedure does result in some loss of information concerning the five components themselves.

Counterproductive work behaviors (CWB) ► [aging and psychological well-being](#), on the other hand, are typically conceived as deliberate and intentional harm inflicted on the organization and/or individuals within the organization (Bruck-Lee and Spector 2006; Gruys and Sackett 2003; Jones 2009; Krischer et al. 2010; Ménard et al. 2011; Penney and Spector 2005; Spector et al. 2006). CWB are usually classified into two distinct behaviors: interpersonal deviance and organizational deviance (Krischer et al. 2010; Spector and Fox 2010). Interpersonal deviance includes undesirable behaviors aimed at other employees and includes gossiping, lying, physical or verbal abuse, and stealing from other employees (Berry et al. 2007; Robinson and Bennett 1995). Organizational deviance refers to transgressions resulting in production losses and property deviation and includes theft, intentional absenteeism, sabotage, poor job performance, lack of cooperation, passing out confidential information, and/or withholding task information (Berry et al. 2007; Ménard et al. 2011; Ones 2002; Penney and Spector 2005; Shantz et al. 2014; Spector 2012).

Despite the wealth of research which has been conducted on these OCB and CWB, there is considerable debate about whether they are in fact polar opposites, and recent articles have suggested that they are not necessarily negatively correlated with each other (see, e.g., Fox et al. 2012). That is, a person could engage in both OCB and CWB activities, and under certain circumstances OCB might be harmful and CWB could be beneficial to the organization. Mostly, however, these constructs have been treated separately in research. For this reason, the present entry presents separate discussions of their relationships with age.

There have been relatively few direct investigations of the association of age with OCB and CWB. Given the considerable debate over the relationship between age and task performance and effective work, this is surprising ► [altruism and prosocial behavior](#). It would seem logical that the links of age with OCB and CWB would be of considerable interest, both theoretically and practically. Only recently, however, have researchers probed these associations. Below they summarize the major findings from these lines of research. The entry is structured as follows. First they examine the relationship between age and citizenship (OCB), followed by discussion of the age-CWB relationship. They conclude the entry with an overview of the implications of extant research findings and some suggestions for further research in this field.

### Age and Citizenship (OCB)

As noted above, research on the relationship between age and OCB is relatively sparse, and the findings are not totally conclusive. An important and very relevant meta-analysis was conducted by Ng and Feldman (2008), who included the relationship between age and both task performance and contextual performance (organizational citizenship). These authors noted that research over the past two decades or more has obtained inconsistent findings on this relationship. For instance, several studies have found a negative correlation between age and job performance generally, which sometimes has included contextual performance and prosocial behaviors (OCB). The explanation for this negative association is typically that, as workers grow older, their physical and (to a lesser extent) cognitive functioning declines. In situations where these attributes are critical for job performance, it is clear that aging can have some negative impact on task performance. However, this does not necessarily flow over to contextual performance. Instead, growing older can enhance a person’s motivation and willingness to engage in OCB, especially toward other people in their work environment (i.e., person-oriented OCB). In addition, older

workers may display more emotional stability and conscientiousness, both of which are associated with the display of citizenship behaviors (Ng and Feldman 2008).

In their meta-analysis of 380 empirical studies which had incorporated job performance as a criterion variable, age demonstrated relatively small but nevertheless statistically significant relationships with OCB, for both self-ratings and other-ratings of OCB. Ng and Feldman differentiated between three forms of OCB: person oriented, task oriented, and organization oriented. Relationships between age and OCB were somewhat higher for task-oriented citizenship. Ng and Feldman concluded that “older adults are more motivated to volunteer in general” (p. 4013) and that “older workers are good citizens, are more likely to control their emotions at work, and are less likely to engage in counterproductive behaviors” (p. 4013).

Some caution is needed, however, when interpreting the above findings. For starters, the relationships were quite low, .06 for person-oriented OCB, .08 for organization-oriented OCB, and .27 for task-oriented OCB. As suggested by Ng and Feldman, several other variables might function as moderators (buffers) of these relationships. One of these is the person’s physical health status. Put simply, those with health difficulties might be less able to engage in helping and other prosocial behaviors. Secondly, and equally important, chronological age might not be the most salient attribute to evaluate. Ng and Feldman discussed both “subjective age” (how old the person feels) and “relative age” (their age relative to other people in their work environment). As they suggested, in a diverse age environment, older workers may tend to leave core tasks to their younger colleagues, especially if these tasks involve heavy physical activity or are more cognitively demanding, and perhaps engage in more mentoring and support activities. Similarly, there is evidence that career motivations among older workers sometimes shift from a focus on their personal career development to the enhancement of their younger colleagues’ careers and progression within the organization (Lyons and Kuron 2014) ► [Job Attitudes and](#)

[Age](#). If this happens, it is likely that older workers would be more inclined to perform citizenship behaviors, especially in respect to their coworkers.

A more recent meta-analysis of OCB has been reported by Carpenter, Berry, and Houston (2014), although their focus was not specifically on the relationship between age and OCB, but rather on the connection between self-ratings and other-ratings of citizenship behaviors. Nevertheless, they did report the correlations between age and both self-ratings and other-ratings of OCB. Carpenter et al. found quite low relationships between age and the two ratings of OCB. Age was slightly positively related to self-rated OCB ( $r = .03$ ) and slightly negatively related to other-rated OCB ( $r = -.05$ ). The latter correlation might reflect the impact of stereotyping on workers’ perceptions of their colleagues’ levels of OCB, but the overall conclusion is that, at least in this meta-analysis, there was virtually no relationship between age and the two OCB ratings. Interestingly, self-ratings were more convergent with supervisor ratings than they were with coworker ratings of a person’s OCB. Overall, however, the differences between self- and other-ratings were relatively small and not significant.

Bertolino et al. (2013) explored stereotypes of both younger and older workers in Italy. They argued that stereotypes are highly pertinent to people’s job performance and especially expectations of their performance. Given the global aging of the workforce, the impact of age stereotypes will probably increase in the forthcoming years. These stereotypes are based only partially on actual differences in performance, such as those described by Ng and Feldman. In addition, people’s perceptions are based on in-group versus out-group distinctions and a tendency to view members of one’s own in-group as being superior (for instance, in terms of performance) to out-group members. For example, Finkelstein et al. (1995) found that younger workers rated members of their own age group more highly than older workers on several performance-related dimensions. Bertolino et al. discussed these differential perceptions in terms of *social identity theory* (Hewstone and Jaspars 1982),

which posits that favoritism toward one's in-group helps individuals to develop a social identity and protects them psychologically from feelings of inferiority.

As discussed by Bertolino et al., perceptions and stereotypes can be as important as objectively assessed performance differences, particularly in jobs where the "eye of the beholder" is highly salient. Their research examined the relationship between perceptions of personality characteristics, using the five-factor model (FFM; Digman 1990; Goldberg 1990) and ratings of organizational citizenship behaviors. They used the measure of OCB developed by Williams and Anderson (1991), which distinguished between person-targeted OCB (known as OCBI) and organization-targeted OCB (known as OCBO). Overall, the findings confirmed the researchers' expectations. Older workers were generally perceived in a more positive light than their younger counterparts, on most of the personality dimensions and on both measures of OCB (consistent with the meta-analytic findings reported by Ng and Feldman). However, these relationships were moderated, to some extent, by the age of the rater. Both younger and older workers tended to rate members of their own age group more positively, and the rater  $\times$  ratee age interaction was fairly substantial.

Iun and Huang (2007) examined the relationship between age and job performance among hospitality employees in Hong Kong. These authors suggested that the nature of work (job type) and industry might have an effect on the age-OCB relationship. Specifically, work in the hospitality industry (e.g., restaurants, hotels) tends to be physically demanding and fast-paced, which may not suit older workers. Under these conditions, Iun and Huang predicted that older workers would have less energy and motivation to engage in citizenship behaviors than their younger colleagues. However, they also suggested that this negative relationship would be moderated by a highly relevant attitudinal variable, the person's affective commitment to their organization. Affective commitment (Meyer and Allen 1997) incorporates identification and belongingness with the organization plus a desire to promote

the organization's best interests and success. There is evidence that older workers, particularly those who have been with the organization for a longer time period, are more likely to display high affective commitment to their organization (Costanza et al. 2012). This form of commitment can buffer (moderate) the negative effects of age on work performance. In a hospitality context, working long hours in difficult circumstances, rotating shifts, and under high pressure are common experiences for employees. Accordingly, Iun and Huang anticipated that affective commitment would function to alleviate the negative link between age and performance (including OCB) in this work context.

Their findings confirmed the interaction (buffering) effect of commitment, particularly in relation to altruism, which itself was negatively related to age. Older workers who had high affective commitment to their organization were more likely to self-report altruism toward their work colleagues than older employees with low affective commitment. The moderating effect of commitment was not so pronounced among younger workers however. The authors suggested that their results indicate that affective commitment to the organization might be a very salient factor to consider when endeavoring to increase citizenship behaviors among older workers and that management could focus on ways and means to enhance the levels of affective commitment among older workers, such as providing training opportunities for skill development and more support for the needs of these workers.

Other studies have not directly focused on the relationship between age and OCB, although they have incidentally reported the association between these variables. For example, Jain (2015) conducted a study of organizational commitment and citizenship among public sector managers in India, finding that age negatively predicted both person-oriented OCB and organization-oriented OCB. Although the regression coefficients for age were not substantial in these analyses, they were higher than coefficients for other demographic variables, such as education and job tenure, suggesting that age may indeed play some role in citizenship behaviors.

Jain noted, however, that participants in this research were all male managers, which limits the generality of the findings. Furthermore, Jain suggested that the work culture in Indian public sector organizations emphasizes the importance of democracy and collaboration; hence, citizenship scores may have been subject to some range restriction. The managerial nature of the sample might also have contributed to some lack of variance in citizenship scores. Nevertheless, the findings from this study confirm some other research using different samples, which has also noted a negative relationship between age and OCB. The precise reasons for these departures from the expectation that age and OCB will be positively related are not entirely clear and may well be linked with sample-specific characteristics (as noted above).

Some other studies have obtained no significant relationship between age and citizenship. An example of these findings is a study conducted by Lee et al. (2011) of sales representatives in Japan. The major focus of this research was performance-based pay, but age was also included as a predictor variable of altruism, one of the five dimensions of OCB postulated by Organ (1988). However, in this study the correlation between age and person-oriented OCB was negligible ( $r = .01$ ). As with the Jain research described above, it is possible that this finding may be due to characteristics of the participants in the research. Over 80% of the sample was male, and the nature of their work may be a contributing factor in respect to displaying citizenship behaviors. The relatively low standard deviation for altruism scores suggested that there was little variance in OCB across the sample.

Another recent study which obtained positive, but nonsignificant, relationships between age and self-reported OCB was reported by Macsinga et al. (2015), who were concerned with the association between personality factors (such as extraversion and conscientiousness) and various positive work outcomes (work engagement, affective commitment to the organization, and organizational citizenship behavior). This research was conducted in three different types of organization in Romania. As anticipated, OCB was

significantly related to both work engagement and affective organizational commitment, but hierarchical regression analysis revealed that age did not contribute significantly to any of the three key variables (engagement, commitment, or citizenship). In this case, it was clear that the two personality variables plus feelings of empowerment were much stronger predictors of these outcomes. This may indicate that, while age can be a factor in relation to organizational citizenship, its influence is small relative to other potential contributors.

A third example of positive but nonsignificant linkages is a study reported by Turnipseed and Vandewaa (2012) in the USA. These researchers examined both person-oriented and organization-oriented OCB, as well as what they referred to as “aggregate” OCB (derived from combining scores on the two forms of OCB), and reported near-zero correlations between age and all three OCB scores. As with the Macsinga et al. research described above, regression analysis illustrated that age was not a significant predictor of OCB in this study. Rather, emotional intelligence emerged as the most substantial predictor variable. Interestingly, age was negatively associated with emotional intelligence, although the authors did not posit possible reasons for this negative relationship, except to say that one of their samples (university professors, who were substantially older than the other sample, of students) may have displayed less variability in emotional intelligence scores.

Overall, therefore, the jury is still out on whether age is a major contributor to organizational citizenship behaviors, and the evidence is very mixed and inconsistent. One clear implication is that research on age effects needs to examine the possible reasons for a relationship between age and work performance, including citizenship. Even studies which have obtained a significant relationship (mostly positive) between these variables have concluded that the effects of age are likely to be indirect, that is, that there are intervening (mediating) variables in the relationship between age and citizenship. Rioux and Penner (2001) conducted a study which did not focus on age as a predictor of OCB but nevertheless raised

an interesting possible explanation for this relationship. Rioux and Penner examined the potential motives for enacting citizenship behaviors in a work context. They suggested three general motives – concern for the organization, prosocial values, and impression management – which may be pertinent to the display of citizenship, along with empathy and helpfulness (which they labeled as prosocial personality factors) and perceptions of distributive and procedural justice in the organization.

In their research, the three motives were predictors of all five of Organ's (1988) citizenship dimensions, especially altruism, civic virtue, and sportsmanship. As noted, Rioux and Penner were not directly concerned with age as a predictor of OCB, but it is reasonable to expect that older workers would score more highly on motives such as concern for the organization and prosocial values. Although other investigators have also noted that younger and older workers may differ in terms of their work motivations, further research is needed to explore this possibility.

As well as motivational differences, it is also possible that younger and older workers have differing perceptions of the nature and importance of citizenship behaviors at work. Citizenship is typically placed under the rubric "contextual performance" and is considered to be voluntary behavior that is not linked with the organizational reward system (e.g., pay or promotion), in contrast to "task performance," which is mandated by the individual's job description. That is, citizenship behaviors are not (normally) considered to be part of the in-role performance of workers. However, Wanxian and Weiwu (2007) argued that older workers may believe that citizenship is expected of them, and they may feel some obligation to enact these behaviors. Wanxian and Weiwu reported an interesting study in North China which examined this proposition. They predicted differences between the perceptions of younger and older workers of the centrality of OCB to job performance, with older workers more likely to view OCB as a component of their in-role performance. This expectation was confirmed, with a significant positive correlation between age and all five of Organ's OCB dimensions.

In addition, older workers were significantly more likely to rate citizenship behaviors as being part of their job. The authors attributed these findings to Chinese cultural changes over the past two decades, with younger workers now more likely to express individualistic rather than collectivistic values and to place more emphasis on self-interest and self-achievement rather than the more traditional (collectivistic) values of interpersonal harmony and overriding concern for their employing organization. Whether these differences would be obtained in other cultural settings is a matter for further empirical research.

So far we have discussed the potential direct relationships between age and organizational citizenship, and most studies have focused on this direct relationship. It is also possible, however, that age may be a moderator of relationships between OCB and other variables. Few studies have investigated this potential moderation effect. Wagner and Rush (2000) suggested that older workers typically exhibit greater job satisfaction than their younger counterparts and tend to have lower need for achievement and higher need for affiliation. They argued that these differences "lead to different salient motives for altruistic OCB among younger and older employees" (p. 382). Specifically, older workers may have more belief in the moral imperative of helping other people and hence a greater propensity for altruism in their work environment. Based on this logic, Wagner hypothesized that age would moderate relationships between OCB (altruism) and various work attitudes, including job satisfaction, organizational commitment, trust in peers and management, and moral judgment.

For their research, Wagner and Rush administered questionnaires to nursing staff from two hospitals in the USA. Their results demonstrated no direct relationship between age and citizenship, but age significantly moderated the relationship of several predictor variables (including trust in management, job satisfaction, and commitment) with OCB (altruism). Specifically, older workers displayed a stronger relationship between moral judgment and self-reported altruistic OCB, whereas relationships of OCB with job satisfaction and organizational commitment were

stronger among younger workers. The authors concluded that “dispositional tendencies to behave in an altruistic manner may have been better predictors of behavior for the older workers” (p. 388). Furthermore, the inherent value of helping behaviors may be more internalized among older workers. These interpretations coincide with the suggestions proposed by Rioux and Penner.

### Age and Counterproductive Behaviors (CWB)

As they noted earlier, there has been relatively little research on the relationship between age and both OCB and CWB, and the attention given to CWB is far less than that accorded to OCB. It is well established that CWB cost organizations billions of dollars every year especially in terms of lost productivity, lost or damaged property, increased insurance costs, and increased turnover (Krischer et al. 2010; Penney and Spector 2005). Additionally, CWB result in loss of job satisfaction, increased job stress, burnout, increased somatic tension, and fatigue (Spector and Fox 2002; Penney and Spector 2005). While there continues to be a lack of empirical understanding of the antecedents of CWB, it has been suggested that they may be the result of job conditions such as stressful work, job conflict, role ambiguity, organizational injustice, and perceived lack of job control (Fox et al. 2001; Jones 2009; Spector 2012). These contribute to employee negative emotions, and thus, engagement in CWB can be viewed as a way to restore psychological equilibrium. Some research suggests that engagement in CWB allows employees to cope with work demands (Allen and Greenberger 2013). Indeed Spector and Fox (2002) speculated that CWB may reduce negative feelings, enhance positive feelings, and serve no other purpose than to “even the score” (p. 274).

While stressful or unjust organizational and/or job-related experiences contribute to our understanding as to why people may engage in CWB, little research has focused on person-centered explanations. Some research has indicated that

specific personality traits (e.g., anger, anxiety, agreeableness, and conscientious) are associated with CWB (Fox and Spector 1999; Fox et al. 2001; Spector 2012). However, far less research has focused on age as an antecedent to CWB (Ng and Feldman 2008).

The aging workforce has seen an increase in negative stereotypes of older workers (Ng and Feldman 2008; Spector 2012). For example, there tends to be a belief that older workers lack motivation, show reluctance to engage in training and development programs, and are resistant to change (Ng and Feldman 2008). However, there is no empirical evidence to support these stereotypes. In fact, research has indicated that some of these stereotypes are totally inaccurate (Ng and Feldman 2008). Specifically in relation to CWB, empirical research has found that as individuals age, they are *less likely* to engage in deviant behaviors such as poor job performance, absenteeism, and theft (Gruys and Sackett 2003; Lau et al. 2003; Mangione and Quinn 1975; Ng and Feldman 2008; Shantz et al. 2014).

In the Ng and Feldman (2008) meta-analysis discussed above, these authors found that age was significantly and negatively related to CWB, with results indicating that older workers were less likely to exhibit workplace aggression, on-the-job substance abuse, lack of punctuality, and absenteeism. Moreover, Lau et al. (2003) in their meta-analysis found that particular CWB (theft, production deviance, poor punctuality, and absenteeism) also decreased with age.

In a much earlier study, Mangione and Quinn (1975) examined the relationship between job satisfaction, CWB, and drug use in the work setting. They found that CWB were less prevalent in older employees, than those who were younger than 30 years old. This finding was supported by Shantz et al. (2014), who examined several workplace variables (work engagement, perceived organizational support, turnover intentions, and deviant behavior). Post hoc analyses found a significant negative relationship ( $r = -.33$ ) between age and deviant behavior, indicating that older workers were less likely to engage in CWB than younger workers.

Typically, research tends to indicate that the relationship between age and CWB is negatively related (Hollinger 1983; Lau et al. 2003). While there is little understanding of the reasons for this, it has been suggested that older workers have greater satisfaction and commitment toward their job than their younger counterparts and are, therefore, less likely to engage in CWB (Hollinger 1983; Mangione and Quinn 1975). Hollinger (1983) suggested that younger workers have less commitment to their organizations, are less likely to view CWB negatively in relation to social norms, are less emotionally mature, and feel “less social risk if detected” (Hollinger 1983, p. 67). On the other hand, even though older workers are less likely to engage in CWB, they tend to be more secure and more socially aware; thus, they may see counterproductive behavior as appropriate action to take if there is a lack of organizational justice (Fox et al. 2001). For instance, older workers may be more likely to engage in retribution or “whistle-blowing” (Miceli and Near 2005) if they perceive unfair work conditions and procedures. However, this proposition has not been fully explored to date.

Overall, research demonstrates that older workers are less likely to engage in CWB (Gruys and Sackett 2003; Lau et al. 2003; Mangione and Quinn 1975; Ng and Feldman 2008; Shantz et al. 2014). While more research is needed in this area to uncover and understand why this is so, researchers have found that older workers are more likely to contribute to their organizations and more consciously engage in positive actions (such as OCB), rather than negative work behaviors (Ng and Feldman 2008). Thus, while some negative stereotypes of older workers continue to exist, it is acknowledged that, despite being in its infancy, research examining older workers and CWB has uncovered significant findings and that older workers are less likely to engage in counterproductive work behavior. These findings add to notions that older workers are key to organizational success and hopefully will encourage employers to rethink the roles and contributions of these workers (Shantz et al. 2014), who will be important assets to workplaces in the future.

## Conclusions and Implications

In this entry we have overviewed the link between age and two forms of contextual behavior – citizenship and counterproductive work behavior. Overall, the picture which emerges from the (relatively sparse) research is that relationships of age with these two contextual behaviors are somewhat indeterminate, although the research findings suggest that age may be (slightly) positively associated with OCB and negatively linked with CWB. Other factors, however, can also play a major role in the expression of these behaviors, and these need to be taken into account when examining the possible effects of age. We have highlighted that personality and motivational factors in particular may be especially relevant to the impact of age on OCB and CWB.

Two important implications of the extant research findings are that (a) negative stereotypes of older workers need to be counteracted and (b) older workers need appropriate types and amounts of support to contribute their knowledge, skills, and abilities to enhance organizational performance. The research on OCB and CWB therefore has significant implications for organizational managers and HR practitioners, who need to be aware of the potential for stereotyping to affect older workers’ performance and well-being and also of the importance of appropriate forms of social support for older workers.

Clearly, more systematic research is needed on these topics, especially longitudinal studies which control for the effects of other variables which contribute to OCB and CWB when examining age relationships with these variables. As the population in general and the working population grow older over time, research on the relationships of age with OCB and CWB will increase in importance.

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## Age, Self, and Identity: Structure, Stability, and Adaptive Function

Frieder R. Lang

Institute of Psychogerontology, Friedrich-Alexander-University of Erlangen-Nürnberg, Nürnberg, Germany

### Synonyms

Adaptive self; Age identity; Personal identity; Possible selves; Self-concept; Self-construal; Self-continuity; Self-definition; Self-esteem; Self-regulation; Self-representation; Views of self

### Definition

The *self* is a cognitive structure that involves representations and evaluation of an individual's past, present, and future (Brandtstädter and Greve 1994; Diehl et al. 2011). The structure of the self is typically described along three dimensions (Asendorpf and van Aken 2003): A *content dimension* that involves context-related and domain-specific knowledge of one's internal states, motives, and behaviors. The contents of self-knowledge are also described with respect to their verifiability and veracity (i.e., realistic or illusionary) (Baltes 1997). A *temporal dimension* that reflects knowledge about one's past or future self, and about change of the self over time (Bluck and Alea 2008). An *evaluative dimension* that reflects emotional responses to one's self-representation. In addition, there is a debate regarding whether the self in adulthood should be defined as a process (i.e., regulating one's thoughts and actions), or whether the self reflects an outcome of the aging process. Structures of the aging self are defined as outcomes of age-related change, while the self also involves processes that regulate age-related change. Theories of *personal identity* in old age often do not differentiate between structures and processes in the formation or maintenance of identity across adulthood.

In this vein, maintaining a sense of personal *identity* across adulthood and continuity of identity typically involves effort in response to a change or to discontinuity in the aging process.

## Introduction

This entry focuses on two pertinent issues in the literature on self and identity across adulthood.

- (A) What is the structure of the aging self? How stable is the aging self?
- (B) What are the regulatory functions of the self across adulthood?

The first issue addresses the contents and the *structure of the self* across adulthood as an outcome of aging-related challenges. Typically, the structure and stability of the aging self involves information-processing, temporal, and affective components. The second issue addresses the *regulatory self* as a process across adulthood. The process of self-regulation pertains to the pursuit of goals, to the accomplishment of developmental tasks, and to the maintenance of continuity or stability. At present, the theoretical and empirical research on self-regulation in the aging process remains vague with respect to whether the regulatory self is the target (i.e., *regulating one's internal states*), or the origin of regulatory efforts (i.e., *producing a cognitive, affective, or behavioral output*). Much of the literature pertains to the regulatory self in the latter perspective, while the first perspective is sometimes referred to as coping, or as emotion regulation. There exists a plethora of theoretical and empirical work on self-representations across adulthood (Brandtstädter 1999; Diehl et al. 2011). Consequently, and for reasons of parsimony, this entry focuses on the self across adulthood from a lifespan psychology perspective with regard to the following five fundamental principles of development (Baltes 1997):

*First*, the aging process typically entails *not only loss but also gains* until very late in life. The aging self entails a changing ratio of loss

and gain experiences across adulthood. More importantly, the meaning of what is a gain and loss is malleable. Any loss experience may be subjectively construed as reflecting or involving an experience of gain, or of personal growth. For example, coping with a severe health problem may also entail a sense of mastery and control (Heckhausen 1999).

*Second*, there is a *multidimensionality of change* across adulthood. That is, aging-related change in one domain of functioning may differ from change in another domain. For example, how one perceives oneself in professional life may differ from how one develops in the context of family life. Such domains of the self may be differentially interrelated across adulthood depending on age. Accordingly, self-representations show considerable domain specificity, and domain-specific changes in old age (Diehl et al. 2011; Freund and Ebner 2005).

*Third*, there is much behavioral and cognitive *plasticity* across adulthood, even very late in life. Individuals are able to learn and develop new knowledge, skills, and behaviors at all phases of adulthood. Consequently, there is also malleability of the aging self that appears to respond in flexible and adaptive ways to contextual changes in old age (Brandtstädter 1999).

*Fourth*, the course and direction of the aging process depends on *social and cultural contexts* (Baltes 1997). For example, findings of research on age differences in interdependent versus independent self-construal in various cultures suggest that with increasing age, there is an increasing correspondence between cultural values and an individual's self-representation as a member of the culture (Diehl et al. 2011). For example, older adults in China tend to show a more interdependent self-construal, while older adults in the US tend to promote values that reflect stronger independent self-construal (Fung 2013).

*Fifth*, the human lifespan reflects a finitude of personal resources, and involves a limited future lifetime. Thus, individual differences in resources and remaining time in life strongly

impact the course, direction, and outcome of one's development across adulthood (Carstensen 2006; Heckhausen 1999; Lang et al. 2011). Accordingly, the aging self may positively adapt to a shrinking of one's remaining time in life and to limited resources in old age. Even when experiencing much physical and psychological change, many older adults manage to maintain a sense of continuity of self and identity throughout the aging process, and even into very late life. There is robust evidence that when confronted with the finitude of life, and with limited resources, the regulatory self displays flexibility, resilience, and malleability that contributes to experiences of continuity, or even stability of the self (Brandtstädter 1999; Carstensen 2006).

### The Structure of the Aging Self: Stability and Change Across Adulthood

A fundamental distinction in the structure of the self pertains to the duality of the *self as agent* ("I") versus the *self as known* ("Me") in the tradition of the works by William James (James et al. 1890). In the "*self as agent*"-perspective, the term self typically reflects the origin or target of an individual's conscious thought or action. Examples of this perspective pertain to concepts such as self-regulation or self-monitoring. In the "*self as known*" perspective, the self pertains to contents that account for a person's self-representation. The terms self, self-concept, views of self, and self-representation are used interchangeably to reflect the *self-as-known* perspective. Mostly, the structure of the self is described along three major dimensions: (Asendorpf and van Aken 2003) a content dimension (e.g., "*Who am I?*"), (Baltes 1997) a temporal dimension (e.g., "*How did I change? How shall I change?*"), and (Bluck and Alea 2008) an affective or evaluative dimension (e.g., "*How satisfied am I with myself?*"). Such dimensions are strongly interrelated. Evaluation of the self typically occurs in a temporal frame involving one's past and future, while

reflecting domain-specific and contextual contents. These dimensions of the self operate jointly to both stabilize the self and to promote continuity of personal identity across adulthood (Brandtstädter and Greve 1994; Diehl et al. 2011; Troll and Skaff 1997). Accordingly, a critical question is to what extent the stability and change in content, temporal, and affective dimensions of the self reflect age-related adaptation processes. Lastly, although the three dimensions of the aging self are closely connected in the representations of adults, it is not yet well understood how these dimensions work together to form an adaptive, resilient, and proactive self in old age (Brandtstädter 1999; Freund and Ebner 2005).

### The Content of Self-Representations Across Adulthood

Representations of the self typically refer to a person's knowledge about his or her attributes that he or she believes to be relevant or meaningful (Diehl et al. 2011; Filipp and Klauer 1986). This typically involves all aspects of an individual's self-related knowledge, such as one's physical appearance, personality, behavior, values, attitudes, and motives. The structure of such knowledge is embedded in an individual's developmental context, thus reflecting individual differences related to cohort and chronological age. For example, there exist substantive age differences in self views: Older adults' self views as compared to those of young adults' are typically found to be made up of more issues related to current interests, life circumstances, health, and chronological age. Findings from such studies are corroborated in research on the contents of self-definitions that found much similarity in contents of self-definitions between old and very old adults (Diehl et al. 2011; Freund and Ebner 2005). Self-definitions in old age appear to reflect challenges and contexts of old age that revolve around issues of health, social roles, and meaningful activities in everyday life. Accordingly, it is a robust finding that a more flexible or multifaceted self-definition is often associated with more adaptive functional outcomes in late life (Brandtstädter 1999; Brandtstädter and Greve 1994; Diehl et al. 2011; Freund and Ebner 2005).

To date, few studies have examined the change in the contents of self views in old age from a longitudinal perspective, and those that have often provide data based on short time intervals only. Therefore, findings on the temporal stability of self-descriptions are not consistent and contradictory. There are several possible explanations to help explain the inconsistent findings regarding the stability and change of the aging self.

- (a) Findings vary depending on the *measurement* approach. For example, methods using a free response format show less stability than self-descriptive ratings (Diehl et al. 2011).
- (b) *Context- or domain-specific self-knowledge* (e.g., “I am quite amused about this new movie”) is different than universal self-descriptions (e.g., “I am a humorous person”) that are known to be shared by many individuals (Snyder and Shenkel 1975). Consequently, universal contents of self-definitions are likely to show greater stability over time. The self views of older adults may reflect greater domain-specificity and context-relatedness, and are thus less stable.
- (c) *Core* self-representations differ from *surface* knowledge about self (Asendorpf and van Aken 2003). While the core self reflects stable knowledge about one’s personality (e.g., related to Big Five personality traits), surface self-representations reflect contextual influences that may depend on specific tasks or activities. Accordingly, Diehl and colleagues (Diehl et al. 2011) report that temporal stability of the self is positively associated with a measure of perceived authenticity.
- (d) *Veracity* and *verifiability* of self-related knowledge may also affect stability and change. Some contents of self-definition may be more objectively testable (e.g., “I am a skilled lawyer”) when related to physical appearance, health, skills, competence, and cognitive abilities, while some contents of self-definitions are not observable or difficult to verify (e.g., “I am trustworthy”). This typically pertains to self-views of internal or past states of self, to motives, and to preferences. Typically, the contents of self-definition are

not checked with regard to their veracity. Objectively testable views of the self (e.g., “I am intelligent”) may show greater stability because they are less context-specific. There may be aging-related shifts with regard to veracity of self-representations (e.g., becoming more accurate with age; 14).

In sum, findings on the stability and change of self-views in old age vary depending on what contents of the self are examined and on how such contents are assessed. More research is needed to explicitly address issues related to veracity, verifiability, idiosyncrasy, and context- and domain-specificity of self-representations across adulthood. In addition, multimethod measurement approaches are recommended in the assessment of self-representations across adulthood (Diehl et al. 2011).

### The Temporal Dimension of the Aging Self

The passing of time is a central dimension in descriptions of the aging self. The temporal dimension of the self reflects adaptation, maintenance, and continuity of identity across adulthood. The passing of time in self has been described with concepts such as personal identity (Troll and Skaff 1997), autobiographical memory or remembered self (Bluck and Alea 2008), and possible selves (Hooker 1999). For example, an older person’s view of his or her current self may result from a reflection of his or her past (e.g., “*I am wise now, and I learned many lessons in life*”), his or her present (e.g., “*I am as happy today as I was last year*”), or from thoughts related to one’s future (e.g., “*I feel old because there is not much left to do in life for me*”). There is a paucity of integrative views on how the temporal components of the aging self relate to the structure and stability of the self. In general, findings suggest that the self-representations of older adults are mostly present-oriented, and more likely to refer to the past than to the future (Diehl et al. 2011; Filipp and Klauer 1986; Freund and Ebner 2005). It has also been suggested that this may be reflective of the narrowing of future time that results in a process of seeking meaning in those domains and contexts that are of immediate centrality and relevance of the self (Brandtstädter 1999; Carstensen 2006).

A critical issue pertains to the adaptive function of the temporal perspective in views of the self. There is agreement in the literature that the temporal perspective in self-representations serves to stabilize the present view of the self (Brandstädter 1999; Staudinger et al. 2003). Temporal perspectives may contribute to such stabilization in several ways:

- (a) Comparing one's current self with a less positive view of the self in the past (e.g., "*I have become more wise now*"). Such downward temporal comparisons may protect one's current view of his or her self (Staudinger et al. 2003). One implication is that typically, with increasing age, the veracity in representations of one's past self is difficult to prove.
- (b) Anticipating one's future self in humble ways provides a positive frame of reference for views of the self in the future (e.g., "*My life is much better than I had expected*"; 14).
- (c) Focusing on one's present internal state of self may provide a meaningful experience when perceiving a narrowing of one's remaining time in life (Carstensen 2006).

In sum, the temporal perspective is critical for understanding the *adaptivity*, the *plasticity*, and the *malleability* of the aging self. The temporal perspective reflects one of the fundamental experiences that also relates to a flexibility of aging identity in old age (Weiss and Lang 2012). Accordingly, there may be two processes responsible for promoting a flexible aging identity, where one process is related to a dissociation of the self from one's age group, and a second process pertains to one's identification with his or her generation or birth cohort as a resource of social identity. In old age, perceiving one's past self in terms of mastery and competence, while expecting one's future in humble ways, and finding meaning in one's current self appears to reflect a resilient and adaptive self (Lang et al. 2013).

### The Evaluative Dimension of Aging Self

The emotional component of self-representations is reflected in positive and negative evaluations of the self. The evaluative dimension of the aging

self is strongly associated with two psychological constructs, namely self-esteem (Wagner et al. 2014) and possible selves (Hooker 1999).

Self-esteem is defined as a positive evaluation of one's self, and has been shown to decrease over time with respect to both mean levels, and rank-order stability (Wagner et al. 2014). Currently, it is an open issue to what extent the expression of self-esteem in old age depends on age-specific resources, where age-specific resources are not fully understood. For example, self-esteem in old age may depend more strongly on how well older adults manage to lower their expectations towards their future self. Developing more modest and prevention-oriented frames of self-evaluation may protect, and at times even provide a positive attitude toward the self in old age (Brandstädter 1999).

Possible selves involve an evaluative frame of the self in the aging process. Hoped-for selves and feared selves reflect an individual's strivings and goal-pursuits. That is, fears indicate what one wants to preserve and maintain, and hopes pertain to aspects of the self that one would like to change or achieve. In this vein, possible selves constitute a motivational dimension in the structure of the aging self (e.g., "*What am I up for?*"; 9). While hopes pertain to a striving for growth and goal achievement, feared selves reflect a preventive orientation, and strive to maintain the present state of self. Thus, hoped-for and feared selves may pertain to distinct processes in the evaluation of the aging self.

Generally, future expectations are robustly observed to be relatively low and modest among the oldest-old adults. Discrepancies between the ideal self and the current self are reported to be relatively low in old age (Diehl et al. 2011). It remains an open question as to what extent age-related changes in discrepancies of possible and current selves also reflect a positive or negative evaluation of the self. Theories of positive versus negative self-perceptions of aging are not always precise with regard to whether the positive or negative affective valence involves a unidimensional (i.e., bipolar), or a two-dimensional structure. In addition, the time perspective of affective evaluations of the self is still not well understood.

Positive evaluations of one's past self, one's present self, and one's future self may have age-differential functions (Brandtstädter and Greve 1994; Bluck and Alea 2008; Hooker 1999; Staudinger et al. 2003). Also, social comparisons with other people may age-differently influence one's self-evaluation in old age (Heckhausen 1999). More research is needed to clarify the age-differential temporal dimensions of self-evaluation in the aging process. Finally, positive self-evaluation is robustly found to contribute to positive aging outcomes such as health and longevity (Wagner et al. 2014).

### **The Regulatory Self Across Adulthood: Adaptive Functions**

In lifespan psychology, the individual is typically viewed as a co-producer of his or her own development (Baltes 1997). The notion of co-produced aging implies that there are active processes involved that reflect responses to age-related challenges such as limitation, loss, or environmental change. This implies that individuals engage in interactive processes between their internal states and the external world. Hence, individuals may either bring about a change of their internal self or a change in the external world. Processes of adapting the aging self as well as processes related to changing one's contexts in the aging process are typically referred to as self-regulation or developmental self-regulation (Brandtstädter 1999; Heckhausen 1999). Regulation processes may differ depending on chronological age, available resources, and time limitations remaining in life. For example, studies show that individuals actively choose meaningful contexts and social roles across adulthood when they perceive to have limited time left in life (Carstensen 2006; Fung 2013). In this vein, individuals invest resources in activities and goal pursuits that they prioritize, while disengaging from other less prioritized domains of life.

Regulation of the aging self reflects age-associated efforts and activities that emerge in response to age-specific challenges across adulthood (Baltes 1997). Typically, challenges

that require regulatory efforts involve limitations or constraints of the older individual's resources. In the aging process, there are typically two main sources for an increased need of self-regulatory effort.

*First*, limitations of resources in old age, and the finitude of time in life both challenge self-representations in later adulthood. The biology of the aging organism typically relates to increased loss experience, declining health, and limited physical or mental functioning (Baltes 1997). In addition, only humans are capable of anticipating their future self and to perceive the ending of their time in life (Carstensen 2006; Lang et al. 2011). Thus, older adults are typically confronted with biological deterioration and with a nearing end of their lives. Taken together, these objective conditions of human existence can be expected to threaten or even erode the stability and continuity of the aging self. Surprisingly however this is not observed. Consequently, one may expect powerful and strong self-regulatory forces that contribute to the maintenance, continuity, and stability of the self until very late in life.

*Second*, in later adulthood compared to earlier phases of adulthood, there are fewer social norms that structure one's activities, tasks, and social roles (Heckhausen 1999). At the same time, negative views of aging and age stereotypes prevail. However, in old age there is much heterogeneity and variability in all domains of functioning, including the self (Baltes 1997). Consequently, the potentials of the individual reflect a wide array of biographical, contextual, and biological resources. This implies that there do not exist general guidelines or rules on how challenges related to old age may be mastered in positive ways. Generally, there is not one uniform trajectory of change in old age; on the contrary, the course and direction of an individual's aging process may strongly reflect a life-long history of individual decisions. Again, this involves that individuals may have to invest regulatory effort in response to challenges, but there is not one single solution on how to find an adaptive person-environment fit.

In sum, both biological and societal constraints challenge the plasticity and the malleability of the

regulatory self in old age. There are several theoretical perspectives that have elaborated and advanced assumptions of processes involved in the adaptive regulation of the aging self. For reasons of space, two exemplary models of self-regulation in old age are addressed here: the dual-process-model of assimilation and accommodation of the resilient self (Brandtstädter 1999; Brandtstädter and Greve 1994), and the model of selective optimization with compensation (Baltes 1997; Lang et al. 2011). Descriptions of related models such as the life-span theory of primary and secondary control can be found elsewhere (Heckhausen 1999).

### Dual-Process-Model of Assimilation and Accommodation

Throughout adulthood, individuals are confronted with processes of change of internal or external resources. Such aging-related change may result from discrepancies between the desired and the actual self in old age. According to the dual-process model, there are two ways of coping that individuals can utilize to reduce, resolve, or eliminate self-discrepancies in old age. These coping strategies are referred to as assimilation and accommodation processes (Brandtstädter 1999; Brandtstädter and Greve 1994), and are assumed to operate antagonistically, that is, when accommodative processes are activated, assimilative regulations are inhibited.

*Assimilation* involves intentions that aim to transform a situation such that the situation is in greater accord with the individual's self-representation or personal goals. Assimilative activities target the direction and regulation of one's behavior, and pursuits that are of personal relevance to one's self concept. Thus, assimilation involves activities that stand in the service of continuity of one's self and identity. For example, according to the dual-process model, older adults may engage in assimilative actions that involve prevention of future self-discrepancies (e.g., *preparatory activity*), correction of ongoing behaviors (e.g., *choosing a more healthy diet or engaging in sports*), or compensation (e.g., *use of a hearing aid*). However, it is suggested that

assimilative activities are relinquished when it is not in the service of self-continuity (Brandtstädter 1999).

*Accommodation*, in contrast, is activated when assimilative efforts are obstructed and when the continuity of self is challenged. Accommodation involves efforts to restructure and reframe one's self-representation and goal pursuits, for example, by lowering expectations and restructuring priorities and preferences. Brandtstädter (Brandtstädter 1999) argued that the accommodative process – once activated – “*overrides assimilative tendencies*” (Brandtstädter 1999, p. 128) by eliminating and reinterpreting any prior thought or pursuit that is in the service of such tendencies. For example, when goals are blocked, one may disengage from, devalue, or redefine a goal in more flexible ways.

In addition, some depictions of the assimilation-accommodation model also refer to an additional process that has been suggested to protect the self from realizing any potential discrepancies between desired and actual states. This process has been described as immunization (Brandtstädter 1999; Brandtstädter and Greve 1994). Immunization involves a preconscious and automatic avoidance or neglect of self-discrepant information. It is not quite clear to what extent such immunization may be separated from automatic, unconscious self-regulation related to either assimilation or accommodation (Freund and Ebner 2005). Immunization may pertain to perceptual and attentional cognitive processes of the aging self. More empirical evidence is needed to better understand the specific ways in which immunization may be empirically differentiated from assimilative and accommodative processes.

Overall, the dual-process model posits that assimilation and accommodation contribute in fundamental ways to the continuity and to the positivity of self-representations in the aging process. While operating in antagonistic ways, all three processes are relevant to successfully adapt to the challenges of the aging process. There is robust empirical evidence that with increasing age, accommodative strategies such as flexible goal-adjustments prevail over more assimilative

self-regulation strategies (e.g., tenacious goal pursuits). Moreover, it has been shown that a shift from an assimilative to an accommodative self-regulation is associated with more positive aging outcomes and psychological resilience (Brandtstädter 1999).

### **Self-Regulation Model of Selection, Optimization, and Compensation**

The self-regulation model of selection, optimization, and compensation (SOC) reflects the multidimensionality of the developmental dynamics of gains and losses across adulthood (Baltes 1997). According to the model of SOC, any developmental process reflects the joint interplay of three fundamental principles, namely: selection, optimization, and compensation. These principles operate within and across all domains of behavior and cognition throughout the human life course. SOC principles furthermore substantively contribute to positive developmental outcomes (Baltes 1997; Lang et al. 2011), including the stability, continuity, and resilience of the aging self. All three principles (i.e., selection, optimization, and compensation) have been shown to be involved in adaptive self-regulatory processes of changing gain-loss dynamics across adulthood (Freund and Ebner 2005; Lang et al. 2011).

*Selection* involves choosing meaningful goals, tasks, or contexts in the aging process. This implies that any decision to pursue specific goals, tasks, or contexts involves gains (in the chosen domain) and losses in not chosen cognitive or behavioral domains. Generally, selection is a necessary developmental process because of limited life time and the finitude of resources. Thus, selection typically involves a narrowing of behavioral options over time.

*Optimization* pertains to the refinement, investment, or enhancement of resources to accomplish a goal or task in specific behavioral or cognitive domains. For example, individuals may invest their time and effort to improve their skills and abilities in a specific task. Optimization implies that costs of self-regulation are minimized while maximizing benefits.

The principle of *compensation* involves the substitution, repair, or restoration of resources in response to a loss or a limitation of the self. Compensation may occur in response to internal challenges to the self (e.g., memory decline), or in response to external challenges to the self (e.g., widowhood).

All together the three principles of selection, optimization, and compensation describe ways of how the self deals with internal and external challenges and opportunities in order to minimize loss while maximizing gains or growth experience. Thus, the SOC model involves an optimality criterion in the aging process. Optimality also refers to the concept of self-contentment in old age that may involve a focus on maintenance rather than a focus on personal growth or self-improvement.

The model of selection, optimization, and compensation is in accordance with assumptions of the dual-process model of assimilation and accommodation. Both models are embedded in a lifespan theoretical framework and build on fundamental principles of lifespan psychology. A difference between these models pertains to what is viewed as the salient motive that drives the regulatory effort of the aging self. The dual-process model emphasizes the effort of eliminating discrepancies between the desired and the actual self. Theories of selection, optimization, and compensation typically emphasize the ever-changing dynamics of gains and losses across adulthood as a central motive of regulatory effort that involves minimization of losses and maximization of gains (Baltes 1997; Freund and Ebner 2005). Therefore, the selection, optimization, and compensation model is explicit in addressing the fundamental impact of internal and external resources that protect the flexibility, resilience, and malleability of the aging self. Once again, both models should be seen as complementing each other at different levels of analysis of self-regulatory processes across adulthood. While the processes of selection, optimization, and compensation more explicitly address the dynamic transactions between a person and their environment across all domains of functioning (including the self), the dual-process model underscores the

steering function of the continuity and consistency of the self as a cognitive structure.

## Conclusion

As people grow old, individuals typically show stability and continuity in the structure of their self-representations. The principles that contribute to the stabilization and stability of the aging self have been reported to be associated with an adaptive choice of contents of one's self concept, with an adaptive use of temporal perspectives regarding one's past, present, and future, as well as with self-serving selection of evaluative information about one's self. Taken together, the stability and continuity of self-representations may reflect a powerful psychological and cognitive adaptation of the human mind that functionally operates even in the face of dramatic loss and health decline until very late in life.

Findings providing evidence for the robustness, and the resilience of the aging self have generated a wealth of theoretical accounts on the underlying psychological mechanisms of such stabilization processes (Brandtstädter 1999; Brandtstädter and Greve 1994; Carstensen 2006; Freund and Ebner 2005; Heckhausen 1999). Such mechanisms of self-stabilization typically represent two broad classes of self-regulation: The first class targets internal states of the self, and the second class targets executive functions of the self directed at the external world. Internal self-regulation involves psychological adaptations such as adjusting one's expectations, disengaging from goals, or restructuring one's priorities. Executive self-regulation pertains to mechanisms that are typically associated with investment of resources to improve or enhance one's functioning such as physical exercises, cognitive training, choosing new friends, or soliciting help in a difficult life situation. Both types of regulatory efforts may complement each other in the process of stabilization of the self as people grow older.

## Cross-References

- ▶ [Life Span Developmental Psychology](#)
- ▶ [Resilience and Aging](#)
- ▶ [Selection, Optimization, and Compensation at Work in Relation to Age](#)
- ▶ [Self-Theories of the Aging Person](#)

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Common to all definitions is that factors that span the physical and social environment impact older adults' lives and are important to consider (Lui et al. 2009). In recent years, the World Health Organization's (WHO) conceptualization of an age-friendly community has been gaining increasing traction among both policy makers and researchers. According to the WHO, an age-friendly community is one in which "policies, services, settings and structures support and enable people to age actively" (World Health Organization 2007a), with the notion of "active aging" broadly defined in terms of health, participation, and security (World Health Organization 2002). Fundamental to the notion of age-friendly communities is that older adults must be respected, valued for their contributions, and included in decisions that affect their lives. More specifically, the WHO highlights the importance of eight domains in making a community age-friendly: outdoor spaces and buildings, housing, transportation, respect and inclusion, social participation, civic participation and employment, communication and information, and community supports and health services (World Health Organization 2007a).

## Age-Friendly Communities

Verena H. Menec<sup>1</sup> and Michael Sharratt<sup>2</sup>

<sup>1</sup>University of Manitoba, Winnipeg, MB, Canada

<sup>2</sup>Schlegel-University of Waterloo Research Institute for Aging, Kitchener, ON, Canada

### Synonyms

Age-friendly communities

### Definition

A variety of definitions of what constitutes an "age-friendly" (or elder-friendly) community have been proposed over the past decade.

### Why the Need for Age-Friendly Communities?

The interest in age-friendly communities on the part of policy makers and researchers in recent years is, in part, due to several interrelated factors:

First, the world is aging. There were approximately 524 million people aged 65 or older in 2010; this number is expected to increase to nearly 1.5 billion in 2050 (World Health Organization 2011). Population aging is occurring as a result of declining fertility rates, lower infant mortality, and increasing longevity. Population aging is not restricted to developed countries; indeed, the speed at which populations are aging is particularly rapid in

less developed countries. From 2010 to 2050, the number of older people aged 65 years or older is projected to increase more than 250% in less developed countries. In comparison, the increase in developed countries is projected to be 71% (World Health Organization 2011). Given the lack of supports for older adults, such as pension systems, in less developed countries, these demographic trends can be expected to present major challenges in the absence of appropriate policy responses (Bloom et al. 2014).

Second, there is growing concern about the sustainability of healthcare and social welfare systems. As people age, the likelihood of health problems increases; consequently, healthcare use also increases with age. Concerns have also been raised over the effects of a retiring workforce on countries' productivity and economic viability. Effective programs and policies are, therefore, needed to promote healthy, active aging and reduce pressures on healthcare and social systems.

Third, healthcare needs have shifted from acute problems to chronic conditions, such as arthritis, diabetes, and dementia, with the co-occurrence of multiple chronic conditions being common. This means that there is a need to move away from healthcare systems that emphasize acute care for time-limited health problems, reflective of a "cure" approach, to systems that focus on "care" over an extended period of time (Chappell and Hollander 2011). Older people require a continuum of care in appropriate settings, such as at home with supports to allow them to remain in their homes as long as possible, to assisted living where some services are provided (e.g., meals), and to long-term care for individuals with extensive care needs.

Apart from these macro reasons for making communities more age-friendly, enhancing the health and quality of life of older adults is a worthy goal in and of itself. What resources and opportunities are available to them in their community, what gaps exist, and how to enhance the community environment to maximize quality of

life become important questions to address. Given its holistic nature, the notion of age-friendliness provides a community development framework for examining these questions.

### Aspects of an Age-Friendly Community

The WHO started to promote the concept of age-friendly communities in 2006 with the launch of its Global Age-Friendly Cities project (World Health Organization 2007a). As part of this project, focus groups were conducted in 33 cities in 22 countries around the world to identify specific aspects of what makes a community age-friendly and what barriers and challenges exist for older adults within each of the eight age-friendly domains: outdoor spaces and buildings, housing, transportation, respect and inclusion, social participation, civic participation and employment, communication and information, and community supports and health services. In each city, eight focus groups were conducted: four with older adults (aged 60 or older), one with caregivers of seniors, and three with service providers (e.g., representatives of governmental organizations, volunteer organizations, and business).

This research provided a rich description of a wide range of features and barriers to making communities age-friendly, with results compiled in an age-friendly guide *Global Age-Friendly Cities: A Guide*, in order to help communities around the world become more age-friendly (World Health Organization 2007a). For instance, in terms of outdoor spaces, focus group participants identified a clean, safe environment and green space as assets and, conversely, uneven sidewalks and unsafe pedestrian crossings as barriers. As another example, within the "community supports and health services" domain, issues identified included the need to have health and social services conveniently located and accessible by all means of transportation and that the delivery of services be coordinated and administratively simple. Additional examples of age-friendly features identified in the project are provided in Table 1.

**Age-Friendly Communities, Table 1** Examples of age-friendly features

Age-friendly domain	Examples of features
Outdoor spaces and buildings	Clean and pleasant public areas Good street lighting to promote safety Good signage on buildings
Housing	Sufficient affordable housing Well-constructed housing Availability of home modification options
Transportation	Reliable and frequent public transportation Availability of specialized transportation for disabled people Well-placed and visible traffic signs
Respect and inclusion	Helpful and courteous service staff Recognizing older adults for their contributions Portraying older adults in the media in a positive way and without stereotyping
Social participation	Affordable activities Conveniently located and accessible venues for events and activities Wide range of activities to appeal to diverse groups of older adults
Civic participation and employment	Flexible and diverse volunteer options for older adults Workplaces adapted to meet the needs of disabled workers No discrimination on the basis of age in the work place
Communication and information	Regular and widespread distribution of information Printed information adapted to the needs of older adults (e.g., large lettering) Public access to computers and the Internet
Community supports and health services	A range of health and community supports to promote health Home care services that include health and personal care and housekeeping Respectful, well-trained staff

Note: Examples are adapted from *Checklist of Essential Features of Age-Friendly Cities* (World Health Organization 2007b)

## Age-Friendly Communities and Healthy, Active Aging

Making communities more age-friendly is expected to promote healthy, active aging and the quality of life of older adults (World Health Organization 2007a). The age-friendly domains proposed by the WHO are consistent with existing, established determinants of health and active aging frameworks. These frameworks highlight the importance of a range of factors within the social and physical environment in people's lives (World Health Organization 2002; Evans and Stoddart 1990).

Research evidence also provides support for specific age-friendly features and their relationship to health-related outcomes. For instance, a large number of studies have examined the relationship between specific environmental features in relation to health-related outcomes such as physical activity, obesity, disability, and mental health (Annear et al. 2014; Saelens and Handy 2008). For instance, a recent systematic review included 83 quantitative and qualitative studies, with the authors concluding that a number of environmental features show promise in terms of contributing to health and activity level in older adults, including accessibility of green space, proximity and density of amenities, and low levels of pollution and environmental degradation (Annear et al. 2014).

Evidence regarding the impact of age-friendly policy initiatives on the health and quality of life of older adults are not yet available. This is not surprising given that the age-friendly movement is relatively new, and implementing specific projects to make communities more age-friendly would take considerable time, particularly large projects like developing housing for older adults. Moreover, health impacts would not be expected to be immediate as there may be a substantial lag time between implementing age-friendly projects and demonstrating health benefits. In the context of the healthy cities movement, Draper et al. (1993) proposed that there is a 5–10-year time lag

between becoming part of such an initiative and observing health benefits.

## Age-Friendly Initiatives

### The Global Context

The age-friendly communities' conceptualization is fundamentally a community development approach targeted at local governments. The WHO Global Age-Friendly Cities project initiated in 2006 included 33 cities from 22 countries, indicative of a substantial interest in the concept on the part of local decision makers. The number has, to date, grown to 210 communities from 26 countries that have joined the *WHO Global Network of Age-friendly Cities and Communities* (<http://agefriendlyworld.org/en/>). The network was established in 2010 by the WHO to provide a forum for communities to exchange information and learn from each other. Belonging to the network does not mean a community is certified as being age-friendly but rather that there is a commitment to becoming more age-friendly and following the four steps of the network cycle: (1) establishing a mechanism to involve older adults, (2) developing a baseline assessment of the age-friendliness of the community, (3) developing a 3-year action plan based on the assessment, and (4) identifying indicators to monitor progress in relation to the action plan.

Indicators to assess a community's age-friendliness are currently being developed and piloted (World Health Organization Center for Health Development 2014). Consistent with the findings from the Global Age-Friendly Cities project (World Health Organization 2007a), they focus on issues such as accessibility of buildings, affordability of housing, and positive social attitudes toward older adults.

### Regional Age-Friendly Initiatives

While the *WHO Global Network of Age-friendly Cities and Communities* is composed primarily of local governments that individually join the network, some countries have established countrywide or regional networks of communities (Plouffe and Kalache 2011; Plouffe

et al. 2013). Canada is at the forefront of the age-friendly movement, with most provincial governments having launched age-friendly initiatives. Over 800 communities across Canada are currently part of such provincially led initiatives.

Leadership in Canada is also provided at the national level through the Public Health Agency of Canada (PHAC), which has developed national guidelines to help with implementation of age-friendly community initiatives at the local level (e.g., the Pan-Canadian Age-Friendly Community Milestones and the Pan-Canadian Age-Friendly Community Recognition Framework) and is helping to coordinate knowledge exchange in the area of age-friendliness. Consistent with the WHO's Network cycle steps, the Pan-Canadian Age-Friendly Community Milestones focus on the process communities should ideally use to become more age-friendly **Public Health Agency of Canada (n.d.)**:

- Establish an advisory committee that includes the active engagement of older adults.
- Secure a local municipal council resolution to actively support, promote, and work toward becoming age-friendly.
- Establish a robust and concrete plan of action that responds to the needs identified by older adults in the community.
- Demonstrate commitment to action by publicly posting the action plan.
- Commit to measuring activities, reviewing action plan outcomes, and reporting on them publicly.

Because they are provincially led, the approaches taken to roll out age-friendly initiatives differ across provinces (Plouffe et al. 2013). By way of example, one of the longest-running Canadian age-friendly initiatives is the Age-Friendly Manitoba Initiative which was launched by the government of Manitoba in 2008. In several successive intake rounds, all 198 municipalities in the province have been invited to become part of the initiative. To date, 100 communities have joined the initiative, representing over 80% of the population of the province. Communities receive a small amount of

funding from the provincial government to help defray some of the costs associated with planning activities or to implement small projects. They are also invited to a 1-day orientation workshop that provides information on the concept of age-friendliness and identifies ways to get the initiative launched in the community (e.g., the importance of forming an Age-Friendly Committee). Moreover, workshops are held at regular intervals with representatives from participating communities to share experiences and problem-solve challenges.

A partnership with university researchers has provided a unique opportunity to underpin the Age-Friendly Manitoba Initiative with research. For example, it led to a formative evaluation, which was designed to assess the process of how the initiative was being implemented. The evaluation, conducted in 2011 (3 years after the initiative was first launched) with 44 participating rural and urban communities, demonstrated considerable progress (Menec et al. 2013). Virtually all communities had formed an Age-Friendly Committee to help guide the implementation of the initiative, and most of them had conducted a community assessment to identify priorities for action. The majority of communities had implemented one or more age-friendly projects. Major barriers to becoming age-friendly identified by participants included funding; lack of capacity, particularly in small communities; and lack of leadership or direction. The evaluation further identified several key issues in implementing age-friendly initiatives, including:

- Becoming age-friendly requires strong leadership at all levels of government (local, provincial, national).
- Communities (particularly rural ones) need support, such as resources to assist with planning and funding for projects.
- Linking the age-friendly community initiative to other initiatives is useful as it creates efficiencies in committee structures and planning processes and can facilitate accessing funding. It can, thus, help mitigate the two biggest challenges identified, namely, lack of financial and human resources to implement projects.

- To be sustainable, ongoing promotion of age-friendliness is important at the community but also at the provincial level to ensure sustained buy-in at the local level.
- Taking into account community characteristics is important as the trajectory and timeline of becoming more age-friendly may differ in rural versus urban communities.

### A Model of Age-Friendly Housing

While the majority of older adults want to age in place in their own homes, many do eventually need some assistance with activities of daily living. Recently, the Health Minister for the Ontario government tabled a 10-point “road map” to include home care as an integral part of the overall healthcare system. By acknowledging that the care for thousands of families is currently “patchy, uneven, and fragmented,” he signaled a need for policy changes that have been severely neglected for too long.

In advanced age, the challenges related to meal preparation, personal support, and therapy sessions grow exponentially. Consequently, remaining in the home may become impossible, and admission to a long-term care facility may be necessary. To accommodate the needs of older adults, there was a rapid development in seniors’ facilities after 1950, growing to one million residents in 36,000 facilities in the USA (ALFA 2009) and 200,000 residents in 2,000 facilities in Canada by the early 2000s (*Insight: Current demographics and trends in seniors’ housing*). The philosophy has been “bigger is better,” especially as it translates not only to larger facilities and organizations but also to larger private bedroom suites compared to common spaces. The tendency has been to make the bedroom areas bigger at the expense of smaller “common” spaces. A competing philosophy might be to reverse this relationship so that the “common” spaces become an exciting hub to bring the resident out of his/her room.

Significant progress has been made in the design of long-term care facilities, countering the stigma of traditional “nursing homes” with their dozens of residents clustering in wheelchairs with no discernible engagement or distraction other

than a small television in an otherwise barren room. In addition, the emergence of CCRCs (continuum of care retirement communities) has redefined housing alternatives for the growing demographic of older adults.

Two dominant patterns prevail that can be characterized either as a “hospitality model” or a “healthcare model.” The hospitality model is designed more like a hotel where you would be delighted to go for a vacation but would not like to live there. Meanwhile, the healthcare model is the antithesis of the hotel model by virtue of integrating as many “homelike” features as possible. Both models are necessary, but not mutually exclusive as all residents are looking for both comfort and medical safety. However, neither of these models seem to address the significant social needs of individuals who have grown up in more simple and community-oriented environments where everybody knew each other, with a main street and common meeting places.

The quest was to recreate that welcoming environment to the extent possible and produce a paradigm shift in the way older adults interact in a congregate setting. Leading this charge in 1989 was Dr. Ron Schlegel, academic, entrepreneur, and philanthropist. Schlegel has a PhD in social psychology and that knowledge of the interface between the environment and social living, combined with growing up in a small rural town in Ontario, led to the Schlegel Village Model. Although conceptualized well in advance of the current age-friendly movement, the Schlegel Village Model provides an excellent example of an age-friendly environment for older adults with care needs that incorporates many of the elements identified in the WHO model (World Health Organization 2007a).

This paradigm change is based on the simple concept of replicating the life experiences that people have had throughout their lifespan. The significant culture change associated with the Schlegel Village Model is to move away from a traditional institutional model of care to a *social model of living*. Thomas (Kaczynski and Sharratt 2010) captured some of this ambience with

emphasis on small-scale “homelike” settings as part of “The Eden Alternative.” This concept extols “well-being” as a much larger idea than quality of life and embraces an “elder” as one who should be seen as an active partner in his/her own case. According to Schlegel, “society was built around cars, streets, and neighbourhoods.” The difference now is that the “walker” has replaced the car and intentional design can still emulate the environment a person would have experienced in past years.

Inspired by Ron Schlegel’s thinking, architect Richard Hammond of Cornerstone Architecture Incorporated has taken the typical functions of dining, lounge, and activity spaces and translated these into an “urban village” setting to make this concept come alive in all 15 villages located across southwestern Ontario in Canada. These functions are reinterpreted as a variety of “storefront” buildings organized along Main Street, leading to the Town Square as the social hub of the community. Architectural detailing helps to reinforce the urban messaging through the use of traditional streetscape materials and canopies. The result not only looks like an age-friendly village, but it also functions that way with social interactions unfolding naturally.

A similar urban theme continues past Main Street into the residential areas of the community. These are conceived as “neighborhoods” with their own local common areas appropriate to the level of care being provided. Entrances to individual resident suites are designed as traditional “front doors,” including a valance, street number, and mailbox, evoking a local residential street as opposed to an institutional corridor.

Age-friendly design is more than simply increasing accessibility by removing barriers. The real magic is design and function, which encourages people to take advantage of the easy access. For example, en route from the home area to the dining room, a person will travel along Main Street at least three times a day and encounter “common spaces” where they might interact with a fellow traveler. This intentional planning is analogous to a grocery store where one has to go

to the far end to get milk, passing all kinds of attractive features along the way.

The notion of a Schlegel Village is not a new invention. Precedents have been taken from observations about how small towns work and even the way urban neighborhoods function within cities. Schlegel has adapted the aphorism of “a doctor learns from his patients” to a congregate housing innovator who learns from his residents. Concepts are also drawn from the “place-making” principles of the New Urbanism ([www.cnu.org](http://www.cnu.org)), such as walkability, diversity of experience, familiar elements, easy orientation, and collective identity, elements that are also evident in the notion of age-friendly communities. Ironically, these principles are part of a larger set that guided development of an “outdoor” village (Williamsburg), which was initiated in 1990 on 52 ha within the city of Kitchener, Ontario. Essentially, it follows the meticulous and intentional design strategies of indoor villages, only with an outdoor Main Street, walkable amenities within 10 min of single-dwelling homes, and a wide array of functional common spaces. A survey of Williamsburg residents indicated that they actually appreciated the many strategies that were designed to create this village/neighborhood within a city (Thomas 1994).

In summary, the growing demographic of older adults demands that attention be given to housing choices and lifestyle opportunities that can preserve dignity and facilitate a sense of purpose to the very end. Fortunately, the WHO has taken this on as a global mandate with the launch of the Global Age-Friendly Cities project. Ideally, this movement should have national, regional, and local financial support. To that end, one demonstration of success has been evident at all three levels in Canada, starting with the Public Health Agency of Canada. Provincially and regionally, Manitoba has stepped up to the plate and engaged over 100 communities in its age-friendly initiative. Last but not least, a single entrepreneur, academic, philanthropist (Ron Schlegel) has touched over 4,000 older adults in congregate settings across southern Ontario with intentional design of the built environment to optimize social engagement.

## Cross-References

- ▶ [Aging and Psychological Well-Being](#)
- ▶ [Aging and Quality of Life](#)
- ▶ [Housing Solutions for Older Adults](#)
- ▶ [Retirement Villages](#)
- ▶ [Small-Scale Homelike Care in Nursing Homes](#)

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## Age-Related Changes in Abilities

Margaret E. Beier and Jacqueline M. Gilberto  
Department of Psychology, Rice University,  
Houston, TX, USA

### Synonyms

Aptitudes; Cognitive abilities; Intellectual development; Intelligence

### Definition

Cognitive abilities are defined as a person's mental capacity to do or act; broadly considered, cognitive abilities include attention, reasoning abilities, memory, and knowledge (Salthouse 2012).

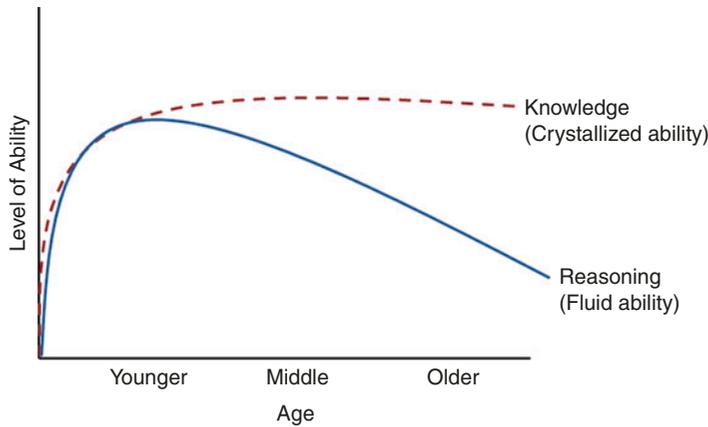
Answers to questions about the development of cognitive abilities with age have implications for work performance, socioeconomic success (i.e., income and education, SES), and even mortality (the likelihood of mortality at earlier ages increases at lower ability levels, even after

controlling for SES) (Salthouse 2012). Cognitive ability facilitates the execution of an array of tasks associated with a successful life, such as registering and completing courses in school, completing job applications and successful execution of job tasks, and simply getting from one place to another. Although not the only important factor, cognitive ability is a central determinant of life success.

Answers to questions about age-related changes in abilities are complex. For one, ability changes throughout the lifespan vary by person. For instance, two 50-year-olds may have extremely different intellectual profiles: one may have the same measured cognitive abilities as an average 30-year old and the other may resemble an average 70-year old. Moreover, within the same person, different abilities decline and/or grow at varying rates. These changes are a function of the continuous use of some skills, which serves to preserve skill-related abilities and the decay of unused skills. As such, there is significant between- and within-person variability in age and abilities. Because of this variability, there is not an agreement on the age at which a person becomes an "older" person. In this review, general changes in abilities are described. Research suggests that these changes are a function of regular aging (memory impairment that is a function of psychopathology such as dementia or Alzheimer's disease is not considered). Nonetheless, it is important to note that the trends described herein will not occur at the same age for every person (Hertzog et al. 2008). Moreover, ability is not a monolithic construct and different types of abilities have different patterns of growth and decline throughout the lifespan.

### Cognitive Abilities

There are two categories of cognitive abilities most relevant to aging: one related to reasoning abilities associated with generating, transforming, and manipulating information and the other related to knowledge accumulated throughout the lifespan. These abilities have different names depending on theoretical orientation; they have



**Age-Related Changes in Abilities, Fig. 1** Hypothetical trajectories of knowledge (crystallized abilities shown with the *dashed line*) and reasoning (fluid abilities shown with the *solid line*) by age group. The figure represents a

compilation of research findings on age-related changes in abilities using an array of measures and both cross-sectional and longitudinal research designs (Ackerman 2014)

been referred to as *fluid* and *crystallized* abilities representing the reasoning and knowledge components, respectively, and the process (reasoning) and products (knowledge) associated with cognition (Carroll 1993; Horn and Cattell 1966). They are thought to represent, for example, a person's ability to acquire new information compared to the information already known (Salthouse 2010). For simplicity, the terms *reasoning* and *knowledge* are used to denote these different types of cognitive abilities.

Measures of reasoning and knowledge abilities are positively correlated in the general population; that is, a person who has relatively higher reasoning capacity is also likely to acquire more knowledge. This relationship reflects the idea that reasoning ability is a major determinant of learning and knowledge acquisition throughout the lifespan. Indeed, the development of knowledge and expertise within a domain is often described as a function of the investment of reasoning ability such as when a student works with full attention to complete a calculus problem in a unit he/she is learning or when an accountant learns a new spreadsheet program to increase his/her productivity (Ackerman 2014).

Despite this positive relationship, however, reasoning and knowledge have different trajectories over the lifespan. The trends differ slightly depending on how the abilities are measured and

depending on the design of the research study (as discussed below), but both reasoning and knowledge increase up to early adulthood, when their paths begin to diverge. Reasoning abilities begin to decline early – some studies suggest as early as late adolescence or early adulthood – and continue the downward trend throughout older ages. The size of the effect varies by study, but generally research shows a decline of about 1.5–2 sample standard deviation units from when a person is in their 20s to when they are in their 70s in reasoning and related abilities (e.g., memory, speed, and working memory tests, Salthouse 2010). By contrast, knowledge levels remain stable and may even increase, up until age 70 or so (Salthouse 2010). Patterns of reasoning and knowledge abilities are shown in Fig. 1, which is derived from research conducted with thousands of participants using an array of measures and study designs (Ackerman 2014; Salthouse 2010). The dashed line represents the growth and stability of knowledge throughout the lifespan, while the solid line represents the growth and subsequent decline of reasoning abilities.

Some theoretical perspectives place a greater emphasis on reasoning abilities than knowledge as representative of intelligence (Spearman 1904). These perspectives either consider knowledge to be a product of intelligence, but not an essential component of it, or they ignore

knowledge completely. Given that reasoning abilities start declining relatively early in life and continue a downward trajectory, this perspective provides a relatively pessimistic view of intellectual development at middle and older ages. Furthermore, this view neglects compelling evidence – available through everyday encounters with smart and successful people – that intellectual abilities continue to develop throughout life. For instance, the overwhelming majority of CEOs of fortune 500 companies in the United States is between the ages of 45 and 70. Similarly, with few exceptions around the globe, heads of states are likely to be older versus younger. Given the ability trajectories shown in Fig. 1, these leaders would be considered long past their intellectual peak if reasoning were the sole or central cognitive ability important in adult intellect (Salthouse 2012). In the context of aging, theories that emphasize reasoning abilities over knowledge paint a relatively pessimistic picture of adult intellectual development; a picture that is not aligned with lay observations and common sense.

Theoretical perspectives that consider adult intellect to be comprised of both reasoning and knowledge give credit to adults for their knowledge and expertise (Ackerman 2014). And although there is little research on the topic of how adults might continually develop their knowledge and expertise even with declining reasoning abilities, it seems likely that people typically choose environments (i.e., for education, work, home, hobbies) that align with their established knowledge and skills. This strategy increases people's reliance on their vast repertoire of knowledge and expertise and also reduces the need for people to reason through every problem in their environment as if it were new. Indeed, research suggests that even though declining reasoning abilities with age can make learning novel information difficult, domain-specific knowledge facilitates the acquisition of new knowledge in that particular domain (e.g., an extensive understanding of investment products facilitates learning about managing investments within a retirement account) (Ackerman and Beier 2006). In this way, the age-related trajectories of abilities shown in Fig. 1 can be considered somewhat

adaptive; that is, people have less need to reason through difficult problems as they age because they have developed vast stores of knowledge through experience that they can bring to bear on an array of adult situations. A middle-aged or older engineer, for instance, might work on a variety of projects during a year – learning something new from each of them – and this learning may not seem very effortful. Nonetheless, it would be more difficult, although probably not impossible given enough time and effort, for the middle-aged or older engineer to learn a completely new field, like psychiatry.

## Assessment

There are a variety of methods used to assess reasoning and knowledge abilities, and a researcher's choice of measure will undoubtedly affect the outcome of the research. Reasoning abilities are typically measured with abstract problems such as pattern completion with figures and numbers (e.g., number series tests where test takers complete a pattern of numbers and Raven's advanced progressive matrices) (Raven et al. 1991). These tests are designed such that performance is relatively knowledge and context free (although it is certainly the case performance is affected by a person's familiarity with test taking and that practice in this regard can affect performance). Assessments of working memory capacity – also shown to be related to reasoning ability – are relatively free of knowledge and focus on a person's ability to simultaneously process and store information. Examples of such tests are the backward digit span test, which requires test takers to recall – in reverse order – a set of three or more numbers that are read aloud, and the operation span test, which requires test takers to make decisions about the veracity of an equation while remembering the equation's numerical outcome (Ackerman et al. 2002).

Because no individual measure is perfectly reliable – or a perfect reflection of a concept as complicated as cognitive ability – researchers typically use a battery of multiple measures to assess reasoning abilities (e.g., spatial,

numerical, symbolic). Reasoning ability is then estimated by aggregating – or averaging – people’s scores on these multiple measures. This approach is similar in concept to factor analytic approaches, which derive an ability factor by pooling the common variance among measures (Ackerman et al. 2002; Carroll 1993). Aggregation helps control for the influence that the measurement error or content associated with any one test has on the assessment of reasoning ability, which can be substantial. For instance, if the only test used to assess reasoning ability is a number series test that is only somewhat reliable, a person’s score on that test would be a function of their reasoning ability, but also a function of their numerical ability and the measurement error associated with the particular test used. It would also be impossible to separate the amount of variance associated with each of these factors (reasoning ability, numerical ability, and error). To avoid these issues and to get a reliable assessment of reasoning ability, scores derived from most commercially available intelligence assessments are a function of an aggregation of individual items and measures over a range of content (e.g., digit symbol, block design, matrix reasoning, and letter number series in the Wechsler Adult Intelligence Scale) (Wechsler 1997).

Knowledge is typically measured with vocabulary tests or general information tests that include questions about widely available information within a cultural context (e.g., *What is the capital city of France? Who was Benjamin Franklin?*). As discussed above, performance on general cultural knowledge tests remains relatively stable across the lifespan, but performance on these tests does not typically show increases in knowledge with age. This is somewhat puzzling given the expectation that knowledge will continue to grow as a function of professional and life experiences. One reason for this discrepancy is that, because knowledge develops in ways that are unique to a person’s experiences, knowledge acquisition is idiosyncratic. As such, a complete picture of what a person knows would include a lot more than general cultural knowledge; it would include knowledge about his or her job, hobbies, and unique life experiences – essentially

anything encountered and learned throughout the life course (e.g., the length of time a whole chicken needs to roast, when a child should be taken to the doctor, how to operate a forklift). As implied by these examples, capturing the whole of knowledge through the lifespan – giving adults credit for what they know – would require an impossibly elaborate knowledge battery. Indeed, researchers endeavoring to assess knowledge growth with age have measured knowledge across multiple academic (e.g., 20 academic domains including natural science, business, social science, and humanities) and nonacademic (e.g., current events, health, financial, and technology knowledge) domains (Ackerman 2014). In this research, age was positively correlated with knowledge possessed across all domains, with the exception of those domains most related to natural science (e.g., physics and chemistry). Nonetheless, these elaborate knowledge assessments will still underestimate what adults actually know because assessments can never account for the idiosyncratic nature of adult experiences that lead to knowledge and expertise.

## Research Designs

Most research on age and abilities is cross-sectional in nature, meaning that people of different ages are assessed simultaneously. Inferences about age-related changes are made by examining the test scores for people of different ages (e.g., comparing performance on an ability battery for 20- versus 70-year-olds or correlating ability scores with age). Though informative, these studies are limited in that differences between age groups may not represent age-related changes within a person. A classic anecdote illustrates this point (Salthouse 2010). A scientist examining age-related changes who finds himself/herself in Miami in the year 2014 might observe that younger people are more likely to be of Hispanic/Latino or African-American descent, while older people are more likely to be of European descent. Based on this observation of an age-diverse cross section of the population, the researcher might conclude that people tend to become increasingly

European looking (i.e., white) with age. This is absurd of course, but it is meant to illustrate that cross-sectional studies may lead to erroneous conclusions about age-related changes because they do not actually assess the changes within a person that are a result of aging; rather, they assess differences between people and presume that these differences are a function of age. Moreover, these designs do not control for environmental, societal, or other extraneous factors that might affect people differently by age group.

Cohort effects are an example of a societal influence on cross-sectional studies in aging. A cohort is a generational group that presumably shares a cultural identity. Factors that affect one cohort differently than others can influence the development of abilities. For instance, millennials are generally defined as those people who reached young adulthood around the year 2000 (i.e., they were born around 1980 or so). In developed and developing countries, millennials have grown up with access to technology that allows them to communicate globally in minutes and that provides them access to a wealth of information at the press of a button. In this example, access to technology would affect the development of knowledge differently for millennials relative to older cohorts. As such, cross-sectional studies on aging and knowledge would capture differences in knowledge that are a function of age and cohort and importantly, the variance associated with each could not be separated (a researcher could not determine what differences between people were a function of age vs. cohort). In cross-sectional designs, cohort essentially introduces a third variable (or confound) in the study. For this reason, there is considerable debate about the value of cross-sectional studies for examining age-related changes in abilities, with some researchers taking the extreme position that the value of cross-sectional research in aging is limited (Salthouse 2010). Rather than discounting all cross-sectional studies, however, it is probably important to understand the influence of cohort vis-à-vis the constructs and variables in question. For instance, the discussion above highlights that cohort might be an important influence on knowledge

development, particularly as related to millennials versus older generations. It is less clear, however, how cohort effects might influence the development (growth and/or decline) of reasoning ability.

In contrast to cross-sectional studies, longitudinal research tracks the development and decline of abilities within a person by administering the same (or similar) measures periodically over time. Most of these studies include the periodic inclusion of a new sample of younger participants to ensure a continuous sample given attrition and mortality. Examples of significant longitudinal studies in cognitive aging include the Seattle Longitudinal Study (Schaie 2013), which was started in the 1950s with a sample of about 500 people ages 20 to 69. Participants were assessed on a battery of reasoning and knowledge measures on 7-year intervals, and every 7 years until 2005, a new cohort was added to the study. The Victoria Longitudinal Study (Hultsch et al. 1998) is similar to the Seattle Longitudinal Study, but the sample is somewhat older (55–85) with new cohorts starting every 10 years or so. Each of these studies has assessed the abilities of literally thousands of participants.

Although longitudinal studies are rare because of the time and resources involved, they provide information about within-person change in abilities and can control for cohort or other influences. Fortunately, the results of longitudinal studies tend to echo those of cross-sectional studies; that is, most of this research shows the growth of both reasoning and knowledge until early adulthood, the subsequent decline of reasoning abilities, and the relative stability of knowledge. Longitudinal studies show a more optimistic picture of cognitive aging than do cross-sectional studies, however. That is, the decline of both reasoning abilities and knowledge tends to be relatively later in longitudinal research (e.g., reasoning abilities begin to decline closer to age 30 in longitudinal studies vs. around age 20 in cross-sectional studies) (Ackerman et al. 2002; Schaie 2013). In summary, the age-related trajectories of cognitive abilities shown in Fig. 1 reflect trends found in cross-sectional and longitudinal research designs.

## Ability Preservation

Important questions have been raised about the factors that affect changes in cognitive abilities throughout the lifespan, and the answers to such questions can inform interventions to preserve abilities. To date, many possibilities have been investigated (e.g., gender, personality traits, initial levels of abilities, and environmental influences such as education and health, Ackerman et al. 2002), but there is generally little evidence that any one factor exerts a strong effect on the course of age-related changes in abilities. There is some research to suggest that a person's initial level of ability, overall health, and education will differentiate people by ability level throughout the lifespan (Salthouse 2010). For instance, a person who starts out with significantly lower scores on reasoning ability tests relative to others in the population of the same age will likely continue to have relatively lower scores compared to the same population throughout the lifespan; a person who is healthier will likely have higher reasoning ability and knowledge scores throughout their life compared to someone who is less healthy.

Recent research has focused on the preservation of abilities throughout adulthood (into older ages). This preservation is indeed important as most people will tend to experience some form of intellectual decline, even in knowledge and expertise, in late life (e.g., age 80 and beyond). The aging of the global population, coupled with the daunting prospect of the loss of cognitive abilities, has increased the urgency of finding remedies to age-related cognitive decline. Common ability preservation strategies include both cognitive (e.g., brain training) and physical (e.g., exercise) approaches.

*Brain training.* Brain training typically employs cognitive exercises to enhance a person's working memory. Based on models of physical fitness that target exercises to specific muscles for strengthening, brain training is designed to strengthen memories or reasoning abilities through mental drills. At least in the United States, brain training is developing into a profitable industry, with advertisements extolling the virtues

of online brain training exercises for people of all ages. Unfortunately, little empirical evidence has shown brain training to be effective; meta-analytic studies examining training effectiveness found little benefit to using these programs (Melby-Lervag and Hulme 2013). Some research has shown that direct training on working memory measures can be effective for increasing cognitive performance. These effects have typically been small, temporary, and limited to already cognitively healthy individuals, however. Moreover, these short-term improvements tend to exist only for the specific working memory tasks practiced in training (or similar tasks), meaning that the effects of working memory training are relatively narrow and have not been found to transfer to more generally complex life tasks (Hertzog et al. 2008). Nonetheless, because of the importance of preserving cognitive abilities into older ages, many researchers continue to work on developing effective strategies for preserving mental abilities through brain training. The bottom line is that current brain training activities are not likely to improve general memory or mental functioning in a measureable way, but they may not do any harm either. Moreover, to the extent that remaining cognitively engaged leads to learning and skill acquisition (i.e., expertise in an area), these exercises may increase levels of knowledge.

*Physical exercise.* Research on physical exercise has shown promise for its effect on preserving cognitive abilities into later life. These findings extend to both short- and long-term exercise interventions and have been most compelling for aerobic exercises (i.e., those that increase heart rate such as brisk walking/jogging vs. stretching) (Hertzog et al. 2008). The key to cognitive benefit appears to be enhancing cardiorespiratory functions that lead to myriad health benefits related to increased tissue oxygenation (healthier muscles, heart, and brain). Studies examining short-term aerobic and high intensity exercise interventions suggest better performance at simple cognitive tests postexercise. Effects are largest for people with lower cognitive ability predating exercise interventions. Long-term effects of exercise are a

bit more complex to study. In younger cohorts, regular aerobic exercise has been shown to predict improvement in various tasks related to reasoning ability and working memory (Guiney and Machado 2013). For healthy older adults, however, regular physical activity does not appear to *improve* cognitive ability, so much as *maintain* it. That is, people who engage in regular aerobic exercise across the lifespan are expected to optimize cognitive ability when young and maintain ability longer and more effectively as they age.

## Conclusion

Medical science has succeeded in expanding life expectancy across the globe. According to the World Health Organization, people born in 2012 can expect to live 6 years more, on average, than people born in 1990, and average life expectancies are now around age 80 for developed countries (such as Japan and the United States) (World Health Organization 2014). Cognitive abilities are essential for healthy aging – they permit people to travel, work, engage in hobbies, and enjoy life. Preserving abilities into late life will help ensure that people can take advantage of the additional years granted by medical science by remaining mentally active and engaged. Age-related changes in abilities are inevitable, and these changes will depend on myriad factors: the person, initial levels of ability, and the ability in question. There are well-established general trends, however, as shown in Fig. 1. As people age, they can expect a relatively early decline in reasoning abilities (and other related abilities such as working memory) and stability and even improvement in those abilities associated with the acquisition of knowledge and expertise.

Research in cognitive aging is moving toward an understanding of the outside factors – such as mental and physical exercise, lifestyle, and education – that influence the relationship between age and cognitive abilities. Research in this area promises the development and testing of interventions designed to help maintain and even increase cognitive abilities into old age. In this

way, researchers are simply responding to the demands of a rapidly aging global population to stave off pending declines. Although the research is currently inconclusive, the best evidence suggests some promise for remaining mentally and physically active throughout the lifespan. The brain, after all, is an organ that benefits from physical activity just as do other organs in the body. And although the research on mental exercise is still inconclusive, brain training activities are unlikely to do any harm, especially if people refrain from spending excessively on unproven techniques (e.g., brain training software programs). There are, after all, plenty of relatively inexpensive ways to stay mentally engaged (e.g., crossword and other word puzzles, math games, reading a book). For both mental and physical health, however, cognitive benefits are most evident when people start early and remain consistently active.

## Cross-References

- ▶ [Canadian Longitudinal Study on Aging, A Platform for Psychogeriatric Research](#)
- ▶ [Cognition](#)
- ▶ [Cognitive and Brain Plasticity in Old Age](#)
- ▶ [Expertise and Ageing](#)

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## Age-Related Hearing Loss

Christina Garrison-Diehn  
Geriatric Research, Education, and Clinical  
Center, VA Palo Alto Health Care System, Palo  
Alto, CA, USA  
Department of Psychiatry and Behavioral  
Science, Stanford University School of Medicine,  
Stanford, CA, USA

### Synonyms

Deafness; Hard of hearing; Hearing impairment;  
Presbycusis

### Definition

Hearing loss is a decrease in an individual's ability to hear. Hearing loss related to aging is called presbycusis.

### Epidemiology

Hearing loss is a common sensory impairment in the older adult population. The US National Institute on Deafness and Other Communication Disorders (NIDCD) reports that almost 25% of adults aged 65–74 and 50% aged 75 and older have hearing loss to the level that they would benefit from an intervention such as a hearing aid (National Institute on Deafness and Other Communication Disorders 2015). Epidemiological data from US samples indicate that men are more likely to experience hearing loss than women and individuals of Native American and White races are more likely to experience hearing loss than individuals of Hispanic, Black, or Asian races (Schoenborn and Heyman 2008). Occupationally, individuals who work in louder environments, such as transportation or manufacturing, are more likely to experience hearing loss (Tak and Calvert 2008). Military service also increases an individual's risk for hearing loss, mostly due to noise exposure. In the USA, hearing loss is the most common disability related to compensation and pension benefits for WW2 and Korean era veterans and the second most common among Vietnam era veterans (Veterans Benefits Administration 2014).

### Types of Hearing Loss

Hearing loss is categorized into two main types, conductive and sensorineural. Conductive hearing loss is due to problems in the outer and middle ear and is often correctable by surgical or medical interventions. A few examples of causes of conductive hearing loss include congenital malformations of the middle ear structures, fluid in the middle ear from colds, impacted earwax, benign tumors, and foreign bodies in the ear.

Sensorineural hearing loss is the most common type of hearing loss in older adults and is caused by damage to the inner ear and/or the nerve pathways between the inner ear and the brain. Common causes of this type of hearing loss are exposure to loud noises, head trauma, viruses, and ototoxic (i.e., “ear poisoning”) medications. Though some causes are reversible, usually sensorineural hearing loss is irreversible. There is a third category, mixed hearing loss, which is a combination of conductive and sensorineural hearing loss.

### **Hearing Loss Health-Care Providers**

Otolaryngology is the branch of medicine focused on issues of the ear, nose, throat, head, and neck. Otolaryngologists (sometimes called ear, nose, and throat or ENT physicians) diagnose and medically/surgically treat diseases and disorders that are causing or contributing to the hearing loss.

Audiology is the scientific study of hearing loss, balance, and related issues. Audiologists have either a Master’s degree or Doctorate (Au.D. or Ph.D.) in Audiology/Communication Sciences and Disorders. They perform hearing evaluations, diagnosis type, and severity of hearing loss, recommend and fit hearing aids, and conduct other clinical activities related to prevention, treatment, and management of hearing loss.

### **Degree and Experience of Hearing Loss**

Hearing loss is categorized as mild, moderate, severe, and profound. These descriptors are based on the decibels (dB), a measurable unit of volume, the individual is able to hear. Most cases of hearing loss are in the mild to moderate range. A person with mild hearing loss (25–40 dB) has trouble hearing softer noises and often has difficulty hearing speech in a loud environment (e.g., talking to a dinner partner in a loud restaurant). A person with moderate hearing loss (40–70 dB) has trouble hearing soft and moderately loud

noises, and it is very difficult to hear when there is background noise. With moderate hearing loss, individuals often have trouble on the phone. When a person has severe hearing loss (70–90 dB), one-on-one conversations in quiet settings need to be conducted loudly, and when someone has profound hearing loss (90 dB and louder), only very loud noises are heard.

Hearing loss can occur in the high-frequency (e.g., birds singing, higher-pitched voices) or the low-frequency ranges (e.g., hum of the refrigerator, a bass drum). The most common hearing loss in older adults is in the high frequencies. Much of human speech patterns fall in the higher frequency, especially consonant sounds S, F, K, T, Sh, and Th. Often individuals with mild to moderate high-frequency loss can hear that someone is speaking to them, but because of their hearing impairment, they are unable to discriminate the speech sounds. For example, “do you think she’ll find it?” may sound like “did you see Saul’s mind yet?” Understandably, this can lead to problems in communication and frustration in social interactions. This sound discrimination issue is one of the reasons that speaking louder is not a good compensatory strategy when working with an older adult with hearing impairment, because saying it louder does not necessarily increase the clearness of the sounds. Rather, ensuring that the individual can see the providers’ face and mouth, slowing down speech, and enunciating clearly can help with this communication problem.

Visual impairment is also a common sensory deficit experienced by older adults. When older adults have both hearing loss and visual impairment (sometimes referred to as dual sensory impairment), this can complicate their experience of hearing loss. Individuals with hearing impairment often use visual cues to help their understanding of conversation, such as lipreading, facial affect, and other environmental information. Visual impairment reduces the individual’s ability to rely on this type of information, which impacts their hearing functioning. A common joke that illuminates this experience is “I can’t hear you. . . I don’t have my glasses on.”

## Hearing Loss and Health Risks

Hearing loss is associated with specific diseases such as diabetes, arthritis, and cardiovascular disease (Stam et al. 2014; Helzner et al. 2011). There is evidence that individuals with hearing loss are hospitalized more and are at higher fall and accident risk (Genther et al. 2013; Lin and Ferrucci 2012). Compared to matched samples of older adults without hearing loss, individuals with hearing loss are at higher risk of functional impairment and decreased levels of physical activity (Chen et al. 2015; Gispén et al. 2014). Some observational studies have found that hearing loss alone was an independent risk factor for mortality (Fisher et al. 2014; Genther et al. 2015).

## Hearing Loss and Cognitive Decline

Individuals with hearing loss are at higher risk of developing dementia and faster decline in the trajectory of the disease (Lin et al. 2013). This risk increases with the severity of the hearing loss – mild, moderate, and severe hearing loss increases risk two, three, and five times, respectively, compared to individuals without hearing loss (even after other health problems were controlled for). Three possible mechanisms of this increased risk are (1) reduced social and environmental engagement due to communication difficulties, (2) shared pathology of hearing loss and dementia (e.g., vascular changes), and (3) increased cognitive load (Lin and Albert 2014). Cognitive load describes the amount of mental effort being used in working memory. Given the difficulty discriminating speech sounds and trying to block out background noise, it can be much more effortful to engage in communication for individuals with hearing loss. It is possible that as the brain allocates resources to engage in this effort, it depletes resources from other brain functions. Currently, it is unknown what mechanism is responsible for this increased risk, but generally it is hypothesized to be a combination of these three mechanisms.

It is notable that untreated hearing loss can result in an individual appearing as though they have cognitive impairment when they do not. Also, if an individual has some cognitive deficits, hearing loss can make them seem more cognitively impaired than they are. Reduced communication abilities or attention abilities are sometimes the result of not being able to hear. For example, an inaccurate answer may be the result of mishearing a question, or a lack of attention may be because the individual did not hear or realize they were being spoken to. Sometimes, simple interventions, like using a personal amplifier (e.g., pocket talker) or making sure that hearing aids are functioning properly (e.g., batteries are charged, ear tubes are clean), can make a big impact on an individual's cognitive ability in the moment.

## Hearing Loss and Psychosocial Risks

An important area of possible intervention in geropsychology is on the impact of hearing loss and psychosocial functioning. Hearing loss is associated with social isolation, loneliness, and depression (Brink and Stones 2007; Pronk et al. 2014). The impact of not being able to hear in loud groups, such as restaurants or theaters, can limit an individual's ability to enjoy these types of events. In one-on-one or small group conversation, it can be frustrating or embarrassing to repeatedly remind conversation partners to speak up or ask them to repeat themselves. This can lead to increased withdrawal. Even solitary activities, such as watching television or listening to the radio, can lose some of their enjoyment, especially if aids such as closed captioning or amplifiers are not available.

Hearing loss can also cause problems in significant relationships, lowering socialization and relationship satisfaction (Kamil and Lin 2015). A marked reduction in socialization by a hearing-impaired significant other can lead to reductions in social opportunities for both parties. For example, if a husband no longer likes to go to

dinner with friends because he cannot hear in that setting, his partner might not want to go without him and is also missing that opportunity to socialize. Within significant relationships, benign or neutral interactions can easily escalate to heated moments or conflict due to frustration by both the hearing-impaired individual and their partner. It is common for individuals with hearing loss to blame their significant other when they cannot hear what is said with comments like “she mumbles too much” or “he is always talking to me from across the house – how is anyone supposed to hear that?” Similarly, it can be frustrating for significant others to repeat themselves, especially when they need to repeat themselves several times. Also, as significant others repeat themselves, they are often raising their voice to a louder volume. This can strain the interaction, making the hearing-impaired partner feel yelled at and increasing feelings of frustration on the part of the speaker.

Individuals with mild hearing loss sometimes lack insight to the changes in their hearing abilities. As described above, it can be common for attributions about changes in others or the environment to be made, instead of acknowledging the changes in their hearing. For example, “my grandchildren speak too fast and mumble” or “the television companies do a poor job with balancing sound on their programs.” While both of these statements might have some truth, often, it is more likely that the individual is experiencing changes in their hearing abilities. Hearing loss is often an insidious process, and changes over time may go unnoticed. This lack of insight or acceptance of hearing loss can be a challenge for family members and contribute to reduced quality social interactions.

## Prosthetics and Rehabilitation

Hearing aids are the most common treatment for irreversible sensorineural hearing loss. There have been large advancements in hearing aid technology, but a hearing aid does not correct hearing in a way that glasses can correct vision (to 100%

accuracy). Hearing aids increase amplification and are programmed to pick up different frequencies to fit the user’s type of hearing loss. The human ear has the ability to focus in on individual sounds and tune out background noise; hearing aids are not able to perfectly mimic this ability. Though advances have been made in reducing the background noise amplification in hearing aids, it still can be difficult for users in louder settings. Other hearing aid advances include tele-coil technology, which directly links into sound systems in public places like auditoriums and theaters (if the setting has the corresponding sound system technology), phones, and televisions. Also, some hearing aids are able to use bluetooth technology to connect to phones and televisions. Unfortunately, it is estimated that a high percentage of individuals who could benefit from hearing aids do not use them. Chien and Lin (2012) found that among hearing-impaired individuals, only 4.3% of people aged 50–59, 7.3% aged 60–69, 17% aged 70–79, and 22.1% aged 80 and older wear hearing aids.

Another, more intensive intervention for sensorineural hearing loss is a cochlear implant. This intervention, which is recommended mostly for individuals with profound to severe hearing loss, involves a surgical procedure, and the implanted device replaces the functioning of the inner ear. A sound processor is worn externally and behind the ear, which captures the sound, turns it into digital code, and sends the information to the implant. The device then converts the code to electrical impulses and communicates via the hearing nerve with the brain. Similar to a hearing aid, while it greatly enhances the individual’s ability to hear, it does not correct an individual’s hearing ability to “normal” levels. Also, often in the surgical placement of the cochlear implant, the inner ear functioning is damaged to the point that what natural hearing abilities the individual had are not restorable if they change their mind or the cochlear implant does not work.

Audiological rehabilitation involves using training or treatment with individuals with hearing loss to improve their hearing abilities and quality of life. Usually provided by an audiologist,

interventions in audiological rehabilitation include education about the hearing loss to both the individual and the family members and education about using the hearing aid or cochlear implant, improving speech, using visual and contextual cues, managing communication, and similar other environmental techniques to improve quality of life.

### Implications for Working with Older Adults with Hearing Loss

In working with older adults, asking about possible hearing loss and the impact on the individual's life is an important area to assess. As noted above, older adults are sometimes not aware of their hearing loss or sometimes shrug it off as just an inevitable part of aging. This can be an area where obtaining collateral information from family members can help give a clearer picture of the individual's hearing functioning and its impact on their daily living. Often just asking about their hearing and observing the patient's behavior in session will give you plenty of information about their functioning. There are also brief screenings, like the *Hearing Handicap Inventory for the Elderly – Screening Version*, which is a ten-item screening that assesses perceived problems related to hearing in the social and emotional domains (Ventry and Weinstein 1982). This can be a useful tool to assess for changes in the individual's quality of life related to hearing loss. If there is concern about hearing loss and the patient has not seen an audiologist recently, a referral would be warranted.

Given the prevalence of hearing loss in the older adult population, it is very important that providers ensure that their older adult patients or clients have the best opportunity to hear and understand during the clinical interaction. Providers should lower their vocal register (especially people who naturally speak in higher tones) and slow down the speed of their speech. It is important to face the patient and make sure that they can see the provider's face and mouth. The provider should enunciate well. Speaking

somewhat louder can be helpful, but providers should be careful that the patient does not feel like they are being yelled at. Clinics and providers who regularly work with older adults should have personal amplifiers on hand (e.g., pocket talkers); these devices can greatly improve communication. It is also helpful to reduce extraneous noise, meeting in a quiet area. And, finally, use written material, such as handouts or written instructions to aid in communication.

### Cross-References

- ▶ [Communication with Older Adults](#)
- ▶ [Disability and Ageing](#)

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## Age-Related Positivity Effect and Its Implications for Social and Health Gerontology

Andrew E. Reed and Laura L. Carstensen  
Department of Psychology, Stanford University,  
Stanford, CA, USA

### Synonyms

Positivity effect

### Definition

Age-related preference in attention and memory for positive over negative information.

### Introduction

Aging has long been associated with sadness, fear, and loss. From the downtrodden visage of Picasso's "The Old Guitarist" to the incompetent shenanigans of TV's Mr. Magoo, older adults have been depicted as depressed and cognitively impaired, and negative stereotypes of aging are ubiquitous. Recent empirical evidence, however, has revealed that older adults experience more positive and fewer negative emotions in their daily lives compared to younger adults (for a review, see Charles and Carstensen (2010)). Older adults also appear to favor positive over negative information in attention and memory compared to younger adults, a developmental phenomenon known as the age-related positivity effect. This entry provides an overview of the empirical origins and theoretical foundations of the positivity effect, the debates concerning its underlying mechanisms, the moderators of the effect, and open questions for future research in this area. Implications of the positivity effect for social behavior and well-being in later life are discussed.

## Empirical Origins

Social scientists have long held that negative stimuli are more attention grabbing than positive stimuli and that negative information is processed more deeply than positive (Baumeister et al. 2001). Even though the bulk of research showing this preference was based on undergraduate samples of young adults, few questioned its universality. When researchers began to study cognitive processing in older adults, however, it became clear that “bad” was not “stronger than good.” In fact, several early studies found that whereas younger adults showed a negativity bias, older adults preferentially processed *positive* over negative information in attention and memory (for a review, see Mather and Carstensen (2005)). The interaction between age and valence in the processing of emotional information constitutes the age-related positivity effect.

Early evidence for the positivity effect spanned paradigms from memory to attention and incorporated a wide variety of stimuli. The positivity effect initially emerged in studies of working memory, short-term memory, and autobiographical memory. Compared to younger adults, older adults appeared to privilege positive over negative stimuli such as emotionally valenced images and words. Studies of visual attention likewise showed that older adults spent more time viewing happy and less time viewing angry or sad faces compared to younger adults.

As empirical studies accumulated, investigations of the positivity effect were extended to higher-level cognitive processes such as decision making (for a review, see Peters et al. (2011)). When asked to make decisions about health-related choices (e.g., doctors and hospitals) or consumer choices (e.g., cars and apartments), older adults focused more on positive than negative attributes compared to younger adults, both when they initially viewed the attributes and when they were asked to subsequently recall the information.

## Theoretical Foundations and Debates

Initial evidence for the positivity effect emerged from empirical tests of socioemotional selectivity theory (SST; Carstensen 2006), a life-span theory of motivation. SST posits that a select group of goals operates throughout adulthood. Some goals are related to preparing for the future, such as accumulating knowledge and meeting new people. Other goals pertain to optimizing the present, such as savoring close relationships and striving for emotional satisfaction. Though both goal categories are important across the life span, their relative prioritization is shaped on inter- and intraindividual levels by future time horizons, which are inversely associated with chronological age. When the future is perceived as long and nebulous, as is typical in youth, individuals prioritize future-oriented goals over emotional gratification. With advancing age, however, people perceive their futures as progressively more limited. As a consequence of these narrowing time horizons, motivational priorities shift in favor of present-oriented goals related to emotional meaning and well-being over goals associated with long-term rewards. Insofar as positive information is more emotionally satisfying and meaningful than negative information, SST maintains that older adults will display a relative preference for the positive. The positivity effect, therefore, represents controlled cognition operating in the service of chronically activated goals and is presumed to adaptively reflect goal-directed behavior (Mather and Carstensen 2005).

SST offers falsifiable hypotheses about the contours of the positivity effect, that is, the precise conditions under which older adults are expected to favor positive information and those where age differences are mitigated or even reversed. Theoretically, the effect will be evident when individuals have sufficient cognitive resources to deliberately direct their attention and memory, but not appear when cognitive resources are limited or constrained. Second, the effect will emerge when individuals are afforded the freedom to pursue chronically activated goals, but not when

external goals or instructions conflict with default priorities. Finally, the effect will appear when selective attention and memory contribute to well-being, but not when it is emotionally risky or maladaptive to selectively process positive information. As discussed in the following section, evidence largely supports these predictions.

Whereas SST posited that the positivity effect emerges from top-down and fluid processes guided by motivational priorities, alternative accounts emerged to suggest that the effect is a product of bottom-up and fixed processes related to biological or cognitive aging (for a discussion, see Reed and Carstensen (2012)). These deficit-based perspectives contend that older adults preferentially process positive information because processing negative information exceeds cognitive capacity and/or neural degradation. Reasoning from these positions, the positivity effect is expected to be most evident among individuals with the most cognitive impairment and is relatively insensitive to contextual factors such as situation-specific goals. Such hypotheses, however, have not been supported in empirical studies. On the contrary, as discussed below, the positivity effect varies systematically in response to situational and methodological factors, and it is typically not observed in cognitively impaired samples.

Not long after the effect was first identified, skepticism emerged among researchers who failed to observe the effect using paradigms that were putatively similar to studies that did observe the effect. Questions soon arose concerning the consistency and reliability of the positivity effect. In the early years, concrete answers to these questions proved elusive because the empirical literature was still nascent and lacking in volume. Within less than a decade, however, mounting empirical attention to the positivity effect yielded a literature with over 100 studies. As discussed in the following section, the sheer volume of evidence enabled a systematic meta-analysis that resolves much of these questions and the surrounding debate.

## Moderators and Mechanisms

In the intervening years since the positivity effect was initially observed, dozens of studies have attempted to clarify the underlying mechanisms of the positivity effect as well as the contexts under which it is observed versus not. The accumulating literature ultimately afforded a systematic meta-analysis of the research literature to determine the reliability, robustness, and moderators of the positivity effect (Reed et al. 2014). Results of the meta-analysis indicated that the positivity effect is evident when cognitive resources are readily available, when experimental tasks or stimuli do not activate automatic processing, and when information processing is unconstrained by external factors such as task instructions. Collapsing across the entire research literature indicates that these conditions yield a reliable, medium-sized positivity effect in the form of a classic crossover interaction between age and valence: Younger adults favor negative information, while older adults favor positive information. The positivity effect also appears across a wide variety of paradigms. In visual attention, the effect is evident in looking time as indexed by eye-tracking and dot-probe methods. Studies observe the positivity effect in working memory, short-term memory (both true and false), long-term memory, and autobiographical memory. The positivity effect has been shown to influence aspects of decision making from pre-choice information processing and gain/loss sensitivity to risky decisions (for a review, see Peters et al. (2011)). The positivity effect manifests across a wide range of stimuli, from basic stimuli such as words, images, and faces to complex stimuli such as health messages and videos.

Consistent with predictions derived from SST, meta-analysis indicates that the positivity effect is significantly mitigated when experimental tasks impose external constraints on cognitive resources and/or goal pursuit. Examples of processing constraints include distracter tasks designed to consume executive control resources

and explicit instructions to attend to or ignore emotional stimuli. Many of these studies inadvertently constrain processing by, for instance, informing participants at the outset that their memory for experimental stimuli will be tested at the end of the session, thereby prompting increased attention across stimulus types.

In contexts such as these where individuals are instructed to pursue specific goals other than emotionally meaningful ones, older adults process positive and negative information comparably, while younger adults' processing preference for negative information is substantially weakened. The moderating role of experimental constraints is further highlighted by studies that purposefully manipulate these factors. For instance, age differences in attention and memory for choice attributes are eliminated when individuals are explicitly instructed to "focus on the specific facts and details" or make decisions for other people rather than for themselves (Löckenhoff and Carstensen 2008). Close analysis of individual studies also indicates that the positivity effect does not appear when experimental tasks target automatic processing and that individuals with habitually poor cognitive control (as indexed by cognitive tests) do not show the positivity effect. Emerging evidence also suggests that positivity may be reduced when the "stakes are high" and other goals supersede emotion-related priorities. For instance, it appears that older adults in relatively poor health pay more attention to negative information than their healthy peers when making health-related decisions such as selecting a physician (English and Carstensen 2015). Theoretically, this is because under such circumstances, the search for personally relevant information outweighs emotional goals.

Consistent with the motivational formulation offered by SST, the positivity effect does indeed appear sensitive to the experimental context under which it is measured. These findings also help to explain why the controversy over the existence of the positivity effect emerged: Concern about the reliability of the effect had been based on studies

that placed constraints on processing (e.g., via experimental instructions to attend to all stimuli), and meta-analysis affirms that these studies typically observe a mitigated, if any, positivity effect. By contrast, when individuals are simply asked to review information without processing instructions (e.g., open-ended visual attention paradigms), the positivity effect is reliable and fairly robust. This pattern underscores the need for a clear theoretical framework. Seemingly minor methodological differences across studies, in theoretical context, are meaningful and result in critical changes to experimental paradigms. Taken together, evidence suggests that the effect reflects default cognitive processing that favors information relevant to emotion-regulatory goals. Older people value goals related to emotional meaning and well-being, and, all else equal, cognitive processing serves such goals.

## Neural Signature

The positivity effect also manifests in distinct age-by-valence interactions in neural responses to emotionally valenced stimuli (for a review, see Samanez-Larkin and Carstensen (2011)). At the subcortical level, older adults show reduced activation in the amygdala relative to younger adults when viewing or evaluating negative faces (e.g., displaying sad, fearful, or angry expressions). Although several researchers have interpreted this finding to support age-related dysfunction in the amygdala, it is critical to note that age-related decreases in amygdala activation are eliminated or even reversed in response to positive faces (e.g., Mather et al. (2004)). The age-by-valence interaction suggests that negative (but not positive) stimuli may be less salient to older versus younger brains. At the same time, age differences observed in cortical activity suggest that older and younger adults differentially engage emotion-regulatory processes while processing negative stimuli. When viewing negative faces, older adults recruit medial prefrontal regions to a

greater extent than younger adults, indicating that they are actively and effortfully downregulating negative affect to a greater extent than their younger counterparts. Evidence also suggests that age differences in prefrontal activation while viewing negative stimuli may underpin downstream age differences in memory. Relative to younger adults, older adults appear to devote fewer subcortical resources to encoding negative stimuli and more cortical resources to downregulating their affective responses, which yields worse memory but better emotional outcomes. In addition to attention and memory, the age-by-valence interaction in brain activation extends to higher-level cognitive processes such as decision making. For example, in financial decision-making tasks, older adults show increased activation of caudate and insula when anticipating monetary losses but not gains. Thus, the positivity effect and its motivational precursors appear to be deeply seated within the brain.

### Temporal Signature

The rapidly expanding literature on the positivity effect not only sheds light on the importance of context but also the temporal signature of the effect, with clear implications for underlying mechanisms. In general, evidence suggests that the positivity effect has a delayed onset consistent with controlled cognitive processing. Close examination of visual gaze patterns using eye-tracking indicates that older adults preferentially attend toward happy faces only half a second after they are presented and that gaze aversion from sad faces emerges only 3 s after onset. In fact, older adults' immediate visual attention (under 500 ms) shows a bias *away* from positive faces, suggesting that positivity may emerge as a response to automatic processing biases rather than constituting an automatic process itself. Neural evidence provides converging support for this view (for a review, see Samanez-Larkin and Carstensen (2011)). Specifically, older adults' medial prefrontal brain activity in response to happy and fearful faces shows an initial reduction in processing of

positive stimuli paired with delayed downregulation of emotional responses to negative stimuli. This pattern of findings is inconsistent with explanations for the positivity effect based on age-related neural or cognitive degradation, which predicts an immediate and automatic positivity effect in processing. However, it is consistent with the motivational view of SST, which emphasizes the deliberate allocation of cognitive resources consistent with a delayed onset.

### Cultural Specificity

The age-related positivity effect was initially conceptualized as a broad developmental pattern related to the increasing value placed on emotionally meaningful information in later life. Findings from cross-cultural studies suggest that, just as the definition of emotional meaning varies between Western and Eastern cultures, age differences in preferential emotion processing may likewise differ across cultures. For instance, East Asian cultures are less likely to distinguish positive and negative information relative to American culture. Consequently, some studies suggest that older Hong Kong Chinese do not show positivity in gaze patterns – if anything, they appear to demonstrate a stronger preference for negative faces relative to younger Chinese (Fung et al. 2008). In Western cultures that place great value on positive experience, evidence for the positivity effect is highly reliable. By contrast, the effect is mitigated and sometimes eliminated in cultures that place comparable value on negative and positive experience and stimuli. In a study conducted with a Korean sample, and based on memory for emotionally evocative images, a positivity effect was observed only when stimuli were categorized as positive or negative based on the Korean participants' own ratings. Korean participants considered some of the images rated by Westerners as neutral, such as a teacup, as positive. These findings indicate that further research is needed to fully elucidate the role of culture and emotional values in the positivity effect.

## Implications for Social Gerontology

The positivity effect appears to support goal-directed behavior and parallels age-related preferences for everyday social behavior. In general, older adults appear particularly motivated to avoid negative social interactions, which presumably contributes to improved emotional experience in daily life (Charles 2010). Selective exposure is arguably the most effective way to regulate emotional states, and there is considerable evidence that older people are more selective than younger people in their choice of social partners and environments (for a review, see Charles and Carstensen (2010)). Specifically, older adults prefer the company of meaningful social partners such as close friends and family over novel partners such as recent acquaintances. Age differences in social partner preferences appear to reflect the same top-down motivational priorities that underlie the age-related positivity effect and are likewise susceptible to contextual factors. Consequently, older and younger adults express comparable partner preferences when future time horizons are experimentally constrained or expanded.

The positivity effect manifests not only in how older adults selectively seek versus avoid social interactions but also in how they process and appraise their social partners and experiences. Consistent with theoretical predictions, the positivity effect is evident in impression formation. For example, in a recent study, participants were asked to evaluate the positive and negative traits of strangers based solely on neutral facial photographs (Zebrowitz et al. 2013). Older adults rated the targets as healthier, more trustworthy, and less hostile than their younger counterparts. Complementary findings were observed in a neuroimaging study in which individuals formed impressions of strangers based on photos paired with valenced behavioral attributes (Cassidy et al. 2013). Older adults selectively recruited brain regions such as the medial prefrontal cortex and amygdala to a greater extent when evaluating positive versus negative attributes about strangers, whereas younger adults showed the

reverse pattern. The positivity effect in impression formation also extends to contexts where social partners are both tangible and aversive. For instance, when older adults are asked to collaborate with a disagreeable stranger on a problem-solving task, they subsequently rate the task as more enjoyable and the stranger as more likeable relative to younger participants (Luong and Charles 2014). In combination, these findings suggest that older adults devote more resources to processing positive versus negative social information and may consequently form more favorable impressions than younger adults – even when their social partners and experiences are negative.

## Implications for Well-Being

Emerging evidence suggests that the relationship between the age-related positivity effect and health is nuanced, complex, and elusive. As defined by SST, the positivity effect operates in the service of goals related to emotional meaning. That is, if a person is seeking meaningful experience, they tend to see stimuli that are related to meaning. A distinct but related issue concerns the *consequences* of attention to positive stimuli. That is, when people attend to positive material, does such attention improve mood? To date, this issue remains unresolved. On the one hand, older adults, who typically display positive preferences, report higher levels of emotional well-being than younger adults, who typically display preferences for negative information (Charles and Carstensen 2010). Findings based on laboratory studies that present positive and negative stimuli and subsequently measure mood are equivocal (Isaacowitz and Blanchard-Fields 2012). Whereas some studies do observe improvement in mood, others do not. It is possible that stimuli in laboratory studies, such as synthetic faces, are insufficiently positive or emotionally evocative to elicit changes in mood. It is also possible that the effect does not directly benefit mood.

It is clear that the positivity effect is most pronounced in older people who have relatively good cognitive functioning and is weak in those in

poorer cognitive health. Alzheimer's disease patients, for example, do not show systematic preferences for positive over negative information (for a review, see Reed and Carstensen (2012)). Again, the balance of evidence indicates that the positivity effect is a reflection of the goal-directed behavior.

Kalokerinos and colleagues (2014) recently proposed that the positivity effect may benefit older adults' health by strengthening immune system functioning. In one study, older adults' positivity in recall of emotional images predicted better immune function (as indexed by t-cell counts and activation) at a 1-year follow-up. Though these findings point to a possible tangible benefit of positivity for health, they should be interpreted with some caution. Specifically, it is likely that cognitive control resources, which were not assessed in this study, predict both the positivity effect and good health in later life. Further research is therefore needed to elucidate the unique contributions of the positivity effect to health, above and beyond cognitive status.

Although the consequences of the positivity effect for emotional, cognitive, and physical health have yet to be elaborated, findings do suggest that the positivity effect *can* effectively be leveraged to improve health-related behavior in later life. In particular, positively framed health messages may be especially effective in motivating older adults to engage in healthy behaviors. Older adults demonstrate better memory for positive health messages (e.g., emphasizing the benefits of regular cholesterol tests) versus negative messages (e.g., emphasizing the risks of failing to check cholesterol), and they may be more responsive to such messages as well (Shamaskin et al. 2010). In two recent quasi-experimental studies, older adults walked significantly more when exposed to messages that emphasized the *benefits* of walking compared to those who were exposed to messages warning of the *dangers* of inactivity (Notthoff and Carstensen 2014). By contrast, younger adults did not walk more or less as a function of messaging. These applications of the positivity effect to health behavior change, though scant, represent fertile ground for future research. Future research testing positive

message frames in alternative domains will be valuable.

## Open Questions and Future Directions

Although the literature on the age-related positivity effect has grown rapidly, its relatively nascent status leaves many questions unanswered. For instance, SST maintains that the positivity effect represents downstream consequences of age-related shifts in time horizons and the increasing valuation of emotional meaning, yet the discrete contributions of these factors remain unclear (Reed and Carstensen 2012). Questions about the role of time horizons in the positivity effect have not been fully addressed, although some evidence suggests that younger adults favor positive information when endings are made salient (Ersner-Hersfield et al. 2009).

In a similar vein, many if not most empirical tests of the positivity effect use stimuli that are neither personally meaningful nor affectively evocative. On the one hand, research-specific materials such as cartoon faces and IAPS images create a "level playing field" for testing attention and memory by ensuring that age groups are equally unfamiliar with the stimuli. On the other hand, they lack face validity. Research that better simulates the emotional worlds people navigate in their daily lives is needed, as well as paradigms that measure affective information processing outside of the laboratory.

Finally, little is known about the potential pitfalls of the positivity effect. Two domains are particularly relevant in this regard. First, older adults' preference for positive and inattention to negative information may leave them especially vulnerable in situations that demand attention to negative information, such as potential scams. Some advocates worry that a disproportionate focus on gains that are "too good to be true" may place older people at risk. Such concerns are compounded by the fact that scam artists disproportionately target older people. A second maladaptive consequence of the positivity effect is that it may be detrimental to everyday decision making. Beyond financial scams, there is no

shortage of domains in which negative information (e.g., about potential risks or drawbacks) is equally important, if not more so, than positive information (e.g., about benefits and strengths). For example, sticking with underperforming investments, failing to switch prescription drug plans after rate hikes (e.g., Medicare Part D), and playing the lottery represent just a few examples of potential suboptimal decisions that stem from the positivity effect. Better understanding the contexts in which the positivity effect undermines decision quality could facilitate the development of interventions to improve decision outcomes in later life.

## Conclusion

The first decade of research on the positivity effect yielded key insights about the basic mechanisms involved, reliability and moderators of the effect, as well as implications for the broader literature on age-related changes in emotion and cognition. Important questions remain unanswered regarding the extent to which the positivity effect may be maladaptive for older adults and, conversely, how the effect might be leveraged to promote adaptive behavior in later life. Resolving these knowledge gaps will require research that translates laboratory-based approaches into naturalistic studies and interventions. In doing so, researchers may use the positivity effect in ways that ultimately improve older adults' health, finances, and overall well-being.

## Cross-References

- ▶ [Aging and Psychological Well-Being](#)
- ▶ [Aging and Attention](#)
- ▶ [Decision Making](#)
- ▶ [Emotional Development in Old Age](#)
- ▶ [Emotion–Cognition Interactions](#)
- ▶ [Memory, Episodic](#)
- ▶ [Positive Emotion Processing, Theoretical Perspectives](#)
- ▶ [Social Cognition and Aging](#)
- ▶ [Socioemotional Selectivity Theory](#)

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Response times of an individual can be characterized in many ways – most often, the central tendency (mean or median) is what researchers focus on, but the dispersion (variance or standard deviation) and skew can be of interest as well. In an aging context, most of the work has focused on changes in mean response times, sometimes labeled “age-related slowing,” and what these changes can teach us about aging in different sub-systems of the cognitive substrate.

### Age-Related Slowing in Basic Response-Time Tasks

It is no surprise that, generally speaking, older adults take longer than younger adults to process information. The increase in response time (RT) with age is monotonic and quite large. In a large meta-analysis on studies using continuous age samples, Verhaeghen and Salthouse (1997) reported an age-speed correlation of  $-0.52$ ; Welford (1977) estimated that each additional year of adult age increases two-choice reaction time by 1.5 ms. The increase accelerates notably with advancing age (Verhaeghen and Salthouse 1997; Cerella and Hale 1994). Cerella and Hale (1994) estimated that the average 70-year-old functions at the speed of the average 8-year-old – a large effect.

One question that was widely debated in the field in the 1980s and 1990s was the question whether or not age-related slowing was monistic or unitary, that is, whether or not “it all goes together when it goes” (Rabbitt 1993). The so-called general slowing hypothesis states that a single dimension suffices to explain age-related slowing. The main technique to investigate the dimensionality of age-related slowing is the Brinley plot (Brinley 1965): a scatter plot with mean performance of younger adults on the X-axis and mean performance of older adults on the Y-axis. Many varieties of Brinley plots exist: One can plot mean latencies or mean accuracies of a number of studies, or mean latencies of a number of tasks or conditions with the same group of participants. Early research using Brinley plots as a meta-analytic technique (i.e., gathering results

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## Age-Related Slowing in Response Times, Causes and Consequences

Paul Verhaeghen  
Georgia Institute of Technology, Atlanta, GA,  
USA

### Synonyms

Latency; Response

### Definition

Response time refers to the time between an input and an output. In cognitive psychology, this is typically the time needed for some task, from the moment the stimulus is presented to the moment a response is emitted, measured most often by the time elapsed between the appearance of the relevant stimulus and an appropriate key press.

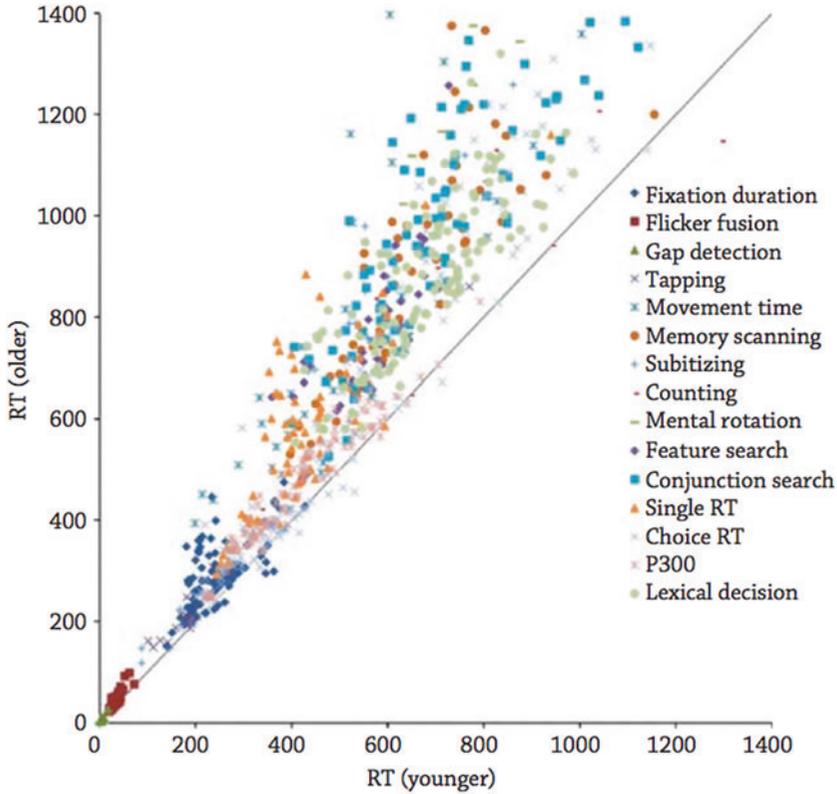
from multiple studies in a single plot) typically demonstrated not only that older adults are slower or less accurate than young adults but that data from multiple studies and conditions could be well described by a single straight line (with a small negative intercept), and hence a single linear equation. For instance, the first published Brinley analysis was a meta-analysis on 99 data points from 18 studies; the resulting equation was  $RT(\text{old}) = 1.36 RT(\text{young}) - 70 \text{ ms}$ ;  $R^2 = 0.95$  (Cerella et al. 1980). This result implies that within broad classes of tasks, performance of a group of older subjects can be extremely well predicted simply from knowing the performance of a group of young subjects and the linear equation from the Brinley plot; information about the actual tasks is not needed. This in turn strongly suggests that processing differences between young and older adults are quantitative rather than qualitative in nature, and that the nature of processing (i.e., the type of processes involved and their sequencing) is well preserved throughout adulthood. According to these studies, what happens over the course of aging, in other words, is mainly a general decline in processing efficiency. The extreme regularity of the Cerella et al. and subsequent data sets thus gave rise to the notion that all computational processes in older adults are slowed to the same degree, as indexed by the slope of the Brinley function (a slope of 1.36 indicates 36% slowing for older adults of the indicated age).

A stronger answer to the question of general slowing, however, demands an approach where age-related effects are first estimated within specific elementary cognitive tasks; in a second step, the slowing factors of these different tasks are compared and tested for statistical differences. One such attempt was made by Verhaeghen (2014) in a large-scale meta-analysis; the Brinley plot is provided in Fig. 1. Table 1 provides data for both younger and older adults for each of 15 elementary tasks/processes, derived from a total of 1,014 data points from 307 studies; the tasks or processes included were fixation duration, flicker fusion threshold, auditory gap detection threshold, tapping speed, movement time towards a target, memory scanning, subitizing

(i.e., enumerating 1, 2, or 3 elements), counting (i.e., enumerating 4 or more elements), mental rotation, feature visual search, conjunction visual search, simple reaction time, choice reaction time, P300 (an ERP component in EEG that reflects the engagement of attention), and lexical decision times. The table includes the estimated average response times for younger and older adults for each of these tasks, the number of studies used for each estimate, and two measures of age-related slowing: the old-over-young ratio of response times and the slope of the Brinley function.

Inspection of both the Brinley plot and the data in the table suggest that there is more than a single dimension at play. It should be noted that, despite the clear fan in the Brinley plot, a single dimension does fit the data impressively, with 96% of the variance in older adults' RT accounted for in a multilevel regression model. A 15-dimensional model, with a separate regression line for each task, adds only 0.5% to the explained variance; this amount, however, was highly significant. The data from this large meta-analytic set thus show that although the general slowing model is a powerful approximation of the data, it is also blatantly imperfect. Many lower-dimensionality cut-ups of the data are possible (see Verhaeghen 2014), but a few regularities can be derived from this and other data sets:

1. Spatial tasks yield larger age-related effects than linguistic tasks and, more generally, tasks involving manipulations of lexical items (such as memory search).
2. Within spatial tasks, lower-level or "early" tasks, likely involving occipital brain structures (such as flicker fusion threshold and feature visual search), generally yield smaller age-related effects than more integrative, "later" spatial tasks, likely driven more by parietal brain structures (such as subitizing, conjunction visual search, and mental rotation).
3. When no decision component is involved, sensorimotor tasks yield small or no age-related effects; when a decision component is involved, a more moderate age-related slowing



**Age-Related Slowing in Response Times, Causes and Consequences, Fig. 1** Brinley plot of all data included in Table 1, grouped by task (1,014 data points); data

restricted to the 0–1,400 ms range. The *dotted line* represents the diagonal (Figure used with permission from Verhaeghen (2014))

**Age-Related Slowing in Response Times, Causes and Consequences, Table 1** Mean response times for 15 tasks for younger and older adults, as derived from a

large-scale meta-analysis (Verhaeghen 2014), as well as young/older ratios and the Brinley slopes derived from these data

	Mean RT (younger)	Mean RT (older)	k	Young/older ratio	Brinley slope
Fixation duration	242 ms	280 ms	27	1.16	0.96
Flicker fusion cycle time	29 ms	36 ms	22	1.24	1.25
Gap detection threshold	4.4 ms	8.1 ms	10	1.84	1.33
Tapping speed	105 ms	121 ms	20	1.15	1.16
Movement time	124 ms	179 ms	9	1.44	1.63
Memory scanning	60 ms	72 ms	9	1.20	1.33
Subitizing	40 ms	61 ms	8	1.53	1.11
Counting	330 ms	335 ms	8	1.02	1.03
Mental rotation	4.8 ms	8.6 ms	8	1.79	1.86
Feature visual search	4 ms	6 ms	39	1.50	1.76
Conjunction visual search	28 ms	55 ms	30	1.96	1.80
Single reaction time	246 ms	310 ms	26	1.26	1.40
Two-choice reaction time	283 ms	351 ms	20	1.24	1.60
P300	400 ms	452 ms	38	1.13	0.95
Lexical decision	679 ms	863 ms	33	1.27	1.36

Note. *k* = number of studies

factor is observed (flicker fusion threshold and tapping rate vs. movement time, single RT, and choice RT).

### Age-Related Slowing in Tasks of Executive Control

Debate is still ongoing about whether tasks with an added executive control requirement yield larger age-related differences than basic cognitive tasks such as the ones described in the previous section (e.g., Braver and West 2008). Executive control can be loosely defined as the set of general-purpose mechanisms that modulate the operation of various cognitive subprocesses and regulate the dynamics of cognition (Miyake et al. 2000). Factor-analytic work (e.g., Miyake et al. 2000; Oberauer et al. 2000) suggests that the concept of executive control can be split into at least four interrelated but distinct aspects: (a) resistance to interference (also known as inhibition as, for instance, measured by Stroop tasks), (b) coordinative ability (as, for instance, measured in dual-task situations), (c) task shifting (measured in task-switching paradigms), and (d) memory updating (as measured, for instance, in N-Back tasks).

Too few studies exist to warrant a meta-analysis on updating, but the former types all have been analyzed using Brinley plots (Verhaeghen 2014). Two conclusions emerged. First, at the level of absolute age differences – the level older adults deal with in their daily lives – there are indeed near-universal deficits: Absolute age differences are typically larger for task versions requiring executive control (e.g., reading the font color of incompatible color words in the Stroop task) than for versions with minimal control demands (e.g., determining the color of color patches). This stands in stark contrast to the second level, the level of the underlying dimensionality as revealed by Brinley plots: Most executive-control tasks do not show deficits over and beyond those already present in their low-control or no-control baseline version. Perhaps most surprisingly given the attention this explanation has received in the literature, most

tasks involving resistance to interference show no age-sensitivity in the control process, neither do tasks measuring task shifting. In contrast, the ability to coordinative different tasks (as expressed in dual-task costs and in the costs of having to prepare for multitasking) does show specific age deficits. At a broad level of generalization, one could conclude that tasks of selective attention are mostly spared and that reliable age differences emerge in tasks that involve divided attention and/or the maintenance of two distinct mental task sets.

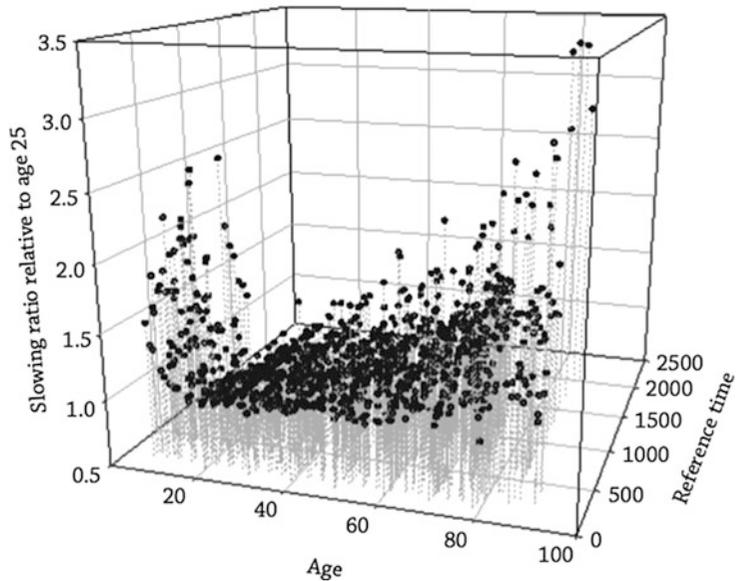
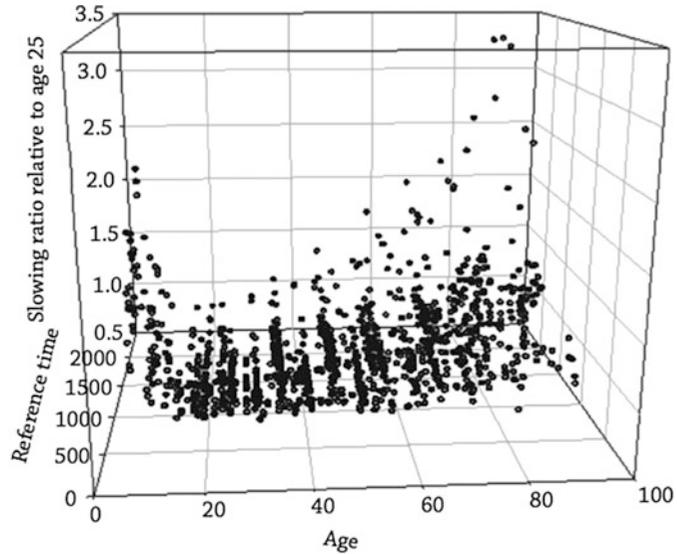
### Life-Span Trajectory of Age-Related Changes in Response Times

Figure 2 shows meta-analytic data (Verhaeghen 2014) pertaining to the life-span trajectory of response times; 1,292 data points from 50 studies that compared younger adults with either children or middle-aged or older adults. The tasks are diverse – simple RT, two-choice RT, go/no-go RT, a cancelation task, a clock test, abstract matching, digit symbol substitution, different category membership classification tasks, lexical decision, memory search, visual search, mental rotation, stroop, task switching, and trail making. The data are represented in 3D space. The X-axis represents age. The Y-axis represents response time at the given age divided by the response time of the group of younger adults for that particular task in that particular study (data for younger adults are data at age 25, real or interpolated from the data); this metric expresses age-related differences in response time as a ratio of speed at age 25. (Thus, a score of 1.25 means that this particular group of subjects, in this particular task in this particular study, are 1.25 times, or 25%, slower than 25-year-olds in this particular task in this particular study.) The Z-axis represent the response time of 25-year-olds for the particular task within the particular study; this time can be taken as an index of task difficulty or task complexity (i.e., harder or more complex tasks typically take longer to perform).

Three findings stand out. First, the decline in speed over the adult life-span is positively accelerated: The trajectories curve upwards, so that

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**Fig. 2** 3D representation of life-span response time data. The X-axis is age; the Y-axis represents slowing ratios relative to speed at age 25 within each task within each study; the Z-axis is the reference time, that is, response time for the task at age 25. The two panels show the same data from a different vantage point (Figure used with permission from Verhaeghen (2014))



decline becomes progressively larger with advancing age. Second, the minimum of the function – the apex of processing speed – is situated in early adulthood, at around age 23. Third, age-related slowing, expressed as an old/young ratio, increases with task difficulty, as can be seen in the increasing 3D curvature as age increases.

The trajectory plotted in Fig. 2 is cross-sectional, that is, it depicts age-related differences between groups of individuals as measured at the

same point in historical time. This confounds aging with generational and historical differences. To have a more precise estimate of changes related to aging proper, we would also need to look at longitudinal studies, where a group of participants is followed over a period of time, often decades. In longitudinal studies, changes in scores are due to the aging process itself, as well as to historical change; generation is kept constant. In eight studies that contained both cross-sectional and longitudinal data, the average

ratio of cross-sectional over longitudinal slopes is 1.09, suggesting that cross-sectional age differences generally overestimate longitudinal age differences by about 10% (Verhaeghen 2014). This, in turn, suggests that some of the age-related differences in cross-sectional studies are due to generational differences: People born later in historical time tend to have faster response times.

### Causes of Age-Related Slowing

Proposed causes of age-related slowing range from the purely psychological to the biological.

Psychological explanations include increased caution (i.e., older adults would place higher priority on accuracy than on speed; e.g., Ratcliff 2008) and disuse (i.e., compared to younger adults, older adults lack recent and/or relevant practice; e.g., Baron and Cerella 1993). The former explanation carries some weight: In a meta-analysis on 42 studies where data could be modeled using the diffusion model, older adults were indeed found to be more cautious, even though they were still slower in their processing even when caution was taken into account (Verhaeghen 2014). The disuse explanation seems less plausible. That is, this explanation would by necessity imply that older adults should show larger practice effects than younger adults when performing speeded tasks repeatedly over an extended period of time. This is, however, not the case: In a meta-analysis of 31 repeated-practice studies, younger and older adults showed identical learning rates as measured by the exponent in the power law of practice (Verhaeghen 2014).

On the biological side, age-related slowing has been associated with a loss of brain connectivity (e.g., Penke et al. 2010); with changes in neurotransmitter systems, notably dopamine (e.g., Bäckman et al. 2000); with changes in brain glucose metabolic rate or intracellular pH levels (e.g., Hoyer 2002); and with the degree of neural myelination (e.g., Anderson and Reid 2005). The life-span trajectory, with its minimum around age 23, likely represents the convergence of two

influences: growth in brain connectivity in the early part of the life-span (functional brain connectivity increases up until age 30; Dosenbach et al. 2010) and loss of connectivity in the second part of the life-span (both, directly through decreases in cerebral white matter volume, starting at age 40 (Walhovd et al. 2011), and indirectly through changes in the dopamine system). Both mechanisms operate in concert to determine the system's processing speed, with a buildup of (functional and anatomical) connectivity dominating childhood and adolescence, until the steady decline in the efficiency of the dopamine system and, later, white matter volume causes the system to slow down even as (functional and anatomical) connectivity is still increasing.

Some researchers (e.g., Anstey 2008) have gone even deeper and argue that the best predictors of response times (especially of the simpler variety) are low-level measures of basic physiological health, such as forced expiratory volume, grip strength, and vision; under this model, age-related slowing can be conceived as a general indicator of the overall intactness of the biological substrate.

### Consequences of Age-Related Slowing

Age-related differences in processing speed are likely to have consequences for more complex aspects of cognition. In younger adults, speed of processing is at least moderately correlated with fluid intelligence. In one meta-analysis on the subject (which included both age-homogenous and age-heterogeneous samples), Sheppard and Vernon (2008) estimate the average correlation between inspection time (the minimum presentation time needed before a given stimulus becomes identifiable, a very basic measure of processing speed) and fluid intelligence at 0.36 and the average correlation between single reaction time and fluid intelligence at 0.26.

Speed of processing indeed turns out to be a powerful mediator of age-related changes in cognition: Individual differences in speed are associated with 62–93% (on average: 78%) of the

age-related variance in more complex aspects of cognition (viz., episodic memory, spatial ability, and reasoning; (Verhaeghen 2014)). The available longitudinal evidence (reviewed in Verhaeghen 2014) confirms the interdependence of different aspects of the cognition over the adult life-span: Individual differences in response time at the onset of longitudinal studies are correlated with changes in higher-order cognition, and vice versa (cross-correlations explain on average 55% of the relevant variance); and within-individual changes in speed over the course of a study are correlated with within-individual changes in higher-order cognition over the same time course (explaining on average 16% of the within-subject age-related variance). Moreover, in lead-lag analyses, speed appears to drive changes in higher-order cognition, but higher-order cognition has no leading role for changes in speed.

These findings all converge on the conclusion that age-related changes in speed (and/or other basic aspects of processing associated with it) drive age-related changes in more complex aspects of cognition. This does not, however, necessarily imply that speed is causal; it may simply be a biomarker or proxy par excellence. That is, speed might be the most sensitive (in the case of individual differences) or earliest (in the case of age-related differences) indicator that a more general, low-level underlying suboptimality is creeping into in the substrate. Speed then acts as the canary, so to speak, in the coal mine of the aging mind. High cognitive speed is then an indicator of a well-functioning substrate at the peak of its integrity; decreases in speed are indicative of insults to the system.

One type of data that suggest that this may be the case comes from the study of intraindividual differences in response times, that is, a person's inconsistency in speed of processing, often considered to be an indicator of noise in the information-processing system (for an overview, see MacDonald and Stawski 2015). Inconsistency, even after controlling for mean performance, follows the same U-shaped trajectory over the life-span as mean RT and shows an

accelerated pattern within the older-adult portion of the life-span. Inconsistency is also longitudinally predictive of cognitive outcomes. For instance, in one large-scale study (the UK Heath and Lifestyle Survey (HALS); Shipley et al. 2006), higher variability in response times significantly predicted all-cause mortality over the course of 19 years; inconsistency has also been shown to uniquely predict terminal decline (i.e., cognitive decline close to the end of life; MacDonald et al. 2008).

### **Can Age-Related Slowing Be Remediated or Reversed?**

There are at least two ways to improve response time, even in old age. First, performance can be improved with repeated exposure to the task. There are, however, two clear limitations to be noted here. The first is that, as stated above, learning rates of older adults are identical to those of younger adults. This suggests that the effect of practice is not one of remediation or reversal of age-related slowing, but simply one of increased efficiency of the processes involved in the particular task and/or the assemblage of these processes in the service of the task. The second limitation is that there is no indication whatsoever that the effects of repeated practice generalize beyond the task at hand: Only four studies have examined transfer effects (i.e., effects of training on response time that generalize to other cognitive tasks), but the end result is a zero effect (Verhaeghen 2014). Second, performance can be improved with aerobic fitness training (Hillman et al. 2008). The effects of fitness training appear to be rather large and are already visible after relatively short training regimens (3 months or even shorter); they also spread throughout the cognitive system, and thus hold better promise for more general cognitive rehabilitation. Note that such effects appear to be restricted to aerobic fitness training – strength or flexibility training does not yield the same benefits.

## Cross-References

- ▶ [Age and Time in Geropsychology](#)
- ▶ [Aging and Attention](#)
- ▶ [Executive Functions](#)
- ▶ [History of Cognitive Slowing Theory and Research](#)
- ▶ [Individual Differences in Adult Cognition and Cognitive Development](#)
- ▶ [Plasticity of Aging](#)
- ▶ [Process and Systems Views of Aging and Memory](#)

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## Aging and Attention

Eric Ruthruff<sup>1</sup> and Mei-Ching Lien<sup>2</sup>

<sup>1</sup>Department of Psychology, University of New Mexico, Albuquerque, NM, USA

<sup>2</sup>School of Psychological Science, Oregon State University, Corvallis, OR, USA

### Synonyms

Attention; Cognitive control; Executive control; Multitasking; Spatial attention; Task switching

### Definition

In everyday life, people often refer to attention as if it were a single, unitary thing, such as a vat of energy that can be spread across stimuli or tasks. Research suggests otherwise (Nobre and Kastner 2014). There appear to be many different limited mental resources associated with different brain networks and pertaining to different levels of processing (e.g., spatial vs. central) that can be utilized in multiple ways (e.g., activation, inhibition, control). For example, one can apply extra mental effort to an important task, as in the oft-heard command “pay attention,” as opposed to performing it automatically. Attention can also refer to selective processing of one thing over another (selective attention), which could be a spatial location, object, feature, thought, or entire task. Attention can also be spread among tasks (divided attention), often degrading performance on one or all of them. Relatedly, one can shift attention from one task to another. What all of these varieties have in common is control over how limited mental resources are utilized in the service of thought and action.

### Introduction

Attention is critical for everyday performance. Yet it is usually taken for granted until it fails, as in everyday action slips (e.g., forgetting to turn off

the stove) and accidents (e.g., driving accidents while talking on a cell phone) and in disorders such as ADHD and visual neglect. Furthermore, attention is a necessary precursor for many other cognitive functions to work properly. For instance, the most important aspect of *working memory* – best predicting performance in reading, reasoning, as well as academic and occupational pursuits – is not storage capacity per se but rather how well one controls the contents of that store (i.e., attention). Likewise, attention is also critical for encoding information, so poor attention could ultimately lead to poor long-term memory as well.

The central questions motivating research on aging and attention are as follows. Do attentional abilities decline with normal aging (absent any pathologies)? Is the decline uniform across varieties of attention, or is there a mixture of preservation and decline? Can a unified theory explain all, or most, of these attentional problems that occur with old age?

The first possibility to consider is that there are no specific age-related declines in attentional functioning, per se, just a general age-related slowing of all cognitive processes, or at least all non-peripheral processes (Cerella 1985; Salthouse 1996). Regardless of the precise cause of this generalized cognitive slowing – slower synaptic transmission, increased information loss, longer cycle time per calculation, greater neural noise, etc. – the end result is that every task that measures attention by how fast people can respond should show at least some age-related slowing. The exact amount of slowing depends on the age ranges of the older adult sample and other factors (e.g., whether the task is lexical or nonlexical), but the typical response time (RT) increase is about 50%. Performance in an attention-demanding condition should be even worse than this before researchers argue for a specific attentional deficit. To rule out general-slowing explanations, researchers often transform the data (proportional, log, or z-score) or replotted the data as Brinley plots or state traces (Faust et al. 1999; Verhaeghen 2000). Below, references to an “age effect” imply that the researchers found age effects that persisted even after correcting for generalized cognitive slowing. None of the

research areas discussed below are entirely without controversy, in part due to disagreement about how to appropriately account for generalized slowing.

## Empirical Review

This review summarizes research on the impact of normal cognitive aging on three broad categories of attentional function that have been widely studied: selective attention, divided attention, and switching attention. Each has been investigated using a variety of dependent measures (RT, accuracy, neuroimaging) and tasks. However, a prototypical task will include at least one condition that taxes the targeted aspect of attention, to be compared against a control condition that does not.

**Selective Attention.** Selective attention is the ability to focus on one thing while ignoring other things, excluding to-be-ignored information from deeper processing and control over action. Selectivity can be applied to many different things, such as locations, features, objects, sensory modalities, moments in time, or entire tasks. The selection is often a voluntary choice, although it can also be involuntary, as when we orient to a blaring police siren that we were not expecting.

Perhaps the most basic form of selectivity is allocating attention to regions of space. A real-world example is watching a stoplight for a color change. A common approach to studying space-based selective attention is the Posner cuing paradigm, in which participants use an advance location cue, either peripheral or central, to find the target. When a cue reliably predicts the target's location, the question is how well people can utilize that cue. When a cue is unreliable/irrelevant yet particularly salient (e.g., flashing or moving), the question is whether people can successfully ignore it. Many studies have shown preserved abilities with age in both cases – using location cues and resisting capture (Hartley 1993; Lien et al. 2011; Kramer et al. 1999). Interestingly, whereas behavioral data usually show preserved spatial selective attention, neuroimaging data suggest that older adults rely more on top-down

processes, perhaps to (successfully) compensate for underlying deficits in other processes (Madden et al. 2007).

Another widely studied example of space-based selection is the Eriksen flanker task, in which participants respond to a central target character while ignoring flanking distractor characters. Critically, these flankers can have the same or different identity as the target. As an example, a participant might see S H S and be asked to report whether the central character is an S or an H. Although it is relatively easy to find the target, whose location is fixed, people nevertheless usually respond more slowly when the flanker identity is incompatible rather than compatible with the target. Here, again, selectivity appears to be generally well-preserved with age (Salthouse 2010). An electrophysiological study corroborated that conclusion from behavioral data, showing similar early visual components of the event-related potential (P1 and N1) across age groups (Wild-Wall et al. 2008). If anything, older adults showed enhanced target processing relative to younger adults, perhaps by applying greater top-down control over spatial attention.

The negative priming task also involves interference between targets and distractors, except that the key question is not how the distractor influences the *current trial* but rather how it influences the *next trial*. If the distractor is inhibited to facilitate processing of the current target, then this inhibition might slow responses if that inhibited distractor becomes the next target. Researchers have examined both inhibition of distractor identity and distractor location. For younger adults, both dimensions have revealed negative priming effects. Several studies have reported that older adults showed smaller negative priming effects than younger adults, taken as a sign of reduced inhibition in older adults. However, a recent meta-analysis (Verhaeghen 2015) reported that, overall, negative priming effects are quite similar for young (21 ms) and old (18 ms). Negative priming studies typically show little overall age-related slowing in the baseline condition, so, from a generalized slowing perspective, one would also not necessarily expect older adults' negative priming effects to be much larger.

The Stroop task resembles the Eriksen flanker task, except that the competing information is (in most variants) located within the same object. In the classic version, a person must indicate the ink color of a word (typically by saying it out loud) that happens to spell out a potentially conflicting color word. Here, selection must be accomplished by choosing one object feature (ink color) over another (color word name). Ink color-naming is slower when word meanings and ink color mismatch (incongruent) than when they match (congruent) or when the word is neutral (e.g., a row of Xs). In younger adults, this Stroop effect is famously robust, suggesting that word reading is an automatic process that cannot easily be stopped, even when doing so would benefit performance. A majority of studies have reported increases in the Stroop effect with age (Hartley 1993). Although one meta-analysis with Brinley plots argued for a general-slowing interpretation (Verhaeghen 2015), Stroop effects were, on average, almost twice as large in older adults (480 ms) than younger adults (254 ms). Another study failed to find age effects in a few alternative Stroop-like tasks, such as with color words not in the response set (e.g., the word “NAVY” printed in green) or color-associated words (“SKY” or “BLOOD”), but did report age effects with the classic Stroop color word task that produces the strongest interference (Li and Bosman 1996). One popular interpretation of exaggerated Stroop effects is that older adults have reduced executive attentional control (i.e., impaired inhibition). The age effect might also reflect, in part, that older adults read more automatically due to a lifetime of reading (a point discussed in more detail below).

In the flanker and Stroop paradigms, there are typically just a few stimuli (e.g., one or three) and the target location is known and fixed. In visual search tasks, however, people search for a prespecified target in an unknown location among a variable number (possibly quite large) of distractors. In younger adults, if the target has a simple visual feature not shared by any distractors, then visual search is usually very efficient. Meanwhile search for conjunctions of features (e.g., red and horizontal) and search for the

absence of a feature tend to be very inefficient. This means that RT increases relatively steeply as the number of items in the visual display increases (i.e., the search slope is steep). Many studies of simple feature search have reported only modest effects of age on visual search performance, roughly in line with what one would expect from a general slowing of all cognitive processes. Researchers have, however, reported age effects with especially difficult visual searches with high target-distractor similarity, conjunction searches, and also on target-absent trials.

Overall, the general trend in studies of selective attention is that age effects are small or non-existent for many relatively easy tasks (e.g., selection by location), but can become relatively large when the task becomes sufficiently difficult (e.g., classic Stroop and particularly challenging visual searches).

**Divided Attention.** The selective attention tasks discussed above might present multiple objects per trial, but there is really only one task: find the target and report some attribute. In daily life, however, we often attempt to do more than one thing at a time, such as texting while walking. For younger adults, regulating multiple processes simultaneously often results in substantial dual-task costs, possibly because one must spread limited mental resources across multiple tasks. In fact, one popular account (the *central bottleneck model*) asserts that we cannot perform any central operations – those that fall in-between perception and action, such as response selection – on more than one task at a time (Maquestiaux et al. 2013). Even highly practiced tasks such as driving and talking can interfere to a degree, resulting in accidents.

Although dual-tasking is already difficult enough for younger adults, it apparently is even more difficult for older adults. Dual-task costs have often been cited as being particularly sensitive to age effects (Verhaeghen 2015; Craik 1977), and many authors have argued for a specific deficit in multitasking. One review reported an average dual-task cost of 215 ms for older adults but only 106 ms for younger adults (Verhaeghen 2015). These age effects have been attributed to mere slowing of component central processes,

reduced processing resources, or more cautious task-coordination strategies by the elderly.

The aforementioned dual-task studies typically present participants with two novel tasks and provide a minimal amount of practice during a single session lasting about an hour. In contrast, many real-world tasks of interest involve extensive practice, possibly over many years. This observation raises the question of whether younger and older adults can combat dual-task interference by automatizing some or all of the component processes. Automaticity of a mental process can entail many different things, such as being fast, obligatory, or uncontrollable. In a dual-task context, though, the main question is whether a mental process can operate capacity-free (i.e., not requiring any limited mental resources). There are two distinct issues: can older adults acquire new automaticity, and can they maintain previously acquired new automaticity?

With regard to acquisition of new automaticity, the picture is somewhat bleak. Although older adults can improve performance on novel tasks with practice (Fisk and Rogers 2000), they often do so more slowly than younger adults. More importantly, they are in many cases less likely to eventually achieve capacity-free automaticity. Studies of visual search with consistent stimulus–response mappings, for example, have shown that practice reduces search slopes (the RT increase per item to be searched) to nearly zero for younger adults, consistent with parallel display processing, but not for older adults (Rogers et al. 1994).

In dual-task practice studies with *novel* tasks, younger adults can – under favorable conditions (simple tasks, distinct input modalities, distinct output modalities, etc.) – eventually learn to perform the two tasks in parallel, bypassing the central bottleneck. It has been reported, however, that older adults typically continue to perform central processes serially despite considerable practice levels. One study reported that older adults failed to achieve dual-task automaticity despite receiving extra practice on even easier tasks, to the point that they responded just as fast as younger adults on each task in isolation (Maquestiaux et al. 2013). This dual-task finding is very difficult

to explain in terms of mere generalized slowing, so it appears to indicate a genuine age-related deficit in the acquisition of new task automaticity.

Nevertheless, it is not simply the case that old adults avoid all automaticity across the board. It has been argued, in fact, that they actually rely even more heavily on previously automatized routines, while avoiding novel tasks. Studies of expertise have consistently shown that older adults maintain automaticity acquired earlier in life. Expert typists, for example, appear to maintain their skill well into old age. They can sometimes even maintain their high typing rate, compensating for general cognitive slowing with greater chunking (Salthouse 1984). Language skills and vocabulary are also generally well-preserved into old age. Some studies have even found that older adults can access the mental lexical *more* automatically than young adults (Lien et al. 2006). A possible exception to the general rule is that certain motor skills that are automatic in young and middle age (such as walking or writing) are sometimes found to require more attention in old age to compensate for motoric deficits.

In summary, older adults have extra difficulty performing multiple novel tasks at the same time, and this difficulty cannot generally be overcome simply by providing more practice. Although older adults typically maintain automaticity acquired earlier in life, they have difficulty acquiring new automaticity of novel tasks. This might explain the anecdotal observation that younger adults frequently attempt multiple tasks at the same time (texting while driving, walking, or almost anything else), but older adults do not.

A lingering question is whether older adults are merely slow to acquire new automaticity (and eventually would if researchers were to invest in much more lengthy training regimens). Relatedly, do the findings reflect a deficit in forming new associations (reduced plasticity), a decrease in processing resources, or increased cautiousness? Interestingly, one study successfully induced more automatic memory retrieval in older adults by providing monetary rewards for fast responding (Hertzog and Tournon 2011), though it is as yet unclear how widely this finding will apply.

**Switching Attention.** People have a remarkable ability to control their minds and reconfigure themselves to carry out any arbitrary new task rather than reflexively repeating the last task or performing the task most strongly associated with the current environment. This control, however, comes with a cost. It takes extra time and effort to instantiate the new task set, and once instantiated, performance of a new task tends to be slower than performance of an old task. In the terminology used in task-switching experiments, task-switch trials are slower than task-repetition trials. Critically, this is typically true even given ample time to prepare for a new task. This *residual switch cost* might be due to carryover of the previous task set or to an inability to completely reconfigure a new task set via mental preparation alone, without actually performing the task.

Given that dual-task costs are exaggerated with age, one might naturally expect that task-switching costs would as well. Indeed, note that dual-task studies almost always involve task switching as well. However, the picture is not quite this simple. When calculating switch costs between task-repetition and task-switch trials within a block – sometimes called *local switch costs* – many studies have found little or no effect of age beyond generalized slowing (Verhaeghen 2015; Lien et al. 2008), especially with pairs of relatively simple tasks that do not overburden working memory. Substantial age effects often do emerge, however, when comparing task-repetition trials within “mixed” blocks containing both tasks to task-repetition trials in “pure” blocks of only one task, called *global switch costs* (Verhaeghen 2015; Kray and Lindenberger 2000). The cause of this pattern is not yet clear. One speculation, however, is that although task repetitions within mixed blocks could theoretically be performed with minimal executive control, older adults apply extra top-down control anyway. This conservatism by older adults would have two consequences: (a) slowing performance in mixed blocks (hence exacerbating global switch costs) and (b) undermining the usual benefit of task repetition which (perhaps counterintuitively) reduces measured local switch “costs” (Lien et al. 2008).

**Summary.** The findings reviewed above reveal age-related deterioration in some attentional functions that cannot easily be explained by mere generalized cognitive slowing. Yet age effects in attention tasks are far from universal. The strongest evidence of age effects have been obtained when holding multiple tasks active (divided attention and global task switching), suppressing competing semantic representations (Stroop), and when attempting to acquire new automaticity. Meanwhile, the functions that are relatively well-preserved with age tend to be those involving shifts of spatial attention (e.g., using spatial cues, resisting capture, filtering out flankers), local task switching, and the retention of automaticity acquired earlier in life.

A common trend, however, is that even where age effects are generally spared, deficits begin to emerge when the component tasks become more complex (9). A potentially related recurring finding is that even when older adults show equivalent behavioral performance, neuroimaging data often show greater activation in older adults, especially in prefrontal cortex. This finding inspired the CRUNCH (compensation-related utilization of neural circuits) hypothesis, which states that older adults compensate for emerging cognitive deficits by utilizing more top-down resources (Reuter-Lorenz and Cappell 2008). This compensation might be successful for relatively easy tasks, allowing older adults’ performance to mimic that of younger adults, yet be insufficient when overwhelmed by sufficiently difficult tasks. Overutilization of top-down control might also explain why older adults sometimes have great difficulty acquiring new automaticity, which requires performance of a task with fewer resources rather than more.

### Theories of Age-Related Attentional Deficits

It is conceivable that the age-related changes in attention noted above reflect a large set of unique underlying deficits. Alternatively, there might be just a very small set of global attentional deficits, or perhaps just one, that causes all the attentional

problems observed in old age. Several such accounts have been proposed.

One influential account is the inhibitory deficit view, which attributes a wide variety of age-related cognitive declines to a decline in inhibition (Hasher and Zacks 1988). This view could explain the oft-reported age effects in the Stroop task. It could also conceivably explain difficulties juggling multiple tasks (e.g., multitasking and task switching) in terms of a reduced inability to suppress the irrelevant task. Although this inhibitory deficit view has been highly influential, and it is plausible that older adults do sometimes show reduced inhibition, several lines of evidence now argue against a strong version of the account. Several paradigms that would seem to be particularly sensitive to inhibition – such as inhibition of return and negative priming – actually tend to show little or no age effect (Verhaeghen 2015). Meanwhile, other paradigms (e.g., acquisition of new automaticity) do show age effects despite not obviously relating to inhibition.

The frontal lobes decline in volume and integrity more rapidly with advancing age than the other lobes. This has led many to argue that frontal lobe attentional functions such as inhibition and switching should decline more rapidly with age than parietal lobe attentional functions such as shifting spatial attention (Hartley 1993). This prediction loosely fits the findings noted above that spatial attention tends to show the least age effects, whereas certain aspects of executive control (global task switching, dual-task costs, working memory span) tend to show relatively large effects. It is also supported by the observation that cognitive deficits in old age are quite similar to (though milder than) those caused by frontal lobe damage. A potentially inconsistent finding, however, is the lack of an age effect on local task switching, although this exception could perhaps be explained by compensation.

Other single-cause theories of cognitive aging have focused on the dopamine system or more specifically on dopamine projections to prefrontal cortex (Braver and Barch 2002). Note that the above single-cause theories overlap to some degree and are not mutually exclusive. For example, inhibition is a frontal lobe function, and the

frontal lobes are a main target of dopaminergic pathways. Further research combining behavioral and neuroscientific approaches is needed to achieve greater resolution regarding the primary causes of declines in attention with age.

## Cross-References

- ▶ [Age-Related Slowing in Response Times, Causes and Consequences](#)
- ▶ [Aging and Inhibition](#)
- ▶ [Automaticity and Skill in Late Adulthood](#)
- ▶ [Cognitive and Brain Plasticity in Old Age](#)
- ▶ [Cognitive Compensation](#)
- ▶ [Cognitive Control and Self-Regulation](#)
- ▶ [Common Cause Theory in Aging](#)
- ▶ [Executive Functions](#)
- ▶ [Expertise and Ageing](#)
- ▶ [Working Memory in Older Age](#)

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## Aging and Driving

David L. Strayer

The University of Utah, Salt Lake City, UT, USA

### Synonyms

Motor vehicular transport in later life

### Definition

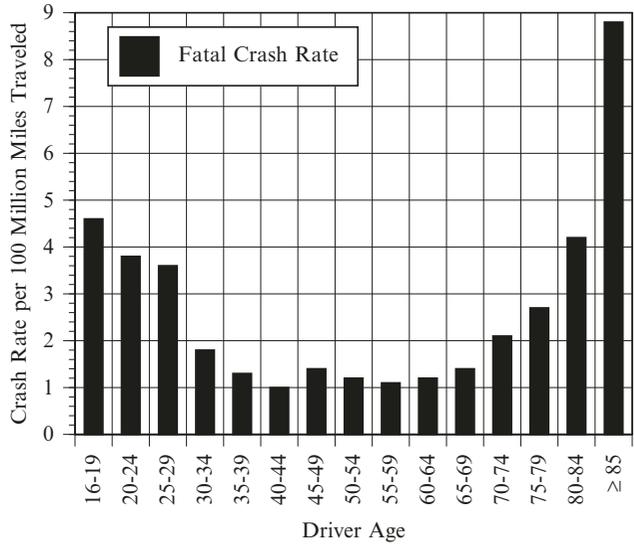
Motorists 65 and older show an increased risk of fatal crashes when turning across traffic. Age-related declines in dual-task processing play an important part in this effect. Several solutions are suggested to mitigate the increased crash risk.

Operating an automobile is the single riskiest activity that most readers of this entry engage in on a regular basis. For example, motor vehicle crashes are the leading cause of accidental injury deaths in the United States and are the leading cause of all deaths for people between the ages 1–33 and 56–71 (NSC 2010). Driving is a complex skill that takes years to master. Support for this assertion is provided in Fig. 1, in which are plotted fatal crash rates for different age drivers normalized by million miles driven (FARS 2015; IIHS 2015). In the figure, fatal crash rates steadily decline from novice/teen drivers until crash rates asymptote around 30 years of age. Around age 65, fatal crash rates begin to steadily increase mirroring the fatal crash rates of the teen drivers.

The U-shaped function depicted in Fig. 1 is multiply determined. On the one hand, younger drivers have less experience, take greater risks, and have a higher likelihood of being intoxicated

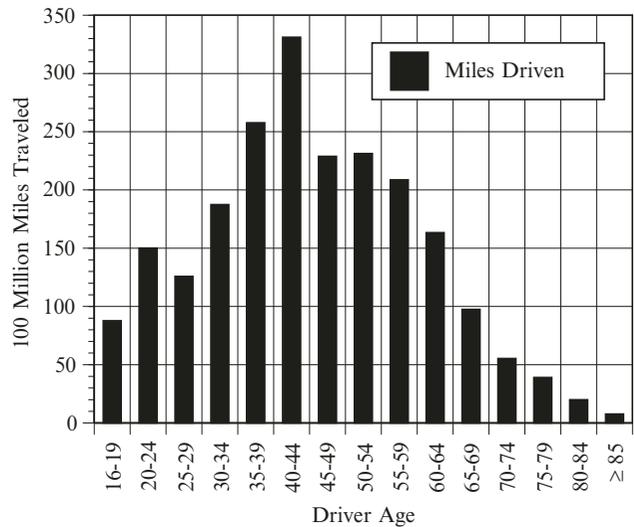
**Aging and Driving,**

**Fig. 1** Fatal crash rates as a function of the age of the driver. The miles traveled for each age cohort were used to normalize the data



**Aging and Driving,**

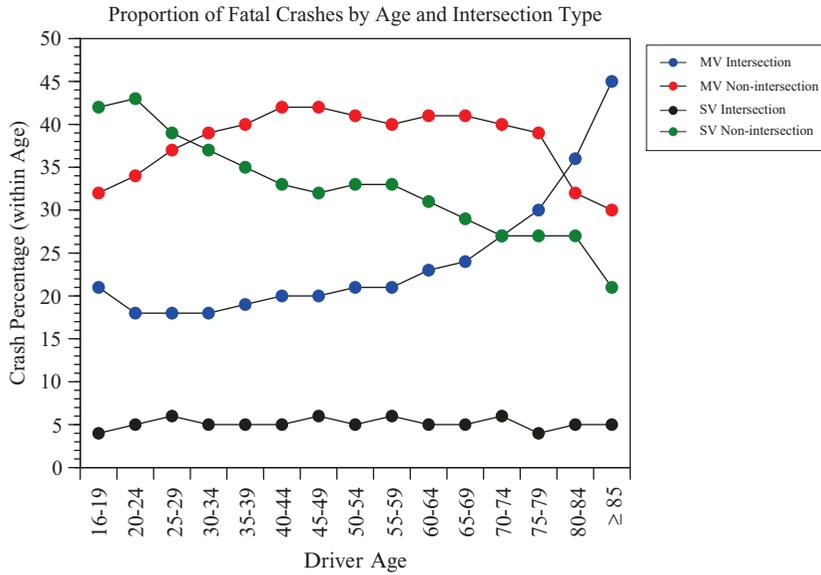
**Fig. 2** Miles traveled as a function of the age of the driver



from drugs and alcohol as compared to drivers in the 35–60-year age range. On the other hand, drivers over 65 years of age tend to have more experience, take fewer risks, are less likely to drive at night, are more likely to use seat belts, and they have the lowest proportion of intoxication of all adults. Older drivers are also more likely to succumb to the health complications associated with a crash than are younger drivers (NHTSA 2009); however, the U-shaped function is still present, albeit muted, when considering both fatal and nonfatal police-reported crashes

(as discussed below, older drivers are involved in more side-impact crashes (i.e., where their vehicle is hit broadside at an intersection). These at-fault crashes are often more severe (Farmer et al. 1997), making it difficult to determine if exposure to serious crashes is really equivalent across the age range.

Interestingly, Fig. 2 shows that driving exposure, plotted in million miles driven, has an inverse relationship with fatal crash rates – most noticeably, as fatal crash rates increase for older drivers, exposure decreases precipitously



**Aging and Driving, Fig. 3** The proportion of fatal crashes by the age of the driver and intersection type. *MV* multiple vehicle, *SV* single vehicle. Note that fatal multiple intersection accidents increase systematically with the

driver’s age; single-vehicle intersection crashes remain constant, and both non-intersection fatal crashes decrease across the age range

(FARS 2015; IIHS 2015). This is likely a consequence of lifestyle changes (e.g., employment status) and self-regulation on the part of the older driver (e.g., avoiding driving at night or in inclement weather). Indeed, Ross et al. (2009) used a longitudinal analysis and found that the most at-risk drivers limited their driving exposure, although this self-regulatory behavior did not adequately compensate for the elevated crash risk. Moreover, as the population of older drivers increases, a greater number of older motorists are projected to be on the road. By the year 2030, one out of five drivers on the roadway will be over the age of 65 in the United States (DOT HS 809 980). The situation is similar in other countries around the world. Driving therefore provides an excellent opportunity to examine aging in this important real-world context, particularly in light of the disproportionate increase in at-fault crashes for older adults.

Figure 3 presents another intriguing piece to the aging and driving puzzle (FARS 2015; IIHS 2015). When examining different sections of the roadway where fatal crashes occur, only one type systematically increases with age: Intersection

crashes involving multiple vehicles. Multiple vehicle intersection crashes begin to increase from baseline levels as drivers enter their sixth decade. The other categories are either flat or decline across the lifespan. Intersections with traffic place high demands on the driver because they require dividing attention between traffic lights, pedestrians, and other vehicles on the roadway. Non-intersections and intersections with a single vehicle apparently do not place the same demands on attention. The patterns in Figs. 1, 2, and 3 are important because they help to illuminate the sort of cognitive issues that underlie fatal crash rates in older drivers.

Older adults are at a particularly elevated risk of crashing when making left turns at intersections. For example, using Fatality Analysis Reporting System (FARS) data and adjusting for exposure, Sifrit et al. (2011) found that the risk of at-fault crashes increased strikingly when older drivers were turning left at intersections both with stop signs or stop lights. These authors reported a similar pattern using a nationally representative sample of police-reported motor vehicle crashes of all types, from minor to fatal.

Other researchers have found that older drivers' at-fault crashes increased when making gap-acceptance maneuvers while crossing traffic (Staplin and Lyles 1991). Side impacts associated with failing to yield the right of way are also more prevalent in older drivers (Evans 2004). Importantly, side impacts account for approximately 34% of crashes on the roadway and 30% of fatalities (Farmer et al. 1997). These side impacts tend to be more severe than front and rear impacts because the side crush space is limited.

Fisher (2015) recently examined the eye movements of drivers at intersections and found that they often make a primary glance to the left and right as they approached the intersection and then make a secondary glance to the left and right just before entering the intersection. Importantly, Fisher (2015) found that older adults were three times less likely to take secondary glances to the left and right as they entered an intersection. This decreased rate of making secondary glances is critical for avoiding intersection crashes. However, with one hour of simulator training, the rate of secondary glances at intersections doubled for older adults thereby reducing crash rates by 50%.

The objective of this entry is to provide an account for the age-related differences in at-fault crashes. As illustrated in Fig. 3, one category stands out above all others as a culprit for the increased crash risk of older drivers: Intersection crashes involving multiple vehicles, particularly those where the driver is turning across traffic. In considering what distinguishes this category of crashes from the others, it is worth considering the factors that are in common (and hence are not a proximal cause in the increased crash risk) (It is often difficult to distinguish causal factors from factors that are simply associated with the elevated crash risk. While not causal factors (e.g., failure to use a seat belt did not cause the crash, reduced health reserves of the driver, etc.), in many instances they heighten the consequences of a crash and, thereby, are associated with fatal crashes.). The ability to control the vehicle, per se, would seem to be ruled out as a causal factor, as are many of the typical risk factors (e.g., speeding, alcohol intoxication, seat belt compliance), since these should be common in each of the crash

categories (and these risk factors also tend to decrease with age).

Slower perception-reaction time is without doubt a contributing factor to the increased crash risk. In fact, slower reactions have been shown to increase both the likelihood and severity of crashes (Brown et al. 2001). However, processing speed of an individual should covary with the four crash categories suggesting that it is not sufficient to explain the increased at-fault crashes. The complexity of an intersection with multiple vehicles places an additional load on the cognitive system over and above the baseline differences in processing speed.

### **Ageing, Vision, and the Useful Field of View**

A variety of physical and psychological factors are likely to contribute to multiple vehicle intersection crashes. One important factor is the overall health of the visual system. Common problems associated with senescence include presbyopia, cataracts, glaucoma, and macular degeneration (CDC 2015). Increased glare sensitivity and reduced light sensitivity are also more prevalent in older populations (Wood 2002). As the visual health declines, the quality of the information transmitted to the visual cortex is degraded. Older drivers are also often restricted with their ability to turn their head and neck, which may limit scanning in the periphery for potential hazards. However, after controlling for these physiological factors, drivers across the age range still differ in the amount of information that they can extract at a glance (Remy et al. 2013).

The useful field of view (UFOV) refers to the area in the visual field in which a driver can extract useful information without head or eye movements (Ball and Owsley 1993). UFOV is most commonly assessed using a computerized program that has four subtests (Ball et al. 1993; Edwards et al. 2006). The first subtest involves the identification of a centrally presented target (a silhouette of a car or truck). The second subtest measures divided attention by requiring identification of both a centrally presented target and a

peripherally presented target at a fixed eccentricity in one of eight radial locations. The third subtest combines these two subtasks but adds 47 visual distractors (triangles) along the eight radial locations. The fourth subtest adds to the demands of the third subtest, by presenting two objects at the center location and requiring a same-difference judgment in addition to the localization of the peripheral target. In the UFOV task, the display duration for each subtest is systematically adjusted so that it is performed accurately on 75% of the trials (i.e., the duration of each subtest ranges from 16 to 500 ms). The UFOV score is determined by the sum of the durations of the four individual subtests.

The UFOV tests the speed of both visual and higher-order attentional processing (e.g., focused attention, divided attention, visual search, ignoring distractions, etc.). In an examination of over 2700 adult drivers, the UFOV scores were found to be positively correlated with age ( $r = 0.437$ ). UFOV scores was approximately 800 ms for drivers less than 70 years of age and averaged 1200 ms for drivers 85 or older – a 50% increase in UFOV processing time (Edwards et al. 2006). In fact, each of the subtests of the UFOV correlated with age, with correlations of .209, .353, .399, and .385, for subtests 1–4, respectively. Importantly, UFOV scores are also negative associated driving outcomes (for a meta-analysis Clay et al. 2005).

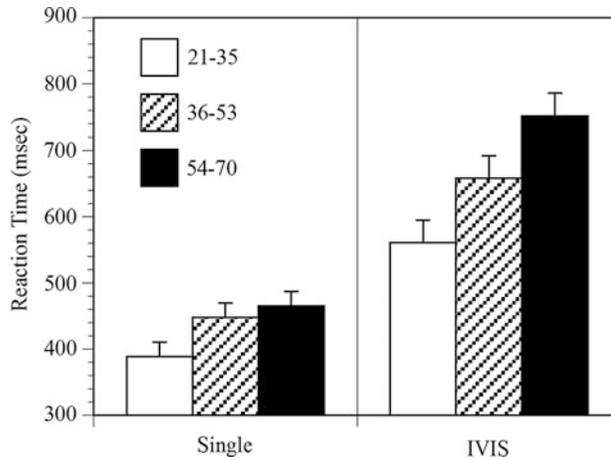
The UFOV measures help to shed light on the increase in multiple vehicle crashes for older adults. In particular, the time required for older adults to divided attention between spatial locations (subtest 2) and ignore distractors (subtests 3 and 4) systematically increases with increasing age. The UFOV task shares many of the processing requirements that confront older drivers as they approach an intersection with multiple vehicles. In such circumstances, drivers must divide attention between the other vehicles, pedestrians, traffic lights, and other sources of visual distractions (e.g., signs, stopped/parked cars, people waiting at the crosswalk, etc.). Intersections with multiple vehicles represent the perfect storm in terms of the demands placed on visual attention and

processing speed for drivers of all ages, but particularly so for older drivers.

## Driving and Multitasking

Watson et al. (2011) combined the driving and neuropsychological literatures by suggesting that the U-shaped function depicting crash rates and age was closely aligned with the rise and decline in prefrontal cortical (PFC) regions of the brain (e.g., an inverted U-shaped function across the lifespan that reaches apex around 30 years of age). The PFC regions are involved in a wide variety of higher-level cognitive functions that support executive attention. In this context, executive attention would be involved in processing task-relevant information associated with the safe operation of a vehicle (e.g., lane position, speed management, relation to other vehicles, status of traffic lights, acceptable gap for making a left-hand turn, etc.) as well as juggling other task-irrelevant interactions (e.g., talking or texting on a cell phone). In addition, the increased perceptual load at intersections places an additional burden on the executive attention system. For example, the effect of secondary-task load increases as the extraneous perceptual load in the driving environment increases (e.g., Strayer et al. 2003). Consistent with this interpretation, multiple studies have found age-related declines in dual-task processing (e.g., Craik 1977; Hartley 1992; Hartley and Little 1999; Kramer and Larish 1996; McDowd and Shaw 2000).

When the complexity of driving increases, as is the case with multiple vehicle intersection crashes, older adults exhibit greater difficulties dividing attention between the different components of the driving task. This is illustrated in Fig. 4 which compares the performance of younger-, middle-, and older-age adult drivers when they drove a new car on residential streets (i.e., the single-task baseline condition) with a condition where they perform the same driving task and also concurrently used voice commands to perform simple operations that were unrelated to the task of driving (Strayer et al. in press). These in-vehicle information systems (IVIS)



**Aging and Driving, Fig. 4** The DRT data plotted for the younger adult-aged (*solid white pattern*), middle-aged (*striped pattern*), and older-aged (*solid black pattern*) adults. The *left panel* reflects single-task performance when participants are driving without any secondary task.

The *right panel* reflects performance in the in-vehicle information system (IVIS) secondary-task portions of the experiment. Error bars reflect 95% confidence intervals around the point estimates

were cognitive in nature and did not require the driver to take their eyes off the road or their hands off the wheel (e.g., using voice commands to place an outgoing phone call or changing the radio station).

The data presented in Fig. 4 were obtained using a new international standard for assessing the cognitive demands of driving an automobile (The DRT task: ISO DIS 17488, 2015). The DRT task presents a visual probe every 3–5 s, and drivers are required to press a button attached to their finger when they detect the light (i.e., this is a simple RT task). The logic behind the DRT task is that RT is inversely related to the mental workload experienced by the driver. Prior research with younger drivers has found that when additional cognitive load is added to the driving task either in the form of increased demand in the driving task itself (e.g., with different traffic densities or different roadway configurations) or by adding a concurrent secondary task that is unrelated to driving (e.g., talking or engaging in other voice-based interactions in the vehicle), that RT increases relative to baseline levels (e.g., Strayer et al. 2013; Cooper et al. 2014).

The left-hand panel of Fig. 4 presents single-task performance in the DRT task. RT increased with age and this is likely due to differences in

processing speed associated with senescence (Salthouse 1996; but see Ratcliff and Strayer 2014). Note that the single-task condition provides the standardized baseline upon which to evaluate the effects of IVIS secondary-task load. Interestingly, the right-hand panel of Fig. 4 shows that the costs of IVIS secondary-task interactions increased with the age of the driver (as evidenced by an age X condition interaction). When older adults used these voice-based commands, the cost of interacting with the IVIS was 55% more than the cost incurred by younger adults performing the same activities.

The data presented in Fig. 4 represents a superadditive interaction. That is, the RT increase for older adults is more than the simple addition of a constant dual-task cost in RT (i.e., dual-task > single-task + constant). The RT cost is also greater than a proportional increase in RT from younger adults to older adults (i.e., the dual-task/single-task ratio for younger adults times the single-task data for older adults is less than that is observed for older adults in dual-task conditions). In fact, the actual dual-task cost for older adults was 40% greater than that predicted by a proportional increase. The costs of interacting with the IVIS system were substantially greater than that predicted by general slowing model.

These findings are in line with the *age-complexity hypothesis* (Cerella 1985; Cerella et al. 1980) that posits that age-related differences are amplified as the complexity of the task increases. The pattern of dual-task interference shown in Fig. 4 should serve as a caution for drivers of all ages who attempt to use these in-vehicle systems as they place surprisingly high demands on the driver. The data also suggest that older adults, who are the most likely to purchase a new vehicle with voice-based technology (Sivak 2013), will experience a much greater cost when required to divide their attention within their vehicle.

## Aging and Mobility

Mobility is important for maintaining independence and is a critical factor in older adults' ability to "age in place," maintaining social connections, accessing healthcare, and performing daily tasks (e.g., shopping, meals, work, etc.) (Colello 2007). Operating a motor vehicle is often a key component of mobility, particularly in rural communities where other modes of transportation are unavailable (Bailey 2004). In fact, twenty percent of adults 65 or older do not drive at all, and half of these nondrivers do not leave home on a regular basis (Farber et al. 2011). Bailey (2004) found that the reduced mobility of senior nondrivers resulted in a 15% decline in trips to healthcare providers, 59% fewer trips for shopping and dining, and 65% fewer trips for social and religious functions.

The cessation of driving tends to isolate older adults and has clear negative consequences for independent living. At the same time, the increased crash rates, particularly multiple vehicle crashes at intersections, is a significant concern for traffic safety. According to the Highway Loss Data Institute (2015), approximately 40% of the states in the United States have restrictions on relicensing of older drivers. Nineteen states currently require more frequent visual screening of older drivers and several do not offer a renew-by-mail option for older drivers. Surprisingly, neither tests for visual acuity nor tests of contrast sensitivity are predictive of population-based crash risk

(McGwin and Owsley 2015), suggesting that the current practice for licensure of older adults is currently not supported by the empirical literature. Based on the literature reviewed above, a more promising test for licensure may be the UFOV.

A recent study by Lambert et al. (2016) added an interesting twist to the aging/driving story. In the study, one group of drivers was given information consistent with the stereotype that older drivers are impaired in driving performance (e.g., the impairments reviewed in Figs. 1, 2, and 3). The other group was given other driving-related information without the stereotype threat. Older participants under stereotype threat exhibited greater impairment to driving (e.g., slower brake RT and a greater frequency of rear-end collisions) than did the age-matched controls that did not receive the stereotype threat. These findings suggest caution in how the media and public policy communicate information about older adult driving, as this information can impair the driving of older motorists (i.e., reading the preceding passages may make older adults perform worse on the driving task).

## Conclusions

At-fault crashes increase with senescence at intersections, particularly when the driver is making a left turn. This pattern is consistent with the hypothesis that age-related declines in dual-task processing play an important part in these fatal crash statistics. There are several things that can be done to mitigate the crash risk. First, the crash risk is lower when there are left-turn arrows to control the flow of traffic (e.g., Sifrit et al. 2011). Adding left-turn signals at intersections would help both younger and older motorists to navigate these hazardous sections of the roadway. Roundabouts have also been shown to reduce the severity of intersection crashes. For example, crashes decline by 40% and serious injuries decline by 80% when roundabouts have been installed (IIHS 2015). Fisher (2015) also found that training older drivers to take second glances as they enter an intersection reduced crash rates by 50%. This simple driver feedback offers a cost-effective

way to reduce fatal crashes for all ages. Moreover, these changes were still present in a 2-year follow-up of drivers who received training, indicating that the benefits are long-lived. In a similar vein, Horswill et al. (2010) found that training using a short video on hazard perception facilitated older drivers' subsequent identification of traffic hazards. Finally, a strategy that could be adopted by older drivers is the "three rights make a left" rule. Motorists can often use this rule (or the comparable rule in countries which drive on the left) to avoid making turns across traffic and to accomplish the same change in navigational direction. While taking longer to complete, the procedure avoids the type of complex turns that are a significant source of at-fault crashes.

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## Aging and Inhibition

Jennifer C. Weeks<sup>1,2</sup> and Lynn Hasher<sup>1,2</sup>

<sup>1</sup>Department of Psychology, University of Toronto, Toronto, ON, USA

<sup>2</sup>Rotman Research Institute, Baycrest, Toronto, ON, USA

## Synonyms

Age-related suppression deficit; Inhibitory deficit hypothesis; Inhibitory theory

## Definition

Age-related decrease in the ability to ignore irrelevant information.

## Introduction

Inhibitory theory, first advanced in Hasher and Zacks (1988) and subsequently elaborated on in Hasher et al. (1999; see also Lustig et al. 2007), proposed that the ability to regulate attention is central to memory and other cognitive functions. The theory made four foundational assumptions: (1) that familiar stimuli automatically trigger activation of their representations in memory; (2) that

downregulation – or inhibition – of excessive activation is the critical function that works together with (3) goals to constrain thought processes to only (or mostly) relevant information; and (4) there are substantial age and individual differences in the ability to suppress nonrelevant stimuli along with minimal differences in automatic activation. The empirical work on this topic now covers a wide range of domains within cognitive and social psychology, along with differences tied to mood (e.g., Biss et al. 2012) and to circadian rhythms (e.g., Anderson et al. 2014). Here we review how a reduction in the ability to ignore irrelevant information has wide-ranging effects on cognition in late adulthood.

### Neural Correlates of Inhibitory Deficit

Neuroimaging findings have corroborated the idea that older adults process more irrelevant information than their younger counterparts. Using recordings of event-related potentials, researchers have found that older adults show a larger neural response to unattended auditory stimuli played while they are reading a book compared to young adults, even after many repetitions of the sounds (Fabiani et al. 2006). Young adults quickly suppress their neural response to the repeated tones, showing efficient “sensory gating” of auditory distraction during reading. These neuroimaging results suggest that the age-related deficit in filtering out irrelevant information occurs at a low level of sensory processing.

Similar low-level processing of irrelevant visual information has been observed in older adults using functional magnetic resonance imaging (fMRI). In a study measuring cortical blood flow during a selective attention task, older and younger adults were instructed to attend to face stimuli and ignore place stimuli (Gazzaley et al. 2005). Older adults showed more activation in a place-selective brain region to the irrelevant stimuli than did young adults, suggesting that the perceptual qualities of distracters are processed to a greater degree in older adults. In that study, only the degree to which irrelevant stimuli were suppressed was correlated with a memory

measure, as inhibitory theory would have predicted. Recent evidence suggests that successful inhibition of irrelevant stimuli is associated with activation in a specific set of frontal and parietal brain regions that comprise the frontoparietal control network (Campbell et al. 2012). Older adults show less activity in cognitive control regions and less coherence within the frontoparietal control network compared to young adults when ignoring distraction (Campbell et al. 2012).

Noisy environments can significantly impair recognition memory in older adults. In one fMRI study, forgetting of face stimuli was predicted by decreased activity in brain areas responsible for successful encoding (e.g., hippocampus) as well as elevated activity in the auditory cortex (Stevens et al. 2008). Since the memory task in this study was purely visual, the auditory cortical activity presumably reflected distraction from scanner noise. The auditory distraction only disrupted the memory performance of older but not younger adults, consistent with the inhibitory theory assumption that young adults are efficient at filtering out irrelevant information.

These lines of work suggest that the increase in processing of irrelevant information is at least partially driven by a failure of top-down control networks to exert control over the focus of attention, which in turn allows irrelevant items to be processed. Once irrelevant items are processed, they can interfere and compete with relevant items, resulting in a general performance reduction in older adults and others with inhibitory deficits (e.g., Nigg 2000).

### Inhibitory Control and Response Times

Perhaps the most replicated finding in all of cognitive gerontology is the slowing of response times with age. Many studies have shown that older adults are slower to make speeded responses than are young adults and there is evidence that age-related slowing is exacerbated by the presence of distraction. Lustig et al. (2006) measured response time to make a simple similarity judgment between two sets of letters

(e.g., *RXL*\_\_\_*RXL*) in young and older adults, and they manipulated visual distraction in this task by either presenting only one trial at a time (low distraction condition) or presenting many stimuli at once (high distraction condition). Older adults were faster to respond in the low distraction condition compared to the high distraction condition, but the manipulation had a smaller effect on young adults. Thus speed differences between young and older adults may be exaggerated in tasks with a high degree of visual clutter. Furthermore, only speed on the high distraction condition predicted fluid intelligence for older adults, consistent with the suggestion that the regulation of attention in the face of distraction is a major determinant of overall cognitive functioning.

A similar effect of distraction has been widely reported in the literature on reading speed. The presence of distracting text interspersed throughout a written passage in a distinctive font has a dramatic slowing effect on older adults' oral reading times, but does not affect young adults to the same degree (Connelly et al. 1991). The slowing effect of distracting text is observed to be greater in older adults even when visual acuity is matched between age groups (Mund et al. 2010).

### **Inhibition and Explicit Memory**

Another hallmark of cognitive aging is a decrease in explicit memory performance (e.g., Craik and Jennings 1992). Attention to distraction can have a profound effect on memory. There are at least two inhibitory-based functions that have been identified. The first is the role inhibition plays at retrieval when a new task follows an earlier one. According to the theory, the ability to suppress the recent past as tasks and goals change is compromised by poor inhibitory regulation. In a previous section, we reviewed the evidence that older adults' reading times are slowed by the presence of distracting text in a different font, but there is also evidence that distracter text can intrude into older adults' memory for a written passage. Following the reading of a passage interspersed with distracting text, young and older participants were prompted to recall the passage

they read; older adults, who were more slowed by distracting text during reading, also made more intrusions from distractor words compared to young adults (Mund et al. 2012), showing that older adults' memories can be colored by irrelevant past experiences.

Interference resulting from the encoding of extraneous, never-relevant information not only influences recall but can also disrupt later learning. Biss, Campbell and Hasher (2013a) asked participants to perform a picture judgment task in which distracting words were superimposed over the pictures; later, in an ostensibly different task, participants were asked to learn pairs of pictures and words, some of which were comprised of new words and old pictures from the judgment task (high-interference condition) and some of which were completely new (low-interference condition). Older adults showed worse cued recall in the high-interference condition compared to the low-interference condition. Young adults showed no effect of the previously seen distraction. This result, consistent with the predictions of inhibitory theory, suggests that older adults retain knowledge of previously encoded distraction and this knowledge can create interference that impacts future learning episodes. Retention of the recent past (or failure to suppress it) is also a source of age differences in measures of working memory capacity (May et al. 1999).

Conversely, the retention and transfer of irrelevant information from one task to the next can confer a unique benefit to older adults' learning if the irrelevant items later become relevant (e.g., Amer and Hasher 2014). Weeks and colleagues (2016) showed that older adults' cued recall of face-name pairs can be improved to the level of young adults' if the names are previously presented as distraction alongside the faces earlier in the experimental session. This transfer of distraction to a new task appears to be implicit since it occurs without participants reporting awareness of any connection between tasks. Together, these studies suggest that separate tasks may begin to bleed into one another in old age, making experiences less distinct and more interrelated as a result of broader encoding.

The second inhibitory-based role at retrieval occurs when a retrieval cue activates two

competing memory traces; inhibition of the irrelevant or incorrect trace is required in order for the correct trace to be selected. Inhibition during competition resolution was directly tested by Healey and colleagues (2013), who found that older adults do not inhibit irrelevant items at retrieval like young adults do (Healey et al. 2013). In this paradigm, participants first incidentally encoded a list of words that contained pairs of orthographically similar words (e.g., *ALLERGY* and *ANALOGY*); later, they solved a series of word fragments, some of which could be completed with only one word from the encoded pair (e.g., A\_L\_ \_GY, solved by *ALLERGY*). In order for the word fragment to be correctly solved, competition between the two activated words would have to be resolved by suppressing the incorrect word (e.g., *ANALOGY*). To test this prediction, Healey and colleagues (2013) measured naming time of competitor words and found that older adults showed priming for competitor (i.e., incorrect) words, while young adults did not. The lack of priming for previously seen competitor words in young adults suggests that they used inhibition to resolve interference at retrieval. In contrast, older adults do not suppress competitors at retrieval and instead show facilitated access to these irrelevant items. In other circumstances, by contrast, older adults can totally fail to produce a response, despite a recent exposure to relevant items (Ikier and Hasher 2006). In this study, older adults who had seen two words (*BELLS* and *BILLS* that could complete a fragment (B\_L\_S) often gave neither answer. Older adults who had seen only one of the two words showed equivalent retrieval to that of young adults. Failure to suppress competing items at retrieval can compound the effects of attending to distraction, resulting in a situation in which interference cannot be overcome and retrieval fails altogether (Postman and Underwood 1973).

### Inhibition of Thoughts and Biases

In some cases, memory retrieval is actually undesirable, as is the case with unpleasant or irrelevant memories. Inhibition is also important in suppressing these unwanted thoughts, and there

is evidence that older adults do not suppress thoughts as effectively as younger adults do. In the so-called “think/no-think” paradigm, participants first learned word pairs (e.g., *BANNER* – *FOOTBALL*) and then, in a second phase, are cued with one word from the pair (e.g., *BANNER*) to either think about or avoid thinking about the second word (Anderson et al. 2011). The no-think instruction is similar to the real-world phenomenon of suppressing retrieval of unpleasant or off-topic thoughts. Anderson and colleagues (2011) measured suppression of the no-think words by cuing the items with their category (e.g., Sport – F\_\_\_\_\_ ) and comparing retrieval rates between no-think items and baseline (i.e., uncued) items. They found that younger but not older adults had suppressed the no-think items, resulting in more forgetting of the unwanted memories (Anderson et al. 2011).

Similarly, there is also evidence that older adults fail to inhibit prejudices, even when they intend to do so. Older adults were more likely than young adults to show implicit prejudice in their judgments of an other-race person, even when they were explicitly instructed not to use a person’s background in their judgments (von Hippel et al. 2000). Although older adults in this study also scored higher than young adults on scales of overt prejudice, the age difference in implicit use of stereotypes was mediated by inhibitory abilities, as measured by the reading with distraction task and not by their overt prejudice scores (von Hippel et al. 2000).

This failure to control social biases may be related to older adults’ inability to suppress previous interpretations of text. In a study by Hamm and Hasher (1992), young and older adults read passages that were initially biased toward one interpretation (e.g., a hunter on a safari) and either took an unexpected turn (e.g., the hunter takes a shot with a camera and the reader learns it is a photographic safari) or remained consistent with the initial interpretation. During the reading of the passage, participants were asked to indicate whether certain words were consistent or inconsistent with their current interpretation of the story. Older adults’ responses indicated that they continued to hold onto their initial interpretation of the story even after the turning point in the story

demanded a reinterpretation. On the other hand, young adults showed evidence of suppressing the initial interpretation when it became clear that it was incorrect. Older adults' inability to suppress thoughts, once activated, may bias their future thoughts and decision-making.

Further, older adults' cognition may be heavily influenced by previous goals, since there is evidence that they do not deactivate no longer relevant goals as young adults do. Scullin et al. (2011) taught a group of young and older adults to respond with a button press whenever they saw a given target word during an imageability judgment task. Later, after the prospective memory task had ended, participants were given a lexical decision task that contained former target words from the prospective memory task, and response latencies were compared between target and new items. In keeping with the idea that older adults do not inhibit previous goals, older but not younger adults showed slower response times to targets from the prospective memory task, despite both age groups indicating that they knew the prospective memory task was complete. Further, the age difference in slowing to former target words was mediated by age differences in measures of inhibitory control (Scullin et al. 2011). The tendency to "hold on to" prior thoughts, goals, and biases may impact the way older adults interact with the world and may underlie many of the observed age-related changes in cognition and social behavior.

## Conclusions

The presence of distraction is disruptive to most people's ability to perform cognitively demanding tasks, but here we have reviewed some evidence that distraction is disproportionately disruptive to older adults. In accordance with the predictions of inhibitory theory (Hasher and Zacks 1988), reduction of inhibitory ability has been implicated as a major contributing factor to cognitive aging and underlies age differences in a wide range of tasks, including speeded response tasks, reading, learning, memory, and social judgments. Lack of inhibition is proposed to be a general deficit, the major consequence of which is an increase in

interference between relevant and irrelevant items. Interference can impact cognition at all levels since it occurs as a result of competing perceptual stimuli, competing memory traces, and competing thoughts or goals. Interference can be either prevented or resolved by top-down control over the contents of attention, and this process seems to necessitate cohesive brain activity in the regions comprising the frontoparietal control network (Campbell et al. 2012). Decreased connectivity of the frontoparietal control network has been observed in other populations with decreased inhibitory abilities, including those with depression (Kaiser et al. 2015) and people at their off-peak time of day (Anderson et al. 2014). The results reviewed here in light of inhibitory theory suggest that some cognitive and social deficits previously associated with aging are instead associated with a decrease in inhibitory ability and not age per se. If this is the case, it may be possible to prevent or reduce impairment in old age by targeting and training inhibitory abilities. An alternative approach has been successful in improving older adults' memory by capitalizing on the tendency to ignore distraction. The benefit of helpful distraction has been demonstrated (a) when information from a previous task becomes relevant to a new task, with some evidence that age differences in memory are eliminated under these circumstances (Weeks et al. 2016), and (b) when distraction occurs during a retention interval and serves as a rehearsal opportunity for those who attend to it, reducing forgetting in older adults (Biss et al. 2013b).

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## Aging and Mental Health in a Longitudinal Study of Elderly Costa Ricans

Luis Rosero-Bixby<sup>1,2</sup>, Sepideh Modrek<sup>3</sup>, Marisa E. Domino<sup>4</sup> and William H. Dow<sup>5</sup>

<sup>1</sup>University of California, Berkeley, CA, USA

<sup>2</sup>University of Costa Rica, San José, San José, Costa Rica

<sup>3</sup>School of Medicine, Stanford University, Palo Alto, CA, USA

<sup>4</sup>Gillings School of Global Public Health, University of North Carolina at Chapel Hill, Chapel Hill, NC, USA

<sup>5</sup>School of Public Health, University of California, Berkeley, CA, USA

## Synonyms

Geriatric depression; Mental well-being and aging; Neuropsychiatric disorders and aging;

Old-age dementia; Psychiatric disorders and aging; Psychotropic and antidepressant medications at old age

## Definition

Geriatric depression and cognition impairment, including memory loss, are common neuropsychiatric disorders at old age. Diagnosing these conditions in the context of a general population-based survey conducted by nonmental health specialists is challenging. The effect of aging on an individual's mental health is not always mirrored in the prevalence of mental disorders of the population by age. Changes over time and across cohorts, as well as survival selection, affect the comparison of individuals at different ages. Longitudinal studies that follow the same individuals over time allow a better assessment of the effect of age on mental health. The Costa Rican Longevity and Healthy Aging Study (CRELES) includes a panel of elderly people that provides a rare opportunity of documenting mental health and aging in a middle-income country.

## Introduction

Worldwide populations are aging. With the exception of a few countries, most have had remarkable increases in life expectancy coupled with declining birthrates in the latter half of the twentieth century, which has led to aging populations even in low- and middle-income countries. The increase in older populations worldwide has led to increased interest in how countries can enable and ensure healthy aging.

A vital aspect of healthy aging is one's mental health, and older adults have a substantial burden of disease from mental health conditions. Worldwide, 7.5% of all disability-adjusted life years (DALYs) for those aged 60+ are due to neuropsychiatric disorders. Alzheimer's disease and dementia are the most disabling conditions in this age group, accounting for 4.2% of all DALYs worldwide and 2.9% of all DALYs in low- and middle-income countries in this age

group. In addition, the number of dementia cases is growing rapidly worldwide, but particularly in low- and middle-income countries (Yasamy et al. 2013). Depression is the second most disabling condition, accounting for 1.5% of DALYs worldwide and 1.4% of DALYs in developing countries in this age group (authors' calculations based on World Health Organization (2004)).

Older adults face specific challenges and opportunities that may affect their mental well-being. The process of aging simultaneously includes several opposing forces with regard to mental health. Older adults are more likely to face increased isolation, declining physical health, changes in cognitive ability, and decreased income, which may lead to more mental health conditions. At the same time, having more time for engaging leisure activities and family interaction may help protect against the onset or remission of mental health conditions. In addition, studies suggest that aging increases one's positive affect because of increased emotional regulation (Mather and Carstensen 2005). These increases in positive affect may lead to a more positive outlook, keep people engaged in their daily activities, and therefore buffer against the onset of mental health conditions.

Understanding what factors are directly related to common mental health disorders in older populations is therefore difficult because researchers must disentangle competing forces. In order to better understand how a change in one factor affects changes in another, longitudinal data enable stronger and richer studies. Longitudinal study designs follow the same individual over time, which allows researchers to compare the same individuals before and after life changes, and thus account for invariant unmeasured or unobservable factors such as disposition or genetics. This possibility is particularly important for the study of mental health conditions, because imperfectly measured individual traits may predict both cognitive and physical disability, as well as mental health-related symptoms, and thus confound inferences in cross-sectional studies.

In an effort to better understand the aging process, several countries have invested in detailed, nationally representative longitudinal health and

retirement surveys of their older populations. These include the United States' Health and Retirement Survey; English Longitudinal Study of Ageing; Survey of Health, Ageing and Retirement in Europe; Japanese Study of Aging and Retirement; The Irish Longitudinal Study on Ageing; China Health and Retirement Longitudinal Study; Mexican Health and Aging Study; and Korean Longitudinal Study of Aging. The Costa Rican Longevity and Healthy Aging Study (CRELES) is part of this growing set of health and retirement surveys being conducted and is a nationally representative longitudinal survey of health and life-course experiences of older Costa Ricans. Costa Rica is of particular interest to study given its high longevity: life expectancy is greater than that of the United States, despite being a middle-income country with about one-fifth the per capita income and one-tenth the per capita health spending.

In this entry, the longitudinal CRELES data are used to describe the prevalence of common geriatric mental health disorders as people age, particularly dementia and depression. To date there have been few studies that examine changes in mental health status for the elderly in middle-income countries such as Costa Rica with large aging populations, particularly the eldest of the old.

## The CRELES Data

The Costa Rican Longevity and Healthy Aging Study (CRELES, or *Costa Rica Estudio de Longevidad y Envejecimiento Saludable*) is a longitudinal study of health and life-course experiences based on a national sample of residents of Costa Rica aged 60 and older in 2005, with oversampling of the oldest old. The sample was selected randomly from the 2000 census database using a multistage sampling design. This entry uses the information from three waves of interviews conducted primarily in 2005, 2007, and 2009. Documentation and public-use CRELES data are available from the National Archive of Computerized Data on Aging at the University of Michigan (Rosero-Bixby et al. 2010).

This entry exploits the longitudinal information on mental health collected within CRELES, to sort out the effect of aging from the effects of cohort, period, and survival selection that usually cloud traditional cross-sectional data by age. The focus of the analysis is on the effects of aging on mental health, and the entry presents estimates of the prevalence of mental health conditions by age and sex among elderly Costa Ricans from cross-sectional CRELES data, as well as of the transition (incidence and remission) rates from the longitudinal CRELES data on changes of state between waves. Then, these rates are used to simulate the pure effect of aging in hypothetical cohorts using multiple-decrement life table methods. The comparison of the age profiles of observed and simulated mental health prevalence provides not only a better picture of the effect of aging on mental health but also hints some of the changes under way in Costa Rica.

## CRELES Indicators of Mental Health

### Ever Diagnosed with Psychiatric Problems

Responded "yes" to the wave 1 question "Has a physician ever told you that you have a nervous or psychiatric problem such as depression?" In wave 3 the question was: "In the last 4 years, since the first time we visited you, has a physician told you that you have nervous or psychiatric problems such as depression?" Therefore, the yes responses in wave 3 are added to those of wave 1; no information was available from wave 2. This variable does not allow transitions back to "never diagnosed" nor does it allow us to disentangle barriers in accessing care that would yield a diagnosis from the lack of symptoms meeting diagnostic criteria.

### Impaired Cognition

The CRELES used a short version of the Mini-Mental State Examination (MMSE) questionnaire (Folstein and Folstein 1975) that had been adapted and validated for Latin America (Quiroga et al. 2004). This version has a maximum score of 15 points instead of the original 30-point MMSE test. The six cognitive domains included in this

test were time orientation (4 points), primary verbal memory (three words, 3 points), attention (to repeat a five-digit number backward, 1 point), secondary verbal memory (three words, 3 points), following instructions (1 point), and reconstruction (to copy two intersected figures, 1 point). The Cronbach alpha for this series of 15 items was 0.72, indicating acceptable internal validity. The test was administered at the beginning of the interview to decide whether to use a proxy to help in responding the interview. Individuals with a score of  $<10$  were considered to have impaired cognition (needing a proxy respondent) as were individuals who were considered by trained interviewers to be too impaired to complete the test.

### Depression Screening Symptoms

The CRELES used the 15-item short-form Geriatric Depression Scale (GDS15) (Sheikh and Yesavage 1986). This instrument more accurately assesses depression in older populations because it was developed specifically for use with older adults, has a simplified yes/no response format, and contains very few items related to somatic symptoms. This scale is an instrument designed for screening purposes, and thus it may lead to an overestimate of clinical depression. A systematic review of 42 studies validating this instrument reports an average positive predictive value of only 0.32, whereas the negative predictive value is 0.95 and sensitivity and specificity are in the order of 0.8 (Wancata et al. 2006). Most studies in that review used a cutoff value of 7+ to classify an individual as depressed, which is the same cutoff value employed here in the CRELES data. The Cronbach alpha for the 15 items in CRELES data was 0.85, indicating high internal validity of the scale. Per study protocol, the CRELES did not administer the GDS15 questionnaire to approximately 25% of participants with cognitive impairment (i.e., needing a proxy respondent).

### Taking Antidepressant Medicines

As part of the CRELES interview, participants were asked to show the interviewer all of the medicines they were currently taking. From the database of all recorded medicines, antidepressant

medications were identified by brand or generic name to create indicators of whether respondents were taking antidepressants at the time of each survey wave. This indicator has the advantage of identifying those taking antidepressant medications regardless of the reason for medications; antidepressants are known to have high rates of off-label use (Radley et al. 2006). Respondents who were prescribed antidepressants but did not fill them and respondents who initiated and then discontinued antidepressant therapy between waves could not be identified.

## Results

Of the 2,827 participants interviewed in the CRELES first wave, 2,369 (84%) were interviewed in the second wave and 1,855 (79%) in the third wave. Loss of follow-up was 6% in wave 2 and 9% in wave 3. The remaining 10% and 12% of participants died between waves, respectively.

Table 1 shows the prevalence of the four indicators of mental health by wave and sex. A simple way of using data from longitudinal studies is by taking each wave as a cross section as shown in Table 1 and looking for time trends. For example, the data for women show a reduction in the prevalence of depression symptoms from 19% in 2005 to 17% in 2007 and 15% in 2009 and an increase in the proportion using antidepressant medicines from 9% in the first wave to 11% in second and third waves. Because this panel does not have refreshment cohorts and the effect of age was not controlled for in the analysis, these inter-wave changes could be a result of the aging of the panel, as well as from period changes. Additionally, these changes might be a result of survival selection. Disentangling these three forces – age, period, and survival selection – is a classic problem in demographic studies, as is sorting out aging from cohort effects when one compares individuals at different ages.

Table 1 also shows the results of the three waves pooled together, which yields more reliable estimates as shown by the smaller standard errors. Pooling together several waves of interviews is a

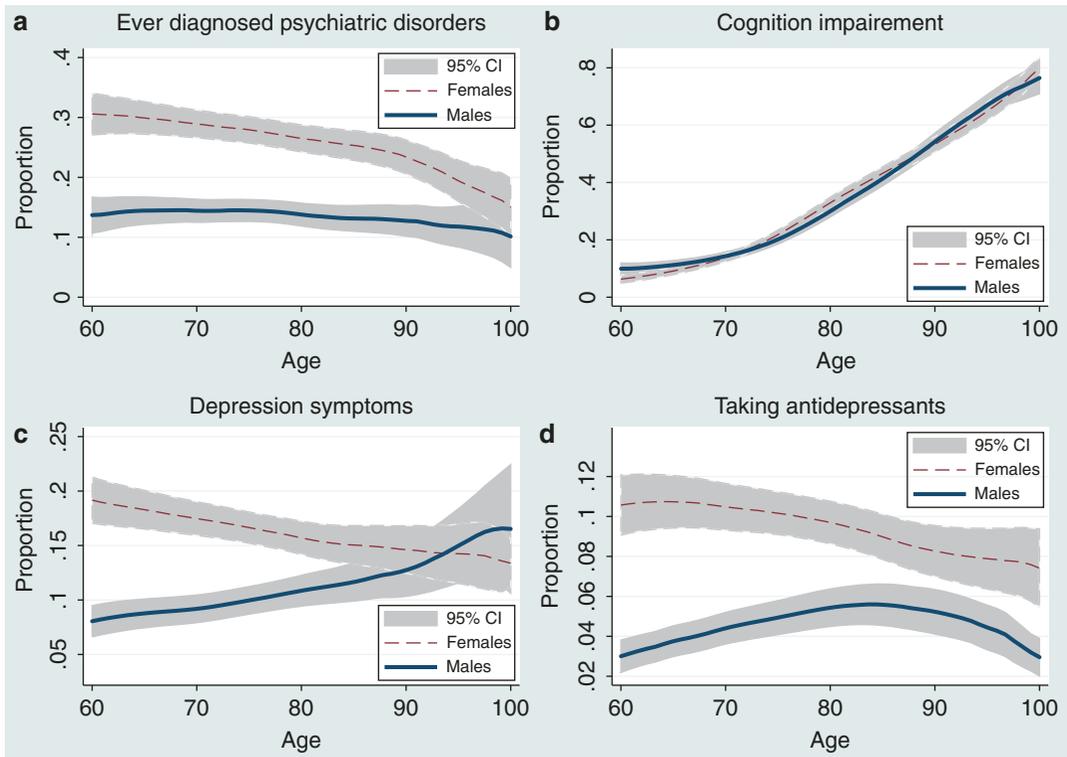
**Aging and Mental Health in a Longitudinal Study of Elderly Costa Ricans, Table 1** Prevalence of four mental health conditions investigated in the CRELES by wave and sex

Sex and mental		Wave 1	Wave 2	Wave 3	All waves
Health indicators		2005	2007	2009	2005–2009
Sample size		2,827	2,369	1,855	7,051
<b>Both sexes</b>					
Ever diagnosed psychiatric disorders	Prevalence	19.6%	.	24.1%	21.4%
	(S.E.)	(0.9)	.	(1.2)	(0.9)
Cognitive impairment	Prevalence	14.2%	20.6%	17.3%	17.2%
	(S.E.)	(0.6)	(0.9)	(0.9)	(0.6)
Depression symptoms	Prevalence	14.1%	12.3%	11.9%	12.9%
	(S.E.)	(0.9)	(0.9)	(1.0)	(0.7)
Taking antidepressants	Prevalence	6.6%	7.9%	7.8%	7.4%
	(S.E.)	(0.5)	(0.6)	(0.7)	(0.5)
<b>Males</b>					
Ever diagnosed psychiatric disorders	Prevalence	13.0%	.	15.0%	13.8%
	(S.E.)	(1.2)	.	(1.5)	(1.2)
Cognitive impairment	Prevalence	13.3%	20.6%	17.7%	16.9%
	(S.E.)	(0.9)	(1.3)	(1.4)	(1.0)
Depression symptoms	Prevalence	9.1%	7.1%	8.6%	8.3%
	(S.E.)	(1.1)	(1.0)	(1.2)	(0.8)
Taking antidepressants	Prevalence	3.8%	4.6%	4.0%	4.1%
	(S.E.)	(0.6)	(0.8)	(0.7)	(0.5)
<b>Females</b>					
Ever diagnosed psychiatric disorders	Prevalence	25.6%	.	32.1%	28.2%
	(S.E.)	(1.4)	.	(1.7)	(1.4)
Cognitive impairment	Prevalence	15.0%	20.6%	17.0%	17.4%
	(S.E.)	(0.9)	(1.1)	(1.2)	(0.8)
Depression symptoms	Prevalence	18.8%	16.9%	14.9%	17.1%
	(S.E.)	(1.4)	(1.4)	(1.4)	(1.1)
Taking antidepressants	Prevalence	9.2%	10.9%	11.3%	10.3%
	(S.E.)	(0.9)	(1.0)	(1.2)	(0.8)

S.E. binomial standard error of the proportion per 100

simple way of taking advantage of longitudinal data, although the researcher must be careful in using only corrected estimates of the standard errors (as was done in Table 1) that take into account the clustering of data due to repeated measurements for the same individual. These estimates show that depression prevalence among women in this sample is 17%, a figure that is more than twice that of men (8%). The proportion of women ever diagnosed with psychiatric conditions (28%) and the proportion taking antidepressant medicines (10%) also more than double the proportions estimated for men. In contrast, the prevalence of cognitive impairment (17%) is about the same for males and females.

Studying cross-sectional variation by age is a common procedure in assessing the effect of aging on mental health or other diseases. Figure 1 shows the cross-sectional age variation in the four indicators of mental health using the pooled CRELES data for the three waves. The prevalence curves in the figure were smoothed out using local regression procedures; the 95% confidence interval for each curve is shown as a shaded area. The figure confirms that the prevalence of depression, other psychiatric disorders, and antidepressant use is higher for women, although this gender gap shrinks or disappears at advanced ages. In contrast, the indicator of cognition impairment does not differ significantly by sex at any age.



**Aging and Mental Health in a Longitudinal Study of Elderly Costa Ricans, Fig. 1** Prevalence of four mental health conditions by age (locally weighted smoothing functions)

Only the prevalence of cognitive impairment shows a strong increase with age, and there seems to be no difference across sexes. Prevalence of this impairment is about 10% at age 60 years, increasing to about 40% by age 85 years. The other three indicators suggest that among women, depression declines with age. The result for males is mixed: depression symptoms increase with age, the proportion ever diagnosed is essentially flat, and the proportion taking antidepressant medicines increases until about age 85 and diminishes afterward.

The age profile of cross-sectional curves, such as those in Fig. 1, is certainly driven by age effects, but cohort and period effects may also exert influence. For example, the higher prevalence of depression among younger women might occur because the disease is less common as a woman get older, but also because, in a generational change, younger cohorts of women are more affected by this disease or because, in a

period change, the disease has become more widely recognized. A fourth source of variation by age is survival selection. For example, age declines in the curve of prevalence of depression could occur if women suffering depression die at substantially higher rates. Longitudinal data allow assessing pure aging effects. It is rare to have long-running longitudinal studies that observe a cohort of, say, 60-year-old individuals at baseline until their death after four or five decades. In the case of CRELES, the longitudinal observation was only during 4 years. During that period, longitudinal transition rates were determined with the data, and then hypothetical cohorts were constructed with those rates using multiple-decrement life table techniques (Wachter 2014). Table 2 shows the transition rates – incidence and remission – estimated from the data and then used to simulate the hypothetical cohorts. Both are annual rates, which are estimated using Poisson regression models with exposure equal to the time

**Aging and Mental Health in a Longitudinal Study of Elderly Costa Ricans, Table 2** Annual transition (incidence and remission) rates for the four mental health conditions by sex

Mental health indicator	Males		Females	
<b>Ever diagnosed psychiatric disorders</b>				
Incidence rate	0.012		0.023	
(S.E.)	(0.002)		(0.002)	
<b>Cognitive impairment</b>				
Incidence rate	0.019	• 1.081 <sup>x</sup>	0.019	• 1.081 <sup>x</sup>
(S.E.)	(0.002)	(0.005)	(0.002)	(0.005)
Remission rate	0.373	• 0.946 <sup>x</sup>	0.373	• 0.946 <sup>x</sup>
(S.E.)	(0.043)	(0.006)	(0.043)	(0.006)
<b>Depression symptoms</b>				
Incidence rate	0.021	• 1.028 <sup>x</sup>	0.067	• 0.979 <sup>x</sup>
(S.E.)	(0.004)	(0.014)	(0.010)	(0.011)
Remission rate	0.279		0.279	
(S.E.)	(0.014)		(0.014)	
<b>Taking antidepressants</b>				
Incidence rate	0.011	• 1.032 <sup>x</sup>	0.039	• 0.991 <sup>x</sup>
(S.E.)	(0.003)	(0.011)	(0.006)	(0.009)
Remission rate	0.335		0.278	
(S.E.)	(0.027)		(0.020)	

*x* = age – 60  
Standard errors in parentheses

(in years) between waves. Because of the log-linear specification of Poisson regression models, the effect of age is multiplicative, and age is an exponent. In models where age showed non-statistically significant effects, age is excluded as a control variable, i.e., the rates are then modeled as constant for all ages. In models where the effect of gender was not significant, the same age coefficients were assumed in each sex.

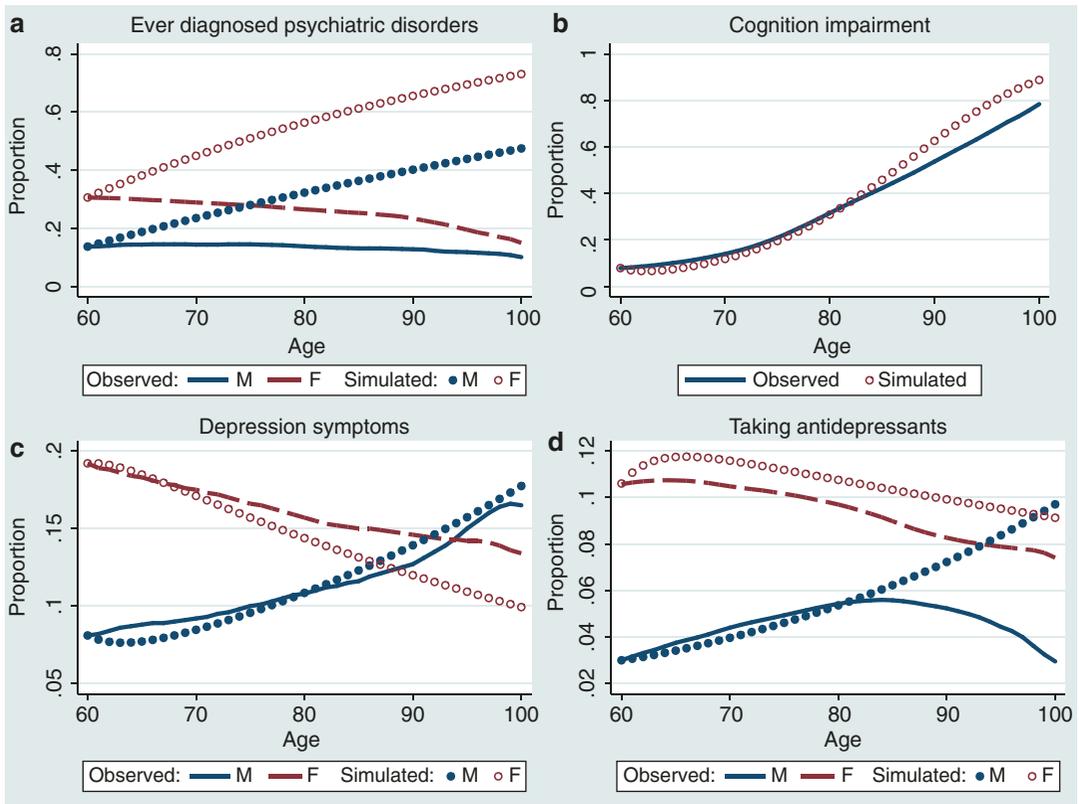
The condition “ever diagnosed” has no remission by definition. Its incidence rate does not vary significantly with age. The incidence rate of 0.023 for women means that, in a year, 23 women are newly diagnosed out of 1,000 not yet diagnosed. The rate for women is about double that for men.

The transition rates for depression symptoms and for taking antidepressant medicines behave similarly. The incidence rate at age 60 years is about three times higher for women than for men (0.067 compared to 0.021 for depression symptoms). Then, while among men the incidence rate increases by 3% per year, among women it decreases by 2% per year for depression symptoms and 1% for taking antidepressant medicines. By age 85 or 90 years, the incidence rates of men and women are about the same. The remission rates for the two conditions are very high at all ages: close to 30% of ill individuals leave the disease state every year.

Figure 2 shows the simulated prevalence in the four conditions under study. The simulations created hypothetical cohorts using as inputs the incidence and remission rates shown in Table 2 and initial prevalence at age 60 similar to that observed in Fig. 1. The simulated curves show the expected age profile of prevalence if aging is the only change that takes place, i.e., if cohort and period effects are absent.

The observed and simulated curves of prevalence of cognition impairment are similar, which suggests that this population has not been subject to meaningful changes in this condition over time nor across generations. The same can be said about the prevalence of depression symptoms, whose observed and simulated curves differ little, especially for men. For women, the simulated curve suggests that the age slope of decline in observed prevalence should be steeper. A potentially important confounder of this curve is the fact that about 50% of the sample aged 80 years or more were not administered the depression screener because they required a proxy for responding (a more complex analysis could also include the simulation of a third state in the model: requiring a proxy.)

The simulated curves for the proportion taking antidepressant medicines are not that different from the observed prevalence curves either, except in two aspects: (1) The simulation for women results in a systematically higher than observed curve, which would be consistent with a recent increase in prescription of antidepressant medicines to women. (2) The simulation for men



**Aging and Mental Health in a Longitudinal Study of Elderly Costa Ricans, Fig. 2** Hypothetical cohort simulations and observed prevalence of four mental health conditions by age

older than 80 years results in a growing curve compared to the flat or even declining observed curve. This discrepancy may result from survival selection as noted below.

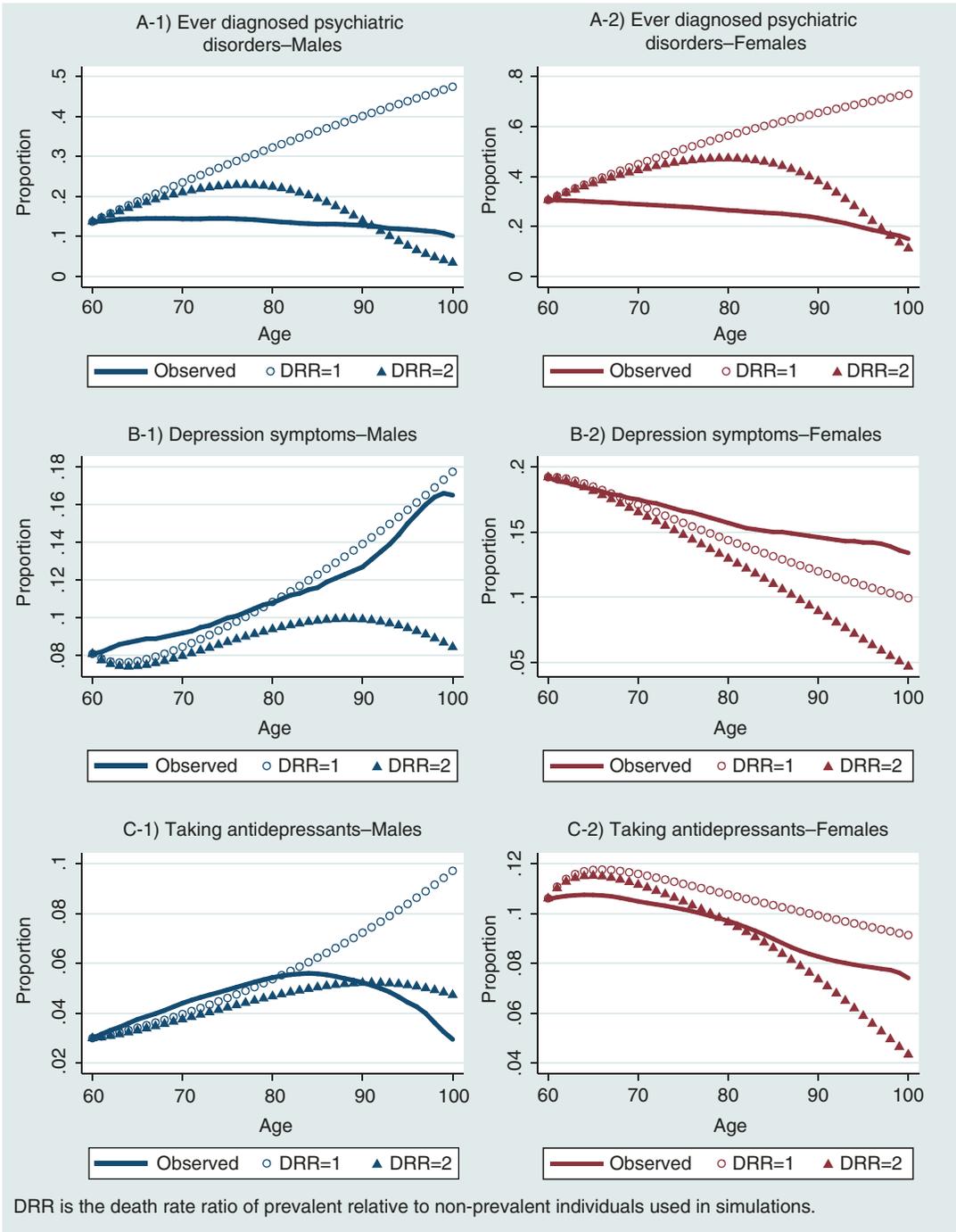
By contrast, the indicator “Ever diagnosed with psychiatric disorders” differs markedly between the observed and simulated aging curves in Fig. 2, panel A. Being cumulative, the cohort proportion of ever diagnosed psychiatric conditions should increase monotonically with age, as it does in the simulated curves. In this case, the decline in the observed curve with age is highly misleading if interpreted as a pure aging effect; instead, this likely reflects cohort or period increases in these diagnoses or else elevated mortality among people suffering from psychiatric impairments.

The simulations shown so far assumed that mortality is similar among prevalent and non-prevalent individuals. To illustrate the effect

of removing this assumption, Fig. 3 shows simulations assuming that mortality among individuals with mental illnesses doubles the mortality of the general population, which is an extreme assumption of over-mortality of people with mental health problems. Mortality for the general population is assumed to follow a Gompertz distribution with the parameters estimated for Costa Rica elsewhere (Rosero-Bixby et al. 2014).

The new simulations for ever diagnosed depression confirm that the flat or declining prevalence curves by age observed in this sample might originate in survival selection, given that the simulation curves that included differential mortality stopped growing by age 77 among men and age 80 among women and decreased afterward. This is speculative, however, pending further longitudinal analysis to more precisely estimate the mortality differences by psychiatric indicator.

A



**Ageing and Mental Health in a Longitudinal Study of Elderly Costa Ricans, Fig. 3** Hypothetical cohort simulations with differential mortality and observed prevalence of three mental health conditions by age and sex

Figure 3, panel C, also shows that the new simulations with differential mortality produce simulated prevalence values that are quite close to the observed values, especially for older men. Again, this indicates that differential mortality is plausibly important in driving the observed age curves of the proportion taking antidepressant medicines, especially for older men.

Simulations with differential mortality of the proportions with depression symptoms (plot B in Figure 3) result in curves lower than those simulated with no differential mortality and, therefore, further away of the observed curves, especially at older ages. This suggests that differential mortality by depression status may be less extreme than it is for the other indicators.

For cognitive impairment, simulations with differential mortality (not shown in Fig. 3) result in even closer observed and simulated curves than those already similar in Fig. 2, especially after about age 80.

## Discussion

The data from the CRELES study is a valuable first step in assessing the prevalence of mental health problems among elderly Costa Ricans. About 28% of Costa Rican women aged 60 or more reported being ever diagnosed with psychiatric disorders, about 17% were screened as suffering cognitive impairment or geriatric depression, and 10% were found taking antidepressant medicines. These female proportions are twice the rates of males except for cognitive impairment, a condition that does not differ by gender.

The longitudinal information in CRELES allow researchers to disentangle the age, cohort, and mortality patterns in mental health rather than simply observing cross-sectional patterns by age. There is a clear increase with aging in cognitive impairment for both sexes, as well as for depression symptoms for males. In contrast, depression symptoms decrease with age among women, and this trend is not an artifact of period-cohort effects nor survival selection. The aging effects on depression symptoms – increasing for males and

decreasing for females – are consistent with similar profiles in the curves of the proportion taking antidepressants, and these are confirmed by the simulations enabled by the longitudinal data.

The cross-sectional pattern for the proportion ever diagnosed with psychiatric disorders is more complex and on its own would provide a misleading description of aging effects. The flat and decreasing cross-sectional patterns by age are likely a result of survival selection or of recent increases in diagnosis among younger cohorts; the simulated age profiles enabled by the longitudinal data instead reveal strongly increasing rates with aging.

An important limitation of two of the indicators used (ever diagnosed psychiatric disorders and taking antidepressant medicines) is that they are sensitive to access to care – those meeting depression criteria but who have poor access to physician care would not report diagnosis nor would they be taking medicines. In addition, since the wording of the survey question specifically asks for diagnoses from physicians, respondents may not report diagnoses received by other mental health specialists, such as psychologists, nurse practitioners, or social workers, thus potentially understanding lifetime diagnosed prevalence.

It is also helpful to compare the different indicators of depression or psychiatric history, as the indicators are better understood in their contrasts. Self-reported psychiatric history could cover psychiatric conditions beyond depression, such as anxiety or psychotic disorders, as well as conditions that are no longer symptomatic, such as childhood or early adult disorders. This measure could undercount depression, however, if there is perceived stigma in reporting conditions or if respondents experienced barriers to care. The depression screener will detect current symptoms, but not prior history. Respondents who are untreated or inadequately treated, for example, might meet current symptom criteria but not have a prior history of diagnosis. The depression screener also has the limitation that it cannot be easily administered to individuals with cognitive limitations requiring a proxy to respond, who are an important group at older ages, close to 50% at 85 or more years. Finally, receipt of antidepressant

medication indicates current use of medication for either depression or other conditions. Persons who are adequately treated by antidepressants would no longer exhibit psychiatric symptoms and may or may not report a prior psychiatric history. The discordance among these measures in the CRELES is further described elsewhere (Domino et al. 2014).

## Conclusion

Many factors suggest that mental health conditions merit increasing attention in aging populations, and this is likely to be particularly true in lower- and middle-income countries that have traditionally devoted fewer resources to mental health. Epidemiological surveillance surveys have drawn attention to an increasing mental health disease burden, but documenting this burden via periodic cross-sectional surveys is only a first step in understanding and planning for likely future patterns. Using the CRELES longitudinal survey, this analysis has illustrated the crucial importance of true panel data in order to disentangle aging effects from period and cohort influences. In addition, the analysis highlights the importance of longitudinal mortality follow-ups in order to better estimate the role of differential mortality selection in shaping these age patterns. Beyond the scope of this contribution, there is of course a long tradition of further uses of longitudinal data in strengthening causal inference, which would be relevant, for example, in evaluating the effects of mental health policies and interventions implemented in low-resource settings. Although only the longitudinal CRELES data was introduced in this entry, there are increasing efforts to collect comparable data in other lower- and middle-income settings so as to enable further cross-national comparisons over time as well.

## Cross-References

- ▶ [Aging and Psychological Well-Being](#)
- ▶ [China Health and Retirement Longitudinal Study \(CHARLS\)](#)

- ▶ [Cognition](#)
- ▶ [English Longitudinal Study of Aging \(ELSA\)](#)
- ▶ [Health and Retirement Study, A Longitudinal Data Resource for Psychologists](#)
- ▶ [Irish Longitudinal Study on Ageing \(TILDA\)](#)
- ▶ [Korean Longitudinal Study of Ageing \(KLoSA\): Overview of Research Design and Contents](#)
- ▶ [Mental Health and Aging](#)

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## Aging and Psychological Well-Being

Dannii Y. Yeung  
Department of Applied Social Sciences,  
City University of Hong Kong, Hong Kong,  
China

### Synonyms

Positive psychological functioning; Psychological health; Subjective well-being

### Definition

Psychological well-being is defined as a psychological state with positive functioning and absence of mental illnesses.

### Introduction

Old age is often associated with declines and losses in physical, cognitive, and social domains, with many older people perceived as unhappy, lonely, or depressed as a result. However, recent empirical findings do not support these stereotypical beliefs. In contrast to the popular belief that most of older adults are depressed, the statistics of the 2012 National Survey on Mental Health reveal that the 12-month prevalence of major depression declines from young adulthood to old age. In particular, the percentages of adults aged 18–25, 26–49, and 50 or older who had at least one major depression episode in the previous year were 8.9%, 7.6%, and 5.5%, respectively, implying that the rate of depression is lower in late adulthood. Moreover, the findings from the German

Socio-Economic Panel Study and the British Household Panel Study also show that average levels of life satisfaction remain quite stable across adulthood and only decline in very late life (Baird et al. 2010). These findings suggest that the majority of older people maintain a high level of psychological well-being that is equivalent to that experienced by their younger counterparts.

When studying psychological well-being over the life course, Carol Ryff's six dimensions of psychological well-being, life satisfaction, and positive and negative affect are often assessed in younger, middle-aged, and older adults (Ryff 1989). In this entry, the age-related changes in these three aspects will first be reviewed, followed by discussion on theoretical explanations and future directions.

### Age-Related Changes in Ryff's Psychological Well-Being

Ryff's (1989) six distinct dimensions of psychological well-being comprise self-acceptance, positive relations with others, autonomy, environmental mastery, purpose in life, and personal growth. These dimensions are regarded as the eudaimonic well-being, which is characterized by purposeful life engagement and realization of one's potential. Self-acceptance refers to a person's attitudes toward acceptance of himself/herself; positive relations with others captures the quality of relationships with significant social partners; autonomy is defined as one's own freedom and independence to think and act in particular ways; environmental mastery assesses the sense of mastery and competence in managing life events; purpose in life concerns the sense of meaning, purpose, and directedness in life; and personal growth refers to the tendency to develop personal talents and actualize potentials.

Cross-sectional studies showed that compared with younger and middle-aged adults, older adults exhibited higher levels of environmental mastery and autonomy but lower levels of purpose in life and personal growth (Ryff 1989; Ryff and Keyes 1995). No significant age variation was found in

self-acceptance and positive relations with others. Using two waves of data from two population-based longitudinal studies, Midlife in the United States (MIDUS) and the Wisconsin Longitudinal Study (WLS), Springer and colleagues (2011) demonstrated a similar pattern of age-related increases in environmental mastery and age-related decreases in personal growth and purpose in life over approximately 10 years. However, for the other three dimensions of psychological well-being, the age trends are somewhat different from those reported in the cross-sectional studies. In particular, autonomy declined with age in the WLS younger, middle-aged, and older groups, whereas it increased with age in the three MIDUS age groups. For the three age groups in the WLS and MIDUS, an age-related increase in positive relations with others was observed. Self-acceptance decreased in the three WLS cohorts, whereas it slightly increased for the middle-aged MIDUS cohorts but not the younger and older cohorts (Springer et al. 2011).

Age-related changes in psychological well-being vary by cultural context. Karasawa and colleagues (2011) compared the six dimensions of psychological well-being between Japanese and American adults. The results of their studies revealed that the culture by age interaction was shown in personal growth and positive relations with others. In particular, personal growth increased with age among Japanese adults, whereas a reverse pattern was shown in the US sample. Concerning interpersonal well-being, younger and middle-aged Japanese adults (aged 35–54) rated their relations with others better than their older counterparts (aged 55–74), whereas older US adults reported more positive relations with others than their younger counterparts.

In summary, when people grow older and progress through the developmental tasks, the direction of changes in psychological well-being is dependent on the dimensions concerned, with increases in some dimensions and declines in the others. These patterns of age-related changes are indeed in alignment with the emphasis in the theory of selective optimization with compensation that adult development is multidirectional (Baltes and Baltes 1990).

## Age-Related Changes in Life Satisfaction

Life satisfaction is another core aspect of psychological well-being. It is defined as a person's cognitive assessment of satisfaction with his/her life. Life satisfaction is often assessed by a single item to measure a person's current happiness with his/her overall life or the Satisfaction with Life Scale which comprises five items (Ryff 1989; McAdams et al. 2012).

Past studies on life satisfaction across adulthood have yielded inconclusive results. For example, a positive linear relationship between age and life satisfaction was shown in a representative sample of Americans aged 25–74 years (Prenoda and Lachman 2001). A curvilinear relationship between age and life satisfaction was demonstrated in a large sample of American men aged 40–85 years who participated in the Veterans Affairs Normative Aging Study over a period of 22 years (Mroczek and Spiro 2005). Specifically, growth-curve models revealed that life satisfaction increased from age 40 to 65 years and then declined. Significant individual differences in rate of change and amount of curvature were also shown, implying that people vary in their life satisfaction trajectories and not every individual changes at the same rate and in the same way.

Mroczek and Spiro's (2005) study, however, included those aged 40 years as the youngest participants, making it difficult to get a clear picture about changes in life satisfaction across the lifespan. To address this concern, Baird and colleagues (2010) analyzed the longitudinal data from the German Socio-Economic Panel Study and the British Household Panel Study which comprise nationally representative samples of a wide age range (16–91 years). Their study demonstrated that average levels of life satisfaction remained relatively stable over adulthood and started declining after age 70 when health, income, and social support were declining. Even though the two samples share some similarities, the British Household Panel Study revealed a moderate increase from the 40s to the early 70s.

In addition to overall life satisfaction, McAdams and colleagues (2012) used data of

the British Household Panel Study to systematically analyze age-related trajectories of domain satisfaction. Eight life domains were investigated, including health, income, house, spouse/partner, job, social life, amount of leisure, and use of leisure. Among these domains, health satisfaction declined steadily over the lifespan. Job satisfaction and income satisfaction remained flat in young adulthood but increased gradually after mid-40s. Satisfaction with spouse/partner first increased from adolescence to the twenties, remained stable until mid-40s, and then slightly improved until late 70s. For the remaining four domains – namely, satisfaction with social life, amount of leisure, use of leisure, and housing – all showed a decline from teens to late thirties or early forties and then increased until late 70s. When aggregating satisfaction ratings in all these eight domains, the overall trajectory is largely similar to that in overall life satisfaction. That is, life satisfaction and aggregated domain satisfaction drop from adolescence to early 40s, then increase until mid-70s, and gradually drop among the oldest group of participants. Similarly, using four waves of data from 80 countries in the World Value Survey, a U-shaped effect of age on life satisfaction was demonstrated, with the lowest level of life satisfaction being observed in between the mid- and late 40s (Blanchflower and Oswald 2008). Such a U-shaped pattern is found in most Western countries (e.g., Canada, France, Germany, Great Britain, the USA), East European countries (e.g., Croatia, the Czech Republic, Hungary, Poland, Lithuania), and developing countries (e.g., Brazil, China, Iraq, Mexico, Vietnam).

Even though the U-shaped pattern of life satisfaction is observed in Western, East European, and developing countries (Blanchflower and Oswald 2008), other studies suggest that the relationship between age and life satisfaction may vary by culture. For instance, in a study conducted among Chinese adults residing in five capital cities in Mainland China, a steady increase in life satisfaction was observed over the life course (Xing and Huang 2014). On average, Chinese adults aged 65 years and above are more likely to experience a higher level of life satisfaction than younger and middle-aged adults.

In summary, the level of overall life satisfaction remains high into the 60s and early 70s and then drops when satisfaction with health, social life, and leisure activities decreases in late life.

### **Age-Related Changes in Positive and Negative Affect**

Positive and negative affect are important components of psychological well-being. They are defined as hedonic well-being. Positive affect refers to subjective experiences of pleasant emotions (e.g., happy, excited, enthusiastic), whereas negative affect refers to subjective experiences of unpleasant emotions (e.g., sad, angry, worry). They are often measured by emotion checklists to record one's affective experiences at the moment of assessment or over a certain period of time.

Recent research has suggested that affective well-being improves from early adulthood to old age until late 70s and 80s. Both cross-sectional and longitudinal studies found that older adults in general experience stable levels of positive affect, lower levels of negative affect, and lower rates of anxiety and depression (Charles and Carstensen 2010). When examining positive affect, a longitudinal study over two decades found that positive affect remained quite stable from early to middle adulthood and then decreased slightly from mid-60s to late 80s (Charles et al. 2001). Moreover, a longitudinal experience sampling study found that positive emotional experiences improve with age and level off after age 70 (Carstensen et al. 2011). A recent investigation of high- and low-arousal emotions also reveals that age-related decreases in positive emotions in late life are strongly related to high-intensity positive emotions such as excitement and enthusiasm, whereas low-intensity positive emotions such as calm and peaceful do not show an age-related decrease (Scheibe et al. 2013). The age-related decreases in negative emotions from early to middle adulthood are consistently shown in prior research, including the examination of both high-intensity (e.g., anger, rage, despair) and low-intensity negative affect (e.g., worry).

For depressive symptoms, the results of the Baltimore Longitudinal Study of Aging (Davey et al. 2004) showed an age-related increase. However, when certain factors such as health and functional abilities are taken into consideration, these age-related increases in depressive symptoms vanish, and old age is again associated with lower levels of negative affect (Kunzman et al. 2000).

Karasawa and colleagues' (2011) cross-cultural comparison on hedonic well-being revealed that both older Japanese and American adults experienced higher levels of positive affect and lower levels of negative affect than their younger counterparts. In a longitudinal study, Hong Kong Chinese adults whose age ranged from 18 to 86 years were interviewed over the phone to report their emotional reactions to the SARS outbreak (Yeung and Fung 2007). Older respondents experienced less anger than did younger and middle-aged adults during and after the SARS outbreak. To conclude, past findings from both Western and Eastern countries all suggest that older adults often display better emotional well-being than younger adults.

## Theoretical Explanations

The aforementioned review of past research suggests that individuals enjoy high levels of psychological well-being in old age even though there are unavoidable declines in physical and cognitive areas. Two theories of lifespan development can help explain these age-related changes. First, socioemotional selectivity theory stresses that motivation changes when individuals age and perceive future time as increasingly limited (Carstensen 2006). Relative to younger people, older people's realization of limited time is accompanied with present-focused awareness, so they are prioritized with goals that can maximize their emotional satisfaction in the present. Accordingly, older adults are more likely to pay attention to emotional information or to use emotion regulatory strategies such as reappraisal to reduce the discrepancy between their current and ideal states. As a result, psychological well-being of older people can be maintained or even improved.

Second, the theory of selective optimization with compensation proposes that when physical and cognitive capacities decline with age, the individuals allocate their resources more carefully (Baltes and Baltes 1990). They select goals that are important and realistic, devote effort and resources to optimize their performance in the prioritized domains, and make use of external aids and social support to maintain a satisfactory outcome. Applying this theoretical framework to psychological well-being, older people select the life domains that are important and achievable to enhance their affective experiences. For instance, they focus on goals of maintaining relationships with emotionally close social partners instead of peripheral partners. Their prior knowledge on handling emotional situations enables them to use the most effective emotion regulatory strategies to deal with the contextual demands. They also seek emotional support and instrumental assistance to compensate their losses in other domains. The use of selection, optimization, and compensation thus helps to maintain psychological well-being in old age.

## Future Directions

Contrary to the stereotypical beliefs that old age is linked to sadness and distress, research evidences reveal that people maintain or even improve their psychological well-being with age. However, most past studies on aging and psychological well-being are conducted during typical periods of daily life, and not in the context of major life events. Maintaining a positive psychological functioning is more challenging during moments of hardship or adversity. It remains an open question whether older adults are more able to maintain a high level of psychological well-being in the midst of stressful life events than younger adults. Future studies should compare younger and older adults' longitudinal changes in affective responses to major life events. In addition, prior research mainly assessed the participants' current psychological functioning and seldom looked into their anticipated outcomes in the future. Lang and colleagues (2013) made use of the data from the

German Socio-Economic Panel Study to investigate the effects of current life satisfaction, anticipated future life satisfaction in 5 years, and accuracy of the anticipated life satisfaction on health outcomes. Compared with younger adults, older adults were more pessimistic about their future and underestimated their actual life satisfaction 5 years later. However, such underestimation was indeed associated with positive health outcomes such as lower rates of mortality and disability. It suggests that anticipating a dark future may be adaptive for older people as it can facilitate more preventive measures to minimize potential losses and cultivate a greater sense of control. Future studies should apply this reasoning to other domains of psychological well-being, such as anticipated positive affective experiences in 5 years, to develop a more comprehensive picture of aging and psychological well-being. In addition, cultural variations are observed in certain dimensions of psychological well-being. Future studies would benefit from making use of the longitudinal data from the representative national samples (e.g., MIDUS and Midlife in Japan) to conduct a systematic cultural comparison to unveil the similarities and differences in psychological well-being trajectory between Westerners and Easterners.

## Cross-References

- ▶ [Age-Related Positivity Effect and Its Implications for Social and Health Gerontology](#)
- ▶ [Aging and Quality of Life](#)
- ▶ [Mental Health and Aging](#)
- ▶ [Positive Emotion Processing, Theoretical Perspectives](#)
- ▶ [Psychological Theories of Successful Aging](#)
- ▶ [Selection, Optimization, and Compensation at Work in Relation to Age](#)
- ▶ [Socioemotional Selectivity Theory](#)

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## Aging and Quality of Life

Neena L. Chappell  
Centre on Aging and Department of Sociology,  
University of Victoria, Victoria, BC, Canada

### Synonyms

Happiness; Life satisfaction; Quality of life;  
Well-being

### Definitions

Quality of life – a multidimensional concept that can refer to physical, psychological, and/or social well-being measured at the societal and/or individual level, objectively and/or subjectively.

### A Broad Concept

Quality of life is both a multidisciplinary and a multidimensional concept. It can refer to physical well-being, incorporating medical disease, health

conditions, and perceived health, to psychological well-being, as indexed by self-esteem and happiness, or to social well-being, capturing how well one functions in their social roles, and connections with family and friends. It can also be conceptualized as a sweeping concept that combines some or all of these particular domains; sometimes referred to as over-all well-being. It can refer to either or both the macro (societal, objective) and micro (individual, subjective) levels.

To illustrate, Anderson (2004) defines five domains of well-being: physical well-being (health, fitness, mobility, etc.); material well-being (possessions, transport, security, privacy, etc.); social well-being (family, relatives, interpersonal relationships, etc.); emotional well-being (trust, self-esteem, satisfaction, etc.); and development and activity (political freedom, employment, education, economic freedom, etc.). Bowling (2004) distinguishes between eight models of quality of life: objective standard of living; health and longevity; satisfaction of human needs; life satisfaction and psychological well-being; social capital; ecological and neighborhood resources; health and functioning; cognitive competence and autonomy and self-efficacy; and values and interpretations and perceptions. Arun and Çevik (2011) draw on Allardt and colleagues' (1993) model, an index comprising three domains – having (material and interpersonal needs), loving (social needs), and being (needs for personal growth) – where each domain has both objective and subjective indicators.

Within each domain, there is similarly no agreement on the conceptualization of the construct. For example, examining only the subjective domain, multiple terms and meanings are used that include morale, self-esteem, fulfillment, happiness, subjective well-being, and overall well-being. Subjective well-being can be studied as either or both cognitive evaluations of one's life and affectivity (ongoing emotional reactions to one's life) (Chappell 2007). It is often defined in terms of valuations of one's life, events in one's life, their bodies and their minds, and the circumstance of their lives (Diener 2006). The World Health Organization (WHO) (1995) has defined quality of life in terms of perceptions of one's

position in life within the context of their culture and in relation to goals, expectations, standards, and concerns. Camfield and Skevington (2008) argue that the centrality of value judgments in definitions of both subjective well-being and quality of life leaves little difference between them. They further argue that, while subjective well-being and subjective quality of life are virtually synonymous, the related concept of life satisfaction is insufficient to explain either.

Some define happiness as affect, feeling, experience, and life satisfaction as an overall evaluation of your life (Deaton 2008); yet others treat them synonymously. Helliwell and colleagues (2013) note that individuals responding to surveys do not have difficulty distinguishing between happiness as an emotion and happiness as an evaluation of life. Knight and Rosa (2011), nevertheless define happiness as relatively short-term, situation dependent expressions of mood whereas self rating of life satisfaction refers to longer-term more stable evaluations. Veenhoven (1999) though defines happiness as the degree to which an individual judges the overall quality of his or her life favorably and states it can be called life satisfaction.

When reflecting on the number of medical conditions one can study, let alone psychological and emotional states or social circumstances one might live in, it is easy to become overwhelmed. Researchers typically do not address all of these areas but focus on particular aspects. As a consequence, inconsistencies or apparent contradictions between different aspects of quality of life can proliferate. An example comes from the ethnicity area where objective inequities often characterize subcultural groups. When quality of life is measured in terms of economic hardship – often within the context of broader economic, political, and social structures – ethnic subgroups often emerge with a low quality of life. However, when measured in terms of subjective well-being, these same groups often emerge as high, if not higher, than host country populations. This is often explained in terms of their greater access to social support from their social relationships, especially family, which appears to enhance their subjective quality

of life (though this does not diminish the objective hardships they experience). The extent to which the in-group supportiveness results from necessity due to a lack of resources to purchase help or lack of culturally appropriate services, and the extent to which it is cultural and preferred, requires more research.

Notions of successful aging are closely aligned with the concept of quality of life. The 1980s saw new nomenclature appear within gerontology with the introduction of terms such as productive aging; referring to an individual who maintains their productivity with age, through work, volunteerism, family caregiving, or other socially valued contributions. The term successful aging became popular at this time, incorporating biomedical, psychosocial and lay definitions. Since that time it has been associated with positive adaptation to growing old, having little disease or disability, preservation of physical and cognitive functioning, high engagement with life, optimal life expectancy, and greater happiness. Recently, the WHO (2002) referred to active aging as “the process of optimizing opportunities for health, participation and security in order to enhance quality of life as people age.” Other terms, often used interchangeably, have captured the same concept: robust aging, successful aging, vitality, maintenance of functioning, and aging well. All of these terms are intended to portray good aging, i.e., aging with a better quality of life.

It should also be noted that those studying a particular domain of quality of life may do so considering it an indicator of quality of life, but others may do so without considering it an aspect of quality of life but focusing only on that phenomenon. In the health area, researchers study cancer or depression or dementia to learn more about the disease or the health of the individual without necessarily having an interest in quality of life. For others, it can represent a partial or total focus for their quality of life research. In another example, standard of living or socioeconomic status are often studied in its own right or as measures of the political and economic structures of a society. It is also found in quality of life studies as objective measures of the quality of an individual's life, where the more material goods one has,

the higher the income, the greater the wealth, the better the quality of life.

It might also be noted that the emphasis of the research varies depending on the region of the world. In the USA, an overwhelming emphasis on life satisfaction has been evident while in Europe the focus has been more on declines in health and functioning, assuming the worse one's health, the worse one's quality of life.

## A Focus on Health

Health receives much attention in gerontology because of the decline in physical health as people age. It is no surprise then that many with an interest in health and aging have an interest in quality of life. As life expectancy has increased in developed countries and increasingly in developing nations, chronic conditions tend to dominate. People are living longer but with several chronic conditions, often requiring complex care. Common chronic conditions in old age include: cardiovascular diseases, hypertension, stroke, diabetes, cancer, chronic obstructive pulmonary disease, muscular-skeletal conditions including arthritis and osteoporosis, mental health conditions such as dementia, and blindness and visual impairment. Both the number of chronic conditions and functional disability increase with age and continue to do so throughout old age (Chappell and Penning 2012).

However, the findings in relation to health-related life quality, within the same country and between countries, are mixed. The extent to which selection effects account for differences between studies is not known. It is clear that most studies exclude those living in long-term care institutions who no doubt have a greater number in addition to more severe chronic conditions. Typically, our physical health declines gradually. Not all older adults are incapacitated and, among those who are, there are degrees of disability. Many have a chronic condition (some loss of eyesight is an example; diabetes might be another) but that condition does not interfere with their functioning. When the health problem interferes with functioning, typically it has more consequences for the

individual's quality of life. Mobility disability is especially important because being able to ambulate is critical to so many activities permitting independence, so often related to quality of life.

Disability is not a characteristic of the individual per se but rather it is a relational concept taking the intersection between the individual and the environment into account. For instance, if an individual has difficulty walking up and down stairs but lives in an area that is flat, with no stairs, they are not disabled and their difficulty is unlikely to effect their quality of life. In gerontology, the disablement process refers to a dynamic interaction that takes into account attitudes, emotions, stigma, accessibility, thus embracing a relational concept. However, it is not often measured as such. Some measures capture bodily function (also referred to as impairment), some activity limitation, some participation restriction. Some ask for self-identification as disabled, some ask about diagnosable conditions, basic activities of daily living, instrumental activities of daily living, and/or participation. The lowest rates are typically obtained when asking a person whether they have a disability, suggesting impairments per se do not necessarily result in perceptions of a lower quality of life.

When someone experiences multiple declines in physical, mental, and psychological functioning, there is relative consensus that he or she has transitioned from independence to dependence, and has thereby become frail. There is general agreement that their quality of life is poor, but no consensus on how to define frailty. Moreover, being dependent does not necessarily mean the person is frail (Rockwood and Mitnitski 2007). Adding to the complexity, some argue that successful aging does not mean avoiding declines in health but includes adjusting to poor health and other challenges in old age. That is, someone who is sick, has poor health, or is frail can age well and have a good quality of life. Supporting this view is the research documenting that life satisfaction, happiness, and well-being tend to be high even among older adults with declining physical health and increasing disability. The vast majority of older adults report being happy or very happy for example in the USA, Canada, China, Italy,

Germany, the Netherlands, Luxemburg, Austria, the UK, and Sweden (Chappell and Cooke 2010).

Health quality of life, similar to overall quality of life, is measured both objectively and subjectively. Declines in objective measures of health, however, do not necessarily translate into perceptions of lower quality of life, pointing to the importance of taking subjectivity into account.

### **Psychosocial/Subjective Well-being**

In this area the focus tends to be on specific domains of quality of life related to family, social relationships, finances, leisure, spirituality, health, and/or a combination of these domains that are summed or weighted to provide an overall global evaluation of one's life. The subjectivity is especially important because the term "quality" suggests a standard of valuation that many argue is necessarily subjective, defined by the individual involved. This implies that older adults themselves must be the definers of their own quality of life (Walker and Mollenkopf, 2007). This argument is supported by the Easterlin paradox which essentially recognizes that within a society, rich people tend to be much happier than poor people; rich societies are no or not much happier than poor countries; and average national happiness does not increase over long spans of time, in spite of large increases in per capita income (Helliwell et al. 2013; Deaton 2008). Additionally, those who have a high standard of living and wealth can nevertheless be unhappy. Conversely, there are those living in objectively disadvantaged circumstances who are happy. Even though much of the research on the correlates or predictors of quality of life, reports that social class or socioeconomic status is a significant correlate, it explains little of the variance. This accounts for the apparent (but not real) contradiction with the fact that many subcultural groups who live in economic disadvantage also maintain good subjective quality of life. It also adds support to the argument that quality of life has, at minimum, a subjective component. Other typical correlates include health and relationships with family and friends, including social support. Furthermore,

higher subjective well-being leads to healthier, more productive, and social connected lives (Helliwell et al. 2013). That is, there are benefits not only for the individual but also for families, the economy, and community.

An added dimension is that correlates of happiness change somewhat as we age. Diener (2006), studying adults throughout the life span, reports that while health satisfaction declines over the life course, job and income satisfaction are flat for much of life, but increase dramatically in later life starting in the 60s and 70s and peaks later. Relationship satisfaction increases sharply from the teen years to the 20s and is flat until the mid-40s then increases steadily until the late 70s. Satisfaction with social life, amount of leisure time, and use of leisure time decreases sharply from the late teens to the early 40s, and then increases rapidly from the mid-40s to late 70s. In most domains and the overall category, life satisfaction ratings do not decline until very late (80+). Indeed, when all domains are aggregated, there is a high correlation with the global life satisfaction scale.

Furthermore, the salience of specific domains of quality of life changes once we are older (speaking here of what we generally consider old age – 60+ or 65+). Not surprisingly, health and relationships, especially with family, gain importance. The decline in satisfaction with health is not surprising given the objective decline in physical health with age. While satisfaction with health is related to objective measures of health, overall satisfaction with life is not strongly related to objective measures of health such as life expectancy (Deaton 2008).

Global indices indicate that life satisfaction among older adults is high. The vast majority report being very satisfied or satisfied with their lives and to experience high levels of overall happiness. Blanchflower and Oswald (2008) analyzed data from 72 countries, and find a curvilinear (U-shaped) association between age and psychological well-being across the life course. Specifically, when factors such as gender, education, income, and marital status are held constant, individual life satisfaction and happiness are at a minimum in middle age. In contrast, Deaton

(2008) reports that, internationally, age has an inconsistent relation with happiness and that the U-shape is found only in wealthier English-speaking countries. Part of the difficulty in drawing conclusions in this area is the diversity of measures used, making comparisons problematic.

Longitudinal research shows differing results depending on the country studied, and often different studies conducted in the same country report different findings. Some countries reveal curvilinear relationships whereby happiness is the lowest in middle age. Depending on the study, some aspects of subjective well-being (such as positive affect) decline in old age while others (such as negative affect) remain stable. Still others find that life satisfaction remains constant across the lifespan, even among the oldest old (Yang 2008; Kunzmann et al. 2000). In many studies, age differences disappear when controlling for other factors such as functional limitations, income, and social relationships such as marital status.

## Conclusions

Quality of life in old age is a concept with much intuitive appeal; people evaluate the quality of their lives. Reaching consensus on its meaning, however, has been challenging and thus far unachievable. It is used in a variety of ways by researchers in many different disciplines. It is viewed as objective and/or subjective, as multidimensional, or as an overarching concept referring to the totality of one's life. Objective domains are not consistently related to subjective domains, indicating the importance of saliency of the domain to the person involved. In older age, it is no surprise that the health domain becomes more salient given the declines in physical health that occur in later life. The fact that some individuals enjoy a high quality of life despite serious health conditions raises some interesting directions for future research that will enhance our understanding of the possible relationships between objective and subjective aspects of quality of life.

Indeed, one of the main paradoxes in this large but inconsistent research literature is the fact that objective measures of social class and socioeconomic status often emerge as statistically significant correlates of subjective measures of quality of life, and at the same time, economically disadvantaged groups can nevertheless experience a subjective quality of life that is at least equal to, if not higher than, those with greater economic or social class wealth. A challenge for this area is to adequately explain these apparent contradictory findings. An answer likely lies in an examination of the intersection of multiple facets of life (such as social class plus social support and expectations).

## Cross-References

- ▶ [Aging, Inequalities, and Health](#)
- ▶ [Aging and Psychological Well-being](#)
- ▶ [Mental Health and Aging](#)
- ▶ [Psychological Theories of Successful Aging](#)
- ▶ [Psychological Theories on Health and Aging](#)

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Semantic memory is postulated to be our mental repository of facts, their relationships, and their meanings – knowledge about the world independent of personal identity or past (Tulving 1972). In Tulving’s conceptual framework, semantic memory stands in contrast to episodic memory, which represents information about personally experienced events and when they occurred. As an example, the knowledge we have about pancakes (a common breakfast item; coming in buttermilk, blueberry, or Swedish varieties; served warm, perhaps with syrup; etc.) would reside in semantic memory. Whether we had pancakes for breakfast yesterday morning, and if so, how many and of what style, or simply whether we had seen *pancake* on a word list would all be time-tagged episodic memories. Generally speaking, information in semantic and episodic memory is said to constitute declarative memory, material we are able to express verbally, and stands in contrast to procedural memory, knowledge expressed via our actions rather than verbally.

There is substantial evidence that the information network comprising semantic memory holds up fairly well over the course of normal adult aging, particularly when compared to episodic memory. This article reviews the relationship of normal adult aging to various characteristics of semantic memory such as the integrity of information in semantic memory, the speed with which it can be retrieved, and the theoretical mechanism (priming via spreading activation) that permits awareness of one item in semantic memory to bring other, meaningfully related items to mind. It concludes with a discussion of semantic memory’s role in neurological and cognitive adaptations associated with normal adult aging.

## Aging and Semantic Memory

Gary D. Laver  
Psychology and Child Development Department,  
Cal Poly, San Luis Obispo, CA, USA

### Synonyms

Conceptual knowledge; General knowledge base;  
Semantic network

## The Contents and Structure of Semantic Memory

Copious evidence shows preservation of (if not an increase in) the information stored in semantic memory such as vocabulary and general knowledge as measured via IQ or similar tests through much of adulthood. Begun in 1988, the Betula Project has involved thousands of adult

participants assessed at five-year intervals. One of its primary goals is to study changes in adult memory functions through old age. Cross-sectional word comprehension and general knowledge data reported from this study (Nilsson 2003) have shown that although the best performance for adults was in their late 50s, there was no significant difference in performance on semantic memory tasks between the group in their late 30s and the group in their late 70s. This corroborated many earlier findings that substantial deficits in vocabulary do not become common until one's 80s.

Rönnlund, Nyberg, Bäckman, and Nilsson (Rönnlund et al. 2005) performed a cross-sequential analysis of data from the Betula Project involving a sample of participants from across ten age cohorts ranging from age 30 to 85. For the portion of the study concerned with semantic memory, participants from these ten groups were administered general knowledge, vocabulary, and word fluency tests on two occasions separated by 5 years. Semantic memory performance based on the cross-sectional data indicated stable performance until age 55 and then a decline in performance close to two standard deviations by age 85. In contrast, the longitudinal change scores actually showed improvement in semantic factors through age 60 and then a much milder decline to age 85. Concerned about the possible influence of cohort effects on the cross-sectional data and practice effects on the longitudinal data, the researchers ran follow-up analyses to account for these factors. The adjusted adult age patterns for both the cross-sectional and longitudinal semantic memory data were remarkably similar to the pattern for unadjusted longitudinal data: improvement through age 60 followed by mild decline into the 80s.

Using participants from the Betula Project and another sample, respectively, both Nyberg et al. (2003) and Enmarker et al. (2006) supported the basic pattern of semantic performance over adult age described above through their comprehensive examinations of the structure of declarative memory, the invariance of this structure with advancing adult age, and the nature of declining performance with advancing adult age.

Their findings supported an age-invariant semantic component to declarative memory with subdivisions of knowledge (the contents of semantic memory) and fluency – the efficiency with which the knowledge can be accessed. (Additionally, an episodic memory component emerged with subdivisions of recognition and recall.) Their results from vocabulary and knowledge-based tests, in particular, showed the same peak performance described above in young-old adults with no significant differences between middle-aged and old-old adult age groups. In the fluency measures, somewhat greater decline was found among the old-old.

Data from another large project in adult aging, the Seattle Longitudinal Study (SLS) (Schaie 2013), provide evidence similar to the pattern in semantic memory found in the Betula Project. This study was begun in 1956 and to date has involved more than 6000 participants aged 22 to over 100. Compared to many other measures of cognitive ability, SLS data show verbal meaning (vocabulary) scores decline the latest – not until the late 70s – but are then among the steepest. As the seven-year data cycles have progressed over the decades, peak scores in the latent verbal ability construct have moved from the 50s to the 60s. Even into the late 80s, declines in general verbal ability are modest. Indeed, because of the rise in abilities through middle age, the SLS data show essentially no difference in overall verbal abilities between adults in their 20s and 80s.

Yet another large project in adult aging, the Victoria Longitudinal Study, has yielded findings similar to the basic patterns reported above concerning semantic memory (Small et al. 2011). Based on two semantic measures (world knowledge questions and vocabulary), data gathered over a period as long as twelve years from nearly a thousand participants aged 55–95 indicated mild declines in world knowledge of about a quarter of a standard deviation per decade prior to age 75 and half a standard deviation per decade after that. No significant changes in vocabulary were found up to age 75; thereafter the declines were just shy of a third of a standard deviation per decade. Interestingly, for neither metric did declines accelerate in the 80s.

Older adults' semantic performance shows impressive resilience even when additional stressors are introduced. Situations in which diminished performance would be expected due to factors other than aging often do not produce interactive aging effects in semantic memory tasks. For example, if older adults' semantic structure were compromised relative to young adults', one might expect noisy testing conditions to impact older adults' performance more severely than young adults'. However, neither Enmarker (2004) nor Enmarker et al. (2006) found an interaction of noisy test conditions with adult age on word comprehension and word fluency measures. Marital status is also well known to affect physical health and cognitive abilities. Compared to married adults, declines are found in divorced, widowed, or never-married adults on such diverse measures as periodontal disease, depression, general cognitive abilities, risk for Alzheimer's disease, and life span. Yet, Mousavi-Nasab et al. (2012) found no interaction of adult age and marital status on vocabulary or fluency tests. The integrity of information in semantic memory appears to hold across adult age even in the face of factors known otherwise to diminish cognitive performance.

### Accessing Semantic Memory

The above discussion shows that the richness of semantic information is well maintained and even rises with age. To this may be added many other findings that young and older adults produce comparable semantic associations, demonstrate similar effects of word frequency, and show the same influence of the strength of two items' semantic relatedness. All of the laboratory evidence supporting the preservation of semantic processes notwithstanding, age-related memory problems are reported more frequently among older than young adults, and these differences are confirmed in the laboratory in areas such as naming common objects, producing words from definitions, and the number of tip-of-the-tongue episodes (Burke et al. 2000). One clue to explaining this paradox is the robustness of reported decline across many

types of information. It is plausible, therefore, that any adult age-related performance declines in semantic tasks may be attributable to retrieval processes rather than changes in the structure or content of the semantic memory system, *per se*. Consistent with this interpretation are production deficits such as generally increased speech disfluencies with adult age and even an age-related increase in spelling errors when conveying well-formed ideas in writing (MacKay et al. 1999).

The assessment of semantic fluency provides a good example of how older adults' decline in production processes might mask intact semantic processes. Early studies of word fluency showed deficits in the rapid access of lexical material with adult aging. As well, the Seattle Longitudinal Study (Schaie 2013) indicated significant decrement in word fluency by age 60 (unlike its finding of preserved vocabulary performance past the 70s), and fluency data from the old-old participants in the Betula Project showed somewhat greater declines relative to other semantic measures. Other work suggests that diminished verbal fluency past middle age may be less the result of declines in accessing semantic content than of declines in executive or language production processes. In a longitudinal study involving data collection at two points separated by a three-year interval, Hultsch et al. (1992) found declines in older adults' world knowledge and verbal fluency but not in their vocabulary. These results have been interpreted as support for the culpability of declining retrieval processes in that both the world knowledge and verbal fluency tasks make high retrieval demands but vocabulary does not.

Mayr and Kliegl (2000) used a word fluency task to demonstrate more directly a dissociation between semantic processes that remain intact and executive retrieval processes that decline with adult age. They had participants in one condition generate exemplars from a single category; participants in another condition generated exemplars from two alternating categories. They proposed that while executive and semantic search processes would be present in both conditions, additional executive functions would be present in the two-category switching task. Their results showed

age effects in the nonsemantic, executive task elements. However, the rate of semantic access did not differ with adult age. Furthermore, the manipulation of category difficulty affected young and older age groups equivalently, evidence that adult age did not affect semantic retrieval. Along with their analyses of the structure of semantic information, Nyberg et al. (2003) and Enmarker et al. (2006) found young-old adults' fluency in producing information from semantic memory was slightly better than middle-aged adults'. Consistent with a broader pattern across adulthood, however, the old-old adult age group showed significant decline.

Further support for the distinction between the activation of semantic information and the ability to report it comes from a study by Shafto et al. (2007) of tip-of-the-tongue (TOT) experiences. Their work also provides a glimpse at how a neurological approach to changes in adult cognition adds a dimension not captured by purely behavioral measures. TOTs produce a frustrating failure to report key information (i.e., the name of a target word) along with strong semantic activation of information related to the target. As mentioned above, there is a parallel increase in semantic knowledge and frequency of TOT episodes as adults age into their 70s. This suggests a deficit in reporting otherwise intact semantic information. Shafto et al. uncovered evidence of the neural underpinnings of these parallel trends. Their findings replicated a positive relationship between adult age and TOT frequency, but they also found a positive relationship between the number of TOTs and the amount of gray matter atrophy in the left insula as measured by MRI. The left insula is known to support phonological production. What is more, this relationship held with the effects of age removed, supporting the involvement of declining phonological production, not semantic impairment, with TOT frequency.

Neurological studies of semantic processes also show that equivalent or superior findings on cognitive measures in older versus young adults may also suggest different forms of supporting neural processes in the two groups. Peelle et al. (2013) had young- and older-adult

participants undergoing an fMRI scan judge whether two named items shared a particular attribute (e.g., are a carrot and cucumber the same color?). While there was an age-group difference on this task, a subset of the older adults performed comparably to the young adults. Generally speaking, semantic processing was associated with a pattern of activation in the ventral-lateral temporal-occipital cortex for all the participants. However, the older adults who performed comparably to the young showed a different intensity of brain activation. Relative to the young adults, the better-performing older adults showed more activity bilaterally in the premotor cortex and in the left lateral occipital cortex. The authors concluded that performance maintenance on this semantic task in some older adults was due to a reallocation of the brain areas supporting the ability. Gray matter atrophy affected these areas in the older adults for whom task performance declined. The issue of modified patterns of brain activation with age is addressed more generally below.

## Semantic Priming

In addition to explicit behavioral and neurological measures of semantic processes, semantic memory may also be examined using implicit measures. Explicit measures of the content or structure of semantic memory or the speed of accessing it based on deliberate, conscious search (e.g., in a fluency task or a free-recall paradigm) may show age-related decline to the extent that they rely on executive or speech production processes. But implicit measures of semantic processes avoid these concerns and provide corroborating evidence of preserved function with adult aging. This is commonly demonstrated in measures of semantic priming and with the semantic priming effect in particular. The semantic priming effect is the empirical finding that recognition or pronunciation of a target word will take less time or be more accurate when the word is preceded by a meaningfully related word than when preceded by an unrelated word or by no word at all. For example, responding that the string of letters *nail* is indeed a word will be faster

if it is presented following the word *hammer* than following the unrelated word *toast* (or following no word at all). The semantic priming effect here would be the difference in reaction times between the primed and unprimed conditions. This effect is held to be evidence for spreading activation, a theoretical (but neurologically informed) construct by which recognition of a stimulus facilitates responding to semantically related concepts. Theories representing semantic memory as a network of nodes and connections (Collins and Loftus 1975) attribute the reduced response time or increased response accuracy in priming conditions to a process of automatic spreading activation from the node of a recognized word to the linked nodes of meaningfully related words. Responding to a related target is facilitated by the accumulated activation from the node of the priming word.

In a meta-analysis of semantic priming effects, Laver and Burke (1993) found older adults' larger, but nonsignificant priming effects from individual studies provided combined evidence that older adults benefit more from a semantically related prime than do young adults. Not surprisingly, older adults' greater priming effects are typically associated with longer response latencies than for young adults. To address the concern that their longer response latencies permitted older adults a greater accumulation of spreading activation and thus greater priming, Laver (2009) employed a response deadline procedure to equalize response times for young- and older-adult participants. With processing times controlled across age groups, older adults still showed semantic priming effects at least as large as young adults'. This suggests the mechanism by which information in the semantic memory system is accessed is at least as efficient in older than young adults.

### **Semantic Memory and Theories of Cognitive Aging**

Among the oldest theories of cognitive aging is general slowing, which holds that speed of execution diminishes with advancing adult age across

all types of cognition (Salthouse 1996). Yet, many of the findings described above appear to contradict the notion of universal slowing. In response to findings incongruent with general slowing, a modification of the theory emerged, domain-specific slowing, in which tasks within a particular area of cognition exhibit decline due to slowed processes. Pressing questions for domain-specific slowing include differences in the onset of slowing in various areas of cognition and the rate with which slowing proceeds once begun. Nevertheless, the evidence discussed above is consistent with domain-specific slowing in that executive and response production processes show decline, whereas access to and activation among semantic concepts appear to remain intact well into adult age.

Another theory of cognitive aging that has been applied to semantic processes is the inhibition deficit theory (Zacks and Hasher 1997). The fundamental premise in this theory is older adults' diminished ability to inhibit task-irrelevant information. While evidence is found in many corners of the cognitive aging literature for greater activation of distracting information in older adults and their reduced ability to inhibit these distractions, this approach does not seem able to explain older adults' preserved or improved verbal and semantic abilities relative to young adults. As summarized above, older adults have no trouble with the comprehension or concept generation processes associated with semantic tasks, but their response production is often impaired. Inhibition deficit theory does not account for this asymmetry. Even when considering the one aspect of verbal production that inhibition deficit theory does predict, verbosity or off-topic speech, the detailed evidence is not congruent with inhibitory deficits. The amount of older adults' verbal output varies with the kind of topic they are addressing, but when they are verbose, older adults' speech is denser with topic-relevant information.

As an elaboration on earlier network theories (Collins and Loftus 1975), node structure theory is able to account for older adults' retained comprehension processes and rich semantic networks as well as their difficulties in response production (Burke et al. 2000). This theory organizes nodes

and their connections into hierarchical levels, with phonological and orthographic nodes at the bottom, lexical nodes above that, and propositional nodes forming the uppermost level. The flow of activation in perceptual/recognition processes is bottom up. The multiple feature nodes of a seen or spoken stimulus send activation upward along connections that converge on a lexical node. This spreading activation summates at the lexical node and may surpass a threshold level resulting in the recognition of a word. An activated lexical node, in turn, sends activation across connections to related propositional nodes in the level above. Related nodes not receiving activation sufficient to result in conscious recognition nevertheless receive a boost toward that threshold. In such a primed state, these nodes require less additional activation to reach threshold relative to their base state.

Activation within the semantic system of lexical and propositional nodes is supported by the redundancy of connections among its nodes. Along with reduced frequency or recency of use, node structure theory posits that advancing age may of itself diminish the ability of individual connections to transmit as much spreading activation as quickly as in young adults. In compensation, however, adult age results in more nodes and connections in the semantic system reflecting a greater knowledge base than in younger adults. The greater number of connections can offset their diminished individual functioning, which accounts for the finding that older adults' semantic priming effects are at least as large as young adults'.

However, the one-to-many, diverging architecture of top-down pathways (e.g., from concepts to phonology) in node structure theory does not always provide sufficient activation for responses, and this transmission deficit (along with older adults' slower connection speed) can explain diminished age-related response production even though concept recognition and generation are spared. When summation of priming is supported, as in bottom-up processes or in the spread of priming among the copious connections within a rich semantic network, the diminished capacity for transmission of priming within individual

connections is easily overcome, and no age-related declines are manifest. Because node structure theory acknowledges the likelihood of slower cognitive processes (i.e., spreading activation) within the semantic system, in its own way it corroborates general slowing theory. But the semantic richness of old age and the converging bottom-up node structure compensate for this slowing. This results in a preservation of function not seen in other areas of cognitive aging.

Craik (2000) has written of the possibility that the general performance difference between episodic and semantic memory in older adults may stem from the specificity constraining the expression of information from the two domains. Semantic memory affords a richness or redundancy of information not present in episodic memory. As a consequence, much semantic information is open to various ways of expression, whereas episodic memories concerning time or place must be more specifically expressed. Craik sees this as a potential explanation of declines in semantic memory performance involving information that leans toward the specific and for which there are few if any possibilities for rephrasing, e.g., word finding or recall of names.

## Semantic Memory and Adaptation

An important theme that emerges from the work on cognitive aging in general and semantic memory in particular is that of adaptation. The process of cognitive adaptation in adult aging is found in areas of study as distinct as age-related changes in basic neurological functions and the ability of elders to function in the everyday world. In the first area, we can juxtapose older adults' well-preserved semantic functions with the substantial adaptation (relative to young adults) in the brain tissue that supports those functions. In the second area, there is the possibility of adapting preserved semantic memory to the practical support of other cognitive functions that decline sooner or more rapidly in adulthood.

The first form of adaptation involves changing cognitive structures and changing patterns of neurological activation with advancing adult age.

Not only may older and younger adults' equivalent performance on certain cognitive tasks rely on different patterns of brain activation (as discussed briefly above), but older adults may demonstrate generally more distribution of brain activation as well. The proposition that what are distinct neurological or cognitive functions in early adulthood merge as adulthood progresses is known as dedifferentiation. Support for dedifferentiation comes from two broad, converging sources: analysis of behavioral measures (both cross-sectional and longitudinal) and results from neuroimaging techniques. In tying these diverse data together, Cabeza's (2002) theory of hemispheric asymmetry reduction in older adults (HAROLD) also incorporates evidence of diminished age-related asymmetry in word recognition and semantic retrieval tasks. What is more, early findings of increasing age-related correlations among cognitive measures as well as their increasing correlations with measures of sensory function suggest that dedifferentiation could occur not only within a cognitive domain (such as semantic memory) but also across cognitive domains (such as semantic memory and sensory processing). Hülür et al. (2015) corroborated this notion with data from the Seattle Longitudinal Study, indicating the consolidation over adulthood of subtest scores on number ability, verbal meaning, and word fluency within the factor of crystallized, semantic abilities. Their analysis also indicated the coupling of this factor with others such as fluid abilities and visualization.

Copious neurological data complement the cognitive data that point to dedifferentiation in showing shrinkage of brain tissue and reallocation of brain activity. Park and Reuter-Lorenz (2009) not only provided a review of such findings from imaging studies, they also offered the scaffolding theory of aging and cognition (STAC) to account for them. STAC posits that cognitive scaffolding – the use of additional neural resources to bolster declining structures – occurs throughout life in response to cognitive challenges. It does, however, become more prevalent over time as adult aging results in more frequent challenges. Of course, theories of age-related changes in cognitive function and neural

activation address far more than semantic memory. But for all the relative resilience of semantic processes through adulthood, it is noteworthy that they too are subject to the broad influence of dedifferentiation.

The second form of adaptation concerns semantic memory's relative durability and how it may serve to support practical aspects of aging. Is it possible to capitalize on the relative preservation of semantic memory in older adults to support or improve other cognitive functions, episodic memory in particular? It seems intuitive and has been formally argued that semantic memories ordinarily begin as forms of episodic memory, but there is preliminary evidence that semantic memory serves to support the formation of episodic memories as well (Cabeza 2002; Greve et al. 2007). Some recent work has explored the question of whether invoking semantic aspects of information may improve older adults' episodic memory performance (e.g., list learning).

Episodic memory may be tested by having participants study lists with individual words or lists with paired words. Memory for lists containing unpaired items is commonly tested via free recall, but paired-item lists often involve cued recall in which the first item from a word pair is presented as a cue for remembering the associated second word. Relative to young adults, older adults' performance in recalling single items from a study list is impaired, but the deficit is even greater for paired items. This has been attributed to a problem in binding the paired words. Binding is considered essential in linking two, often arbitrarily paired words for subsequent cued recall. Naveh-Benjamin and his colleagues have investigated whether semantic memory support can alleviate older adults' associative deficit in recalling paired items. They examined whether word pairs with existing semantic relationships (e.g., *doctor-nurse*) would improve older adults' cued recall over pairs with no such relationship (e.g., *rock-number*). Their results were mixed. A prior semantic relationship between paired words did help older adults' recall performance relative to the condition in which the paired words had no semantic relationship, but this occurred only for

items in long-term, not short-term memory conditions (Brubaker and Naveh-Benjamin 2014).

All else being equal, the mental clustering of to-be-remembered information from a list according to semantically related categories is well known to improve recall relative to conditions in which no strategy is used, but there are mixed findings regarding the benefit of this strategy in older adults. At first thought, it might seem that older adults would have an advantage in the ability to organize such information based on the strength of their semantic networks. However, strategically utilizing semantic information requires executive resources that are not necessarily resistant to decline over adulthood. Kuhlmann and Touron (2014) investigated whether the semantic clustering of items would improve older adults' recall performance on a list-learning task. Older adults were certainly capable of forming semantic clusters of list items, but this strategy was effective for them only when the words were presented simultaneously on a single screen. When the words were presented individually, the dual task demands of needing to keep the words in mind along with the strategy of forming semantic clusters reduced the older adults' performance to the level found when no semantic clustering was used. (Younger adults' recall was superior to the older adults', and they performed as well regardless of word presentation format.) The above discussion suggests that, within the laboratory at least, older adults' intact semantic processes may be hard pressed to improve the function of episodic processes because using them may rely on diminished processing resources.

Outside of the laboratory, preserved semantic processes likely serve a critical role in older adults' ability to deal with everyday life. Despite copious evidence of adult age-related cognitive decline (in areas other than semantic processing), everyday functioning appears typically spared in older adults. Salthouse (2012) offered several possible explanations for this incongruity. First, even with the diminishment of maximal functioning as measured in laboratory assessments, successful functioning in daily life requires a typical level that is below even older adults' reduced maximal

functioning. Everyday life does not regularly present the abstract, novel problems found in formal assessments. Furthermore, there are multiple determinants of successful functioning in everyday life (e.g., motivation, focus, and personality in addition to cognitive abilities), and older adults often make accommodations to declining skills by delegating increasingly challenging responsibilities to others or avoiding difficult tasks altogether. But most relevant to the subject of adult age and semantic memory is Salthouse's point that older adults promote successful functioning in everyday life by adopting a strategy of shifting from novel processing to reliance on their lifetime of accumulated knowledge. As Salthouse points out, "little or no consequence of cognitive declines may be evident when one can draw upon relevant knowledge," and older adults' greater world knowledge and intact ability to draw on it may serve an important role in their success in everyday tasks.

## Summary

In normal adult aging, the rich network of information in semantic memory is retained, at least through one's mid-80s. Although some studies suggest that verbal fluency in reporting semantic information may decline earlier, these findings may well be the result of declining executive and language production processes, not the impairment of the semantic memory system itself. Further evidence for the strong preservation of semantic memory into old age comes from studies of semantic priming, an implicit measure of access to semantic information. Using semantic memory's relative strength in the support of other declining cognitive abilities has received limited support from laboratory studies but seems to be critical in maintaining older adults' everyday functioning.

## Cross-References

- ▶ [Cognition](#)
- ▶ [History of Cognitive Aging Research](#)

- ▶ History of Cognitive Slowing Theory and Research
- ▶ History of Longitudinal Studies of Psychological Aging
- ▶ Process and Systems Views of Aging and Memory
- ▶ Cognitive and Brain Plasticity in Old Age
- ▶ Cognitive Compensation
- ▶ Cognitive Neuroscience of Aging
- ▶ Crystallized Intelligence
- ▶ Language, Comprehension
- ▶ Language, Discourse Production and Communication
- ▶ Language, Naming
- ▶ Memory, Episodic
- ▶ Normative Cognitive Aging
- ▶ Neurocognitive Markers of Aging

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## Aging and Slowing of the Neuromotor System

Steven Morrison<sup>1</sup> and Karl M. Newell<sup>2</sup>

<sup>1</sup>School of Physical Therapy and Athletic Training, Old Dominion University, Norfolk, VA, USA

<sup>2</sup>The University of Georgia, Athens, GA, USA

### Synonyms

Neuromuscular system; motor processes; physiological declines; loss of complexity with aging

### Definition

The declines observed across numerous motor functions that develop as a consequence of the natural process of aging can be broadly viewed within the context of a general slowing of various physiological processes.

The processes of aging tend to progressively degrade the human motor system and reduce the ability of even healthy elderly individuals to move and perform skillfully in the tasks of everyday life (Spirduso 1985). At the behavioral level of analysis, these detrimental effects of aging are most typically manifest in the decrement of performance outcome, a change in indices of movement variability and/or a loss in the efficiency of

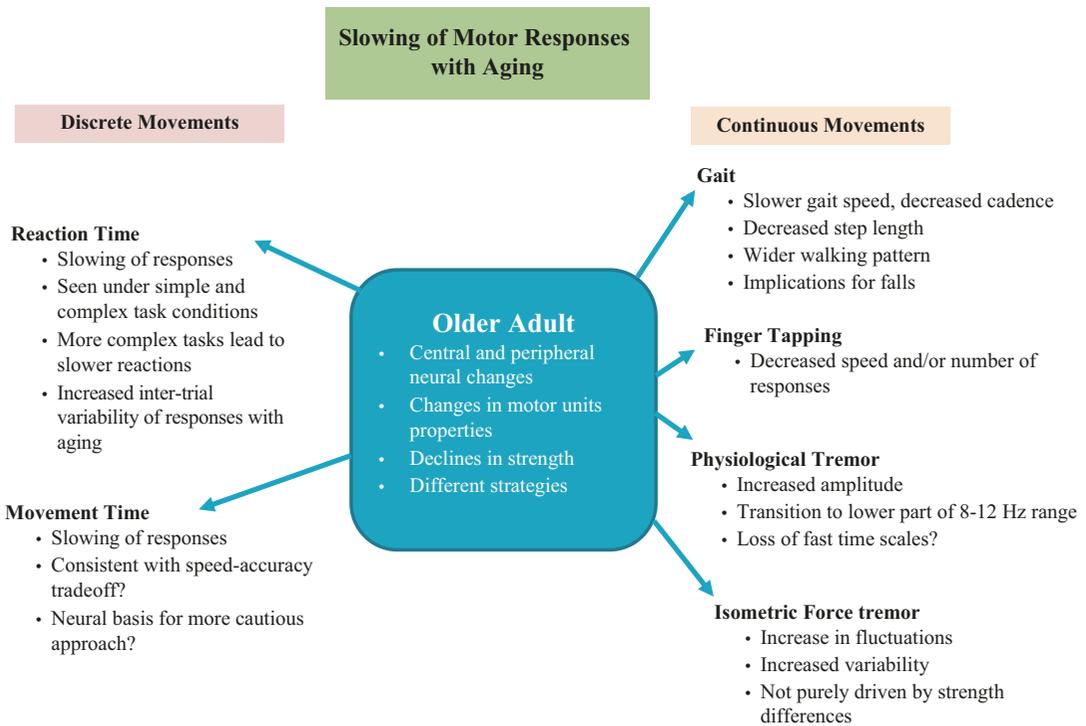
movement. There is also an age-related change in the complexity of output of the human physiological and behavioral systems (Lipsitz 2002; Lipsitz and Goldberger 1992; Vaillancourt and Newell 2002).

A pervasive phenomenological change with aging that has been the subject of considerable experimental investigation is the progressive slowing of the neuromotor system (Cousins et al. 1998; Moehle and Long 1989; Deary et al. 2010). The slowing of movement-related properties is found across all levels of analysis of the system (behavioral, neural, chemical, thermal) and from dynamic analyses of the organization of subsystems in the control of movement behavior, such as the muscle, spinal cord, and brain. The slowing of the aging motor system is also apparent in a range of behavioral movement-related properties. Indices of slowing in aging have been reported across the spectrum of movement actions, from eye movements to fine motor skills involving a small number of joints/muscles such as in laboratory reaction time-movement time and finger-tapping tasks and more complex gross motor activities such as walking that involves the coordination and control of multiple elements of the skeletal-muscular system. Figure 1 provides a schematic overview of the predominant qualitative changes in movement tasks and properties of motor control with aging.

The slowing of the motor system in aging leads to a loss of functional capacity, adaptability, and, in the ultimate expression, death (Birren and Fisher 1991). The changes in the timescales of motor output and the multiple processes that support it provide an interdisciplinary window into the motor control of aging. There has been an increasing interest in system's frameworks of analyses to the timescales of change in aging given that it is difficult to ascribe a causal relation (as in the reductionist agenda) of one particular process to the performance decrement with aging.

### Discrete Movement Tasks

**Reaction Time.** Assessment of reaction time (RT) in discrete movement tasks has been a



**Aging and Slowing of the Neuromotor System, Fig. 1** Schematic illustration of the various changes in motor outputs with aging. The general characteristics of the changes within each movement are also outlined

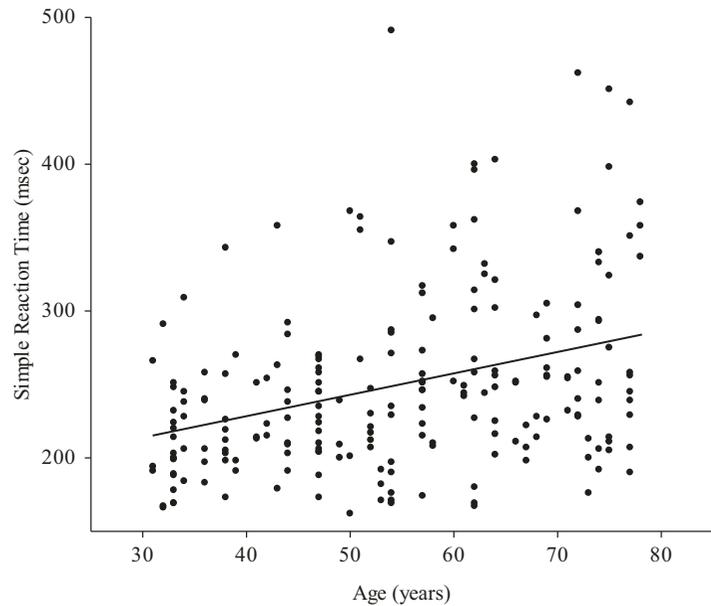
common approach to determining the impact aging has on cognitive and neuromotor processes (Bunce et al. 2004; Graveson et al. 2015; Hultsch et al. 2002; Spirduso 1980; Spirduso et al. 1988; Williams et al. 2005; Welford 1988). Reaction time measures the latency from the presentation of a “go” signal to the onset of the appropriate movement response (Spirduso 1980, 1985). Typically, investigators assess the response latency of the subject under either simple reaction time (SRT) or choice reaction time (CRT) conditions. SRT consists of a single stimulus to begin the action that is paired to a single possible response. For CRT conditions, more than one stimuli is available to be presented, with each stimuli requiring a different response (e.g., the varying stimuli may relate to performing the action with a different effector or, when performing the action, moving to different targets). The time taken to perform the movement component of the task is referred to as movement time (MT). To minimize any anticipatory actions, the foreperiod (i.e., time from a

“ready” signal to the presentation of the “go” signal) is usually varied so the individual cannot predict when the stimulus to start the movement response is provided (Welford 1971, 1988).

Typically, reaction time tends to progressively increase (i.e., individuals get slower in the latency of their responses) from their mid-20 years until the individual passes 70 years of age (Welford 1988). Naturally, the changes in age-related RT are more marked when the task response is more difficult, as where individuals are required to respond under CRT situations (Bunce et al. 2004; Spirduso 1980; Williams et al. 2005). The use of EMG to fractionate RT has shown that the majority of the simple and choice RT age effect is in the pre-motor phase – that is, the time from the onset of the stimulus to begin the action to the initiation of muscle activity (Clarkson 1978). Interestingly, the effects of age on both RT and the time it takes to perform the desired movement (MT) are not the same across genders, with males generally

### Aging and Slowing of the Neuromotor System, Fig. 2

Age-related differences in simple reaction time responses. Data were attained from 75 healthy adults ranging in age from 30 to 80 years of age. The reaction time task involved depressing a computer button with the index finger in response to a light stimulus. Three individual trial responses from each person are shown in this figure



exhibiting faster (shorter latency) responses compared to females. However, both males and females are similarly influenced by condition effects such as complexity of stimulus context (Der and Deary 2006). An example of the typical pattern of change in simple RT with age is shown in Fig. 2.

The resultant age-related slowing of motor responses under the various RT situations is not simply reflected by changes in the average latency of the person's response. Increases in intraindividual variability (i.e., trial-to-trial variation in RT performance) are also a function of healthy aging (Graveson et al. 2015; Hultsch et al. 2002; Light and Spirduso 1990). Together, the age-related slowing of RT and increased trial-to-trial RT variability has been linked with a general decline in cognitive functioning, including attentional and/or executive control mechanisms (Bunce et al. 2004; Deary et al. 2010).

Interestingly, the reports of increased intertrial variability with aging are consistent with the general view that the process of aging or the emergence of age-related diseases is reflected by changes in the variability and/or complexity of a given physiological process (Lipsitz 2002; Lipsitz and Goldberger 1992; Vaillancourt and Newell 2002). Indeed, from this perspective, a diverse

range of studies have shown how the complexity/variability of such diverse physiological time series such as brain activity (i.e., EEG), neuromuscular function, respiratory and cardiovascular responses, balance, walking ability, physiological/pathological tremor, and hormone secretion is systematically affected by increasing age in adulthood (Hausdorff et al. 2005; Newell et al. 2006; Peng et al. 1995; Pincus 1994).

**Movement Time.** Within the context of the reaction time discrete movement paradigm, MT captures the time from initiation of the selected response to the termination of the movement (Schmidt and Lee 2011; Spirduso 1985). Similar to the results reported for RT changes with aging, older adults tend to exhibit a slowing of MT (Sleimen-Malkoun et al. 2013a; Temprado et al. 2013; Birren and Fisher 1991; Heitz and Schall 2012; Ketcham and Stelmach 2004). Based upon an understanding of the age-related changes in various physiological processes, a number of different explanations such as neural noise theory and the general slowing hypothesis were developed to explain the slowing of MT with aging (Schmidt and Lee 2011; Spirduso 1985). Aging individuals tend to follow the speed-accuracy relation described by Fitts' (1954) law in aiming tasks, but the effect of task difficulty

(amplitude increase and/or target size decrease) tends to slow the movement more than in young adults (Fitts 1954; Forstmann et al. 2011; Smith and Brewer 1995; Ketcham and Stelmach 2004; Sleimen-Malkoun et al. 2013b).

## Continuous Movement Tasks

Aging-related effects of the slowing of the neuromotor system have also been studied in sequential and continuous movement tasks. The aging-related slowing of the motor system is observed in both the preferred rhythm and the maximal frequency (or minimal duration) of motor output for a given task.

**Finger-tapping.** The pattern and frequency of finger-tapping has been widely used to assess how aging or neurological disease impacts on central nervous system function (Aoki and Fukuoka 2010; Arunachalam et al. 2005; Cousins et al. 1998; Moehle and Long 1989). Consistent with the general trend of the observed slowing of movement responses, several studies have reported a decline in finger-tapping speed (i.e., declines in overall rate and longer inter-tap intervals) and increased variability of tapping responses in both healthy older adults and persons with neurological disorders such as Parkinson's disease and Alzheimer's disease and where damage to the cerebrum leads to declines in cognitive function (Cousins et al. 1998; Shimoyama et al. 1990). The basis for this decline appears to be embedded within neuromotor changes rather than being attributed to deficits in peripheral sensory function or force-producing capacity of the muscles involved in the task (Aoki and Fukuoka 2010).

**Isometric Force Control.** When grasping an object with the hand, there is a requirement to produce a certain level of (isometric) force in order to hold and manipulate the object (Flanagan et al. 1999). In performing these tasks, the resultant force profile is characterized by a series of small fluctuations or oscillations referred to as force steadiness or isometric force tremor (Enoka 1997; Christou and Carlton 2001). Consistent with the pattern of findings for other

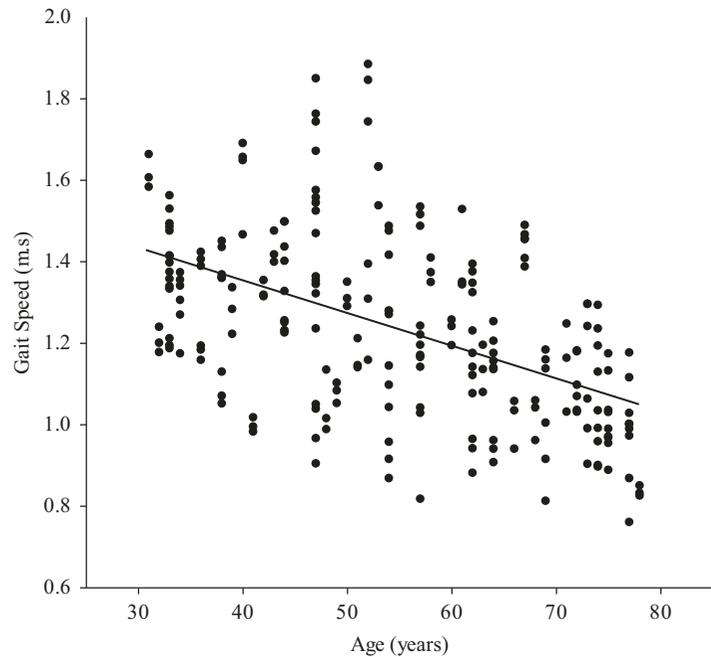
activities, older adults often exhibit reduced control in force production, as quantified by an increase in the amplitude of these fluctuations (Kinoshita and Francis 1996; Lazarus and Haynes 1997). Interestingly, this decrement in force-producing capacity has been interpreted to reflect changes in motor unit (MU) control and sensorimotor function and not simply in terms of muscle strength. The consequence of these changes is that elderly adults exhibit greater targeting error and isometric force variability.

**Gait.** Walking performance is another movement activity where declines are observed with increasing age in adulthood. The preferred walking speed of healthy older adults (i.e., over 60 years) tends to be significantly slower than healthy adults in their 20s, and walking speed continues to decline as the person ages further (Murray et al. 1969). One reason for this decrease in speed appears to be that older persons take a shorter step length in preference to altering (i.e., decreasing) step time (Himann et al. 1988; Winter et al. 1990; Owings and Grabiner 2004). Further adaptations utilized by older adults include increasing the proportion of time spent in double stance (i.e., both feet in contact with the surface of support), taking wider steps, and reducing the proportion of time spent in the swing phase during locomotion (Murray et al. 1969; Winter et al. 1990). The goal of these adaptations would appear to ensure an optimal level of dynamic balance during locomotion and prevent falls (Maki 1997). Figure 3 illustrates the general pattern of change in gait speed as a function of the normal process of aging.

However, these decrements in walking performance are not the singular product of chronological aging per se. Several studies have found no gait differences between healthy young and elderly adults when the older individuals have been screened for potential physical impairments (Grabiner et al. 2001; Owings and Grabiner 2004). These findings indicate that factors other than chronological age such as fear of falling, decline in cognitive processing speed, decreased leg strength, and/or reduced leg range of motion are also likely to contribute to the slower walking speeds observed in the average elderly individual

### Aging and Slowing of the Neuromotor System, Fig. 3

Pattern of changes in individual walking speed as a function of increasing age. Gait speed data were attained while healthy individuals ( $n = 75$ ) walked at their preferred speed on a 20 f. GAITRite pressure-sensitive walking surface. Three individual trial responses from each person are shown in this figure



(Maki 1997; Kang and Dingwell 2008). These associations of potential causal factors provide indirect evidence that there are multiple contributions to the slowing of neuromotor system with aging.

**Generalization of Intraindividual Movement Slowing Across Tasks.** The findings on the behavioral slowing of the aging movement system in different motor tasks have typically been reported in isolation. This experimental design does not afford an examination of the generalization of intraindividual movement slowing that is assumed to hold in theories of aging. The limited studies on intraindividual generalization have reported modest correlations of movement slowing over tasks with the effects stronger as aging advances (Bielak et al. 2010; Dykiert et al. 2012).

### Physiological Basis for Slowing

**Physiological Function and Structure.** While there seems to be little dispute regarding the general slowing of behavioral responses with aging and age-related diseases, the basis for such changes cannot be linked to any single defining

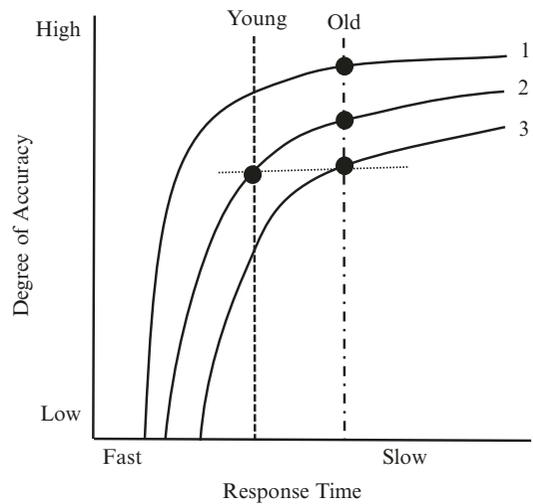
factor. For example, the slowing of RT, increased trial-to-trial RT variability, and decreases in tapping speed have primarily been tied to a generalized decline in cognitive function. In contrast, changes in tremor and force production have been attributed to decline in neuromuscular function, particularly with respect to changes in MU capabilities. Many of the reported age-related declines have been linked to structural changes within the CNS itself that can include decreases in overall conduction velocity, age-related losses of white matter and gray matter, and degeneration of neurotransmitter systems (Zimmerman et al. 2006; Soares et al. 2014; Wang and Young 2014; Seidler et al. 2010). A consequence of these structural changes within the CNS is that, when performing the same motor task, older adults demonstrate increased activity across a wider network of motor areas within the brain (including the regions of the prefrontal cortex and basal ganglia) compared to younger adults (Seidler et al. 2010; Riecker et al. 2006; Ward 2006).

In addition to the central changes in function, there are a number of peripheral physiological changes that may impact on the ability of the older adult to respond quickly and appropriately. Central to these changes is the general decline in

skeletal muscle function that leads to an overall decrease in muscle cross-sectional area, a reduction in muscle mass, and a decline in strength. Specific structural and functional neuromuscular changes that can arise with aging include increases in the variability of MU firing, atrophy of fast-twitch MUs, remodeling of MUs, and a decline in the number of alpha motor neurons (Erim et al. 1999). These peripheral changes have been linked to the slowing of gait responses, declines in isometric force control, and the altered dynamical structure of physiological tremor (Himann et al. 1988; Kang and Dingwell 2007; Morrison and Sosnoff 2009; Enoka 1997).

As an example, changes (slowing) in physiological tremor dynamics have been widely reported in healthy older individuals. The primary mechanism for this change has been some compromise in the neural output – the result of a general decline in the functional capacity of the aging system (Elble 1998; Morrison et al. 2006; Raethjen et al. 2000). Physiological tremor is an intrinsic property of a normal functioning nervous system which reflects the aggregated contribution from the mechanical resonant properties of the limb segment, cardiac mechanics, central neural mechanisms, and more peripheral neural contributions from stretch reflexes (Elble and Koller 1990; McAuley et al. 1997). The oscillations of the central neural component of physiological tremor are typically within the 8–12 Hz range and represent output from neural oscillatory structures including the basal ganglia, thalamus, inferior olive, and alpha motor neurons within the spinal cord (Elble 2000; McAuley et al. 1997). For older adults, changes in this intrinsic, involuntary motor output are reflected by increases in overall tremor amplitude and/or a decrease in frequency, with the tremor responses being observed at the lower range of the 8–12 Hz bandwidth (Elble 1998; Morrison and Sosnoff 2009; Raethjen et al. 2000). Thus, the general slowing of motor responses is also reflected by a loss of the fast timescale processes inherent in physiological tremor of postural control.

While the predominant view is that the slowing of movement responses is primarily driven by declines in physiological processes, an alternate (but related) consideration relates to the



**Aging and Slowing of the Neuromotor System, Fig. 4** Illustration of the potential differences in the speed-accuracy trade-off as a function of increasing age. The increased response time for older adults in comparison to young adults may reflect that they operate on a different point and/or curve. For example, to achieve a similar degree of accuracy as the young adults, older persons may operate on a different curve (3), or if they operate on the same curve (2), they would trade-off accuracy for speed (Adapted from Spirduso 1985)

possibility that older adults select different strategies when performing movement tasks compared to younger adults. Under RT conditions, for example, there is evidence to indicate the older individual is often more careful and cautious in their selection of when to respond – in effect trading speed of movement for accuracy of performance (Bunce et al. 2004; Hultsch et al. 2002; Light and Spirduso 1990; Williams et al. 2005; Spirduso 1985). Thus, in comparison to younger adults, older persons may prioritize minimizing performance errors over moving faster, and so the observed slowing of responses may actually reflect that they occupy a different criterion position on the speed-accuracy continuum (Spirduso 1985; Welford 1988). Figure 4 illustrates this pattern whereby older adults may operate on a different point and/or curve with regard to the relation between speed of response and target accuracy (Salthouse 1979). However, this is not to say that this trade-off is voluntarily driven and occurs independent of any age-related changes in the underlying neurological structures. For example, studies

have reported that the adoption of a more cautious selection strategy in older adults could also be reflective of alteration in the activation pattern and/or impaired neural connectivity between such regions as the supplementary motor areas and striatum (Bogacz et al. 2010; Forstmann et al. 2011; Heitz and Schall 2012). Supporting this view, van Dyck and colleagues (2008) reported that declines in dopaminergic function within the basal ganglia can be linked to the progressive slowing of RT in older adults (van Dyck et al. 2008).

The consequences of the declines across various physiological systems are not simply restricted to performance within the context of a single task. One of the major health concerns for older adults is the likelihood of suffering a fall (Tideiksaar 1998; Tinetti et al. 1988). The trend of a slowing of responses, including decreased strength, slowing of reactions, walking slower, loss of physiological variability, impaired balance, changes in visual and/or sensory function, and declines in cognitive functioning all are factors that are linked with (and contribute to) increased falls risk for older individuals (Close et al. 2005). There is little doubt that the combined gradual slowing of responses across a range of physiological and behavioral outputs are driving factors underlying the increased occurrence of falls in older adults. However, the consequences are not simply limited to the immediate outcomes of suffering a fall (e.g., injury, death), as the long-term effects can be just as problematic. Indeed, a previous fall can be the precursor for a downward cascade of decline, as many people become less physically active, which can lead to further losses of muscle strength, adopting a slower, more cautious walking pattern, and exhibit increased tiredness following a fall. All these outcomes can ultimately lead to a further increased risk of falling and are viewed as markers for the descent into physical frailty (Fried et al. 2001).

### **Aging and the Adaptation of Multiple Timescales**

The preceding sections show the pervasive and well-established examples of behavioral and

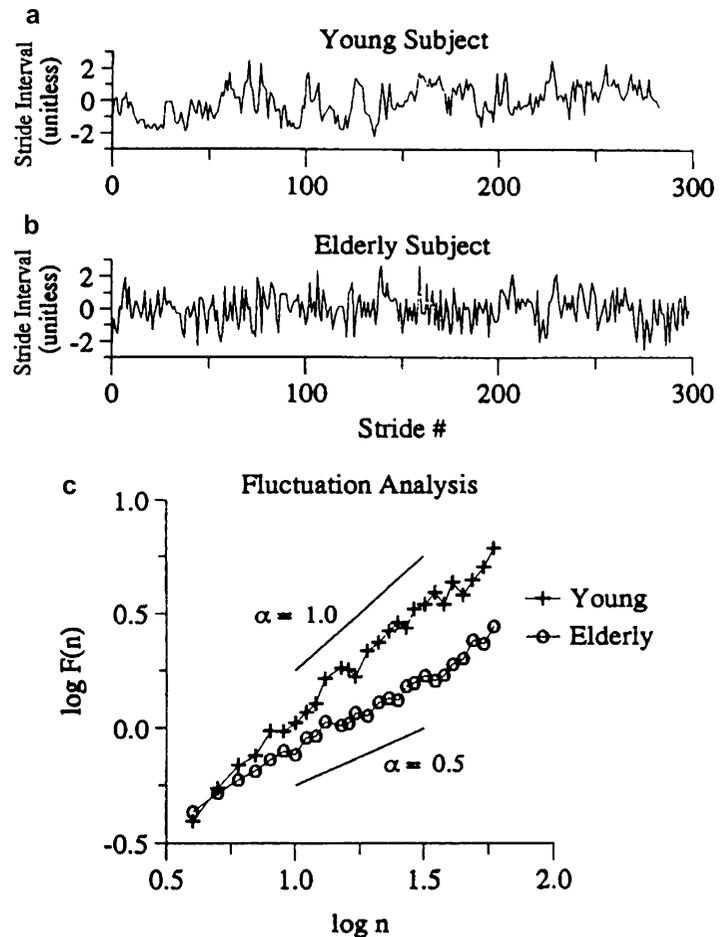
physiological slowing of the neuromotor system as a function of aging. For the majority, these examples rest on the traditional distributional analyses of temporal components of behavioral responses and activities that are driven by the mean and standard deviation of the dependent variable in question (e.g., RT, MT, finger-tapping rates, average gait speed, and cadence). This standard approach, however, takes out the roles of time- and frequency-dependent structure in a time series of behavioral output in spite of being concerned about the role of time in aging and, more generally, developmental processes.

Since the early 1990s, there has been a concerted effort to introduce a new view to understanding the problems of aging that is formulated around the general umbrella theoretical constructs of self-organization and the emergent complexity (Lipsitz and Goldberger 1992; Vaillancourt and Newell 2002). The construct of self-organization in behavior is tied to the emergent dynamics, their change over the life span, and the contribution of different timescales to this process. The timescales provide a window into the role of different processes in a systems framework to movement behavior and its change over time. In this view, a timescale is not merely the duration of an event as in the typical psychological framework, but is an interval that arises from the intrinsic dynamics of the system (growth-decay and/or oscillatory processes).

This approach incorporates the use of nonlinear dynamics, frequency analysis, and time series analysis to provide additional insight as to process of aging and/or disease. While distributional analysis of variables through a mean and SD is still useful, it does not directly address the time- and frequency-dependent properties of physiological and behavioral data that are often more sensitive to age-related change. Moreover, Gilden et al. (1995) showed that even the pattern of RT responses, rather than exhibiting a normal distribution, was more appropriately characterized by complex frequency and nonlinear tendencies (the pattern was referred to as an example of  $1/f$  noise). Subsequently, there have been many developments around this dynamic theme to traditional human performance variables in different experimental paradigms.

### Aging and Slowing of the Neuromotor System,

**Fig. 5** Differences in the pattern of stride interval (*top, a*) during walking in healthy young and older adults. Plots of the resultant differences in signal complexity (*bottom, b*) using detrended fluctuation analysis are also shown (Figure adapted from Hausdorff et al. 1997)



Hausdorff and colleagues (1997) studied the increase in the degree of variability of the gait pattern in aging adults and disease states such as Huntington's and Parkinson's disease (Hausdorff et al. 1997). They used spectral analysis and detrended fluctuation analysis to reveal the structure in the gait cycle beyond mean and SD of stride length (see Fig. 5). Their central finding was that the variability of the gait cycle exhibits properties of a self-similar system. That is, fluctuations of the gait cycle exhibit long-range correlations such that the stride properties of any given cycle are dependent on a cycle previously at rather remote times, perhaps hundreds of cycles earlier in the locomotion sequence. Their analyses showed, as others have since, that the dependence of the stride interval decays as function of a power law, suggesting a fractal pattern to the

structure of the variability of the gait cycle over time. An important consequence of this finding is that it shows that the variability of the gait cycle is not that of a signal plus noise process, as has been viewed traditionally in studies of gait variability and assumed more generally in age-related performance decrements. Rather, this result highlights that there is an inherent dynamic structure to the variability of movement patterns and that deviations from the typical pattern of complexity may reveal insights as to the impact aging and disease on the selected motor output.

Sosnoff and Newell (2008) examined the age-related loss of adaptability to fast timescales in the motor variability of isometric force production (Sosnoff and Newell 2008). The sensorimotor outputs to differing time and frequency properties ( $1/f$  noise structures) of target-force

waveforms were studied. By having force-tracking pathways that followed different fractal noise structures, the manipulation of timescales in the task demands could directly be accomplished (i.e., changing the relative contribution of long- and short-frequency processes). The results showed that, when compared to younger adults, the older persons were progressively less able to approximate the lighter-color noise force targets and utilize information in the higher frequencies of the target signal.

The findings of Sosnoff and Newell (2008) are consistent with aging and the loss of complexity hypothesis of Lipsitz and Goldberger (1992), given that there was a declining ability with aging to use the faster timescales of sensorimotor control in force output. However, several studies have now shown that the particular directional effect of the loss or gain of complexity of force is moderated by the differential impact of task demands (Vaillancourt and Newell 2002). This is consistent with the general view that behavior is an emergent property of the confluence of constraints of the individual, environment, and task and that complexity is an emergent feature of the interaction of the three classes of constraint and not a property that should be viewed as within the body.

## Concluding Comments

An inevitable consequence of the aging process is that behavioral movement speed slows across all movement domains. Although the lifestyle of the older individual in terms of health status and exercise habits can slow this decline in movement speed to some degree (Spirduso 1980, 1985), the degradation across all levels of the central-peripheral nervous system means that slowing of movement responses in the aging adult is pervasive and has many specific manifestations, only the major ones of which are addressed here. It follows then that all theories of aging, whether psychological, physiological, biological, or more general systems accounts, have tended to address this important phenomenon (Spirduso 1985, 2005).

The challenge is that correlates of the slowing of movement speed with aging can be found at many theoretical levels of analysis thereby lending support to the veracity and relevance of all theories of aging although no single unified theory has adequately captured the full scope of the declines seen across the various movement domains. Spirduso (1985, 2005) has proposed that the most compelling hypotheses to explain the age-related behavioral slowing are to be found in the various manifestations of biological deterioration that induce the slowing of movement in action seen in the aging adult. The system's approach to the loss of complexity (Lipsitz and Goldberger 1992) provides a complementary framework for investigating the array of age-related changes found for physiological and behavioral processes. Contemporary research on movement and aging is still focused on hypotheses of network signal and connectivity issues in the aging neuromotor system.

## Cross-References

- ▶ [Age and Intraindividual Variability](#)
- ▶ [Age-Related Changes in Abilities](#)
- ▶ [Age-Related Slowing in Response Times, Causes and Consequences](#)
- ▶ [Healthy Aging](#)
- ▶ [Neurocognitive Markers of Aging](#)
- ▶ [Physical Activity and Aging](#)
- ▶ [Physiological Effects on Cognition](#)

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## Aging and Strategy Use

Thomas Hinault and Patrick Lemaire  
Aix-Marseille Université and CNRS, Marseille,  
France

### Synonyms

Strategic processing; Strategic variations

### Definition

Strategy use refers to the sets of procedures employed to accomplish a cognitive task. With aging, changes in every strategy dimensions are observed.

Research in cognitive aging aims at knowing what changes in human cognition with age and how age-related changes occur. Determining what changes in human cognition entails examining which cognitive functions decline and which ones remain stable (or even improve) with age. Deciphering how changes occur means trying to understand mechanisms underlying both age changes and age invariance in cognitive performance. Investigating strategy use in young and older adults contributes to achieve these two main goals. In this article, strategy use and other strategic variations in human cognition and when strategic variations occur during cognitive aging are first discussed. Then, an elaboration on factors and mechanisms driving strategic variations during adulthood is provided.

### Strategic Variations in Human Cognition

When children and adults of varying ages accomplish cognitive tasks, they use a wide variety of strategies (Siegler 2007). A *strategy* can be defined as “a procedure or a set of procedures for achieving a higher level goal or task” (Lemaire and Reder 1999). When researchers adopt a strategy perspective on cognitive aging, above and beyond determining what changes and what remains constant with age in cognitive performance, they investigate the following strategy dimensions (Lemaire and Siegler 1995; (Lemaire 2010):

- *Strategy repertoire* includes all available strategies to accomplish cognitive tasks.
- *Strategy distribution* refers to how often each strategy is used.
- *Strategy selection* characterizes how strategies are selected among on each item.
- *Strategy execution* concerns performance (i.e., speed and accuracy) yielded by each strategy.

A strategy perspective is useful to understand cognitive aging for several reasons. First, it enables to characterize cognitive changes during aging, as it helps uncovering mechanisms responsible for age-related changes in cognition. Second, a strategy perspective enables to distinguish cognitive processes that decline with age from

those not affected during aging. Moreover, the strategy perspective is fruitful to understand individual differences during adulthood, as research has found that some people age better than others. Finally, a strategy perspective offers a deeper understanding of when age-related declines in cognitive performance result from age-related decrease in processing resources like processing speed and when they result from changes in how tasks are accomplished. This article presents age-related changes and invariance in strategic variations by examining when young and older participants differ (or not) in strategy repertoire, distribution, selection, and execution when they accomplish cognitive tasks (Lemaire 2010); (Duverne and Lemaire 2005).

### Strategy Repertoire

Age-related differences in strategy repertoire are seen in differences in the type of strategies used and/or in the number of strategies used by young and older individuals. Age-related differences and similarities in strategy repertoire have been found both when strategies can be observed directly with external behavioral evidence (via video recordings or verbal protocols) and indirectly when no external behavioral evidence are available (i.e., via performance variations as a function of task or stimuli parameters).

To give one example, previous research has found that both young and older adults' strategy repertoires include the following nine strategies when people are asked to solve mentally two-digit addition problems like  $17 + 51$ : retrieving the product directly from long-term memory (e.g., people retrieve 68 directly from memory as a correct sum), rounding the first operand down (or up) to the nearest decade and then adding (or subtracting) the units (e.g., doing  $10 + 51 + 7$  or  $20 + 51 - 3$ ), rounding the second operand down (or up) to the nearest decade and then adding (or subtracting) the units (e.g.,  $17 + 50 + 1$  or  $17 + 60 - 9$ ), rounding both operands down (or up) to the nearest decades and then adding (or subtracting) the units (e.g., doing  $10 + 50 + 7 + 1$ ;  $20 + 60 - 3 - 9$ ), using columnar retrieval (e.g., adding  $1 + 5$  for decades and then

adding  $1 + 7$  for units), or borrowing units from one operand to increment the other (e.g.,  $18 + 50$ ). What is interesting is that both young and older adults, as a group, used these nine strategies (Lemaire and Arnaud 2008); (Hodzik and Lemaire 2011). However, examining the number of strategies used by each individual revealed that older individuals used fewer strategies than young individuals. This suggests that strategy repertoire used in a given task can be smaller in older than in young adults, even if both age groups know all available strategies.

Changes in strategy repertoire with age have been found not only in the number of strategies used by individuals but also in the type of strategies. For example, when they want to make a decision regarding a product to purchase, older adults tend to adopt simpler strategies (e.g., they tend to search fewer pieces of information) than young adults. Note though that older adults do not always use simpler strategies. For example, if they are asked to verify arithmetic problems like  $8 + 4 = 19$  vs.  $8 + 4 = 13$ , young adults tend to use calculation strategies to determine that the second equation is false and fast, easy plausibility-checking strategies on the first equation. Older adults tend to use the harder, calculation strategies, even when basic arithmetic skills are comparable in both age groups.

Differences in strategy repertoire have been found in a number of cognitive domains, ranging from low-level sensorimotor tasks (e.g., Fitt's pointing tasks) to higher-level inferential tasks (e.g., deductive reasoning tasks). Note though that age changes in strategy repertoires are not always found. Sometimes young and older adults accomplish cognitive tasks using the same and same number of strategies. For example, in episodic memory, where participants are asked to learn pairs of words like *dog basket*, both young and older adults use sentence generation (i.e., they make a sentence with each pair of words like "the dog sleeps in her basket"), interactive mental imagery (i.e., constructing a mental image with each word of the pairs), or repetition (i.e., continuously repeating pairs of words) strategies, as well as other or no strategies (Hertzog and Dunlosky 2004).

One fascinating feature of cognitive aging regarding strategy repertoire is that both differences and similarities in young and older adults' strategy repertoires can be found in the same domain and sometimes with the same task. For example, when participants verify arithmetic problems like  $4 \times 13 = 54$  or  $4 \times 13 = 57$ , both young and older adults are faster on the latter than on the former (Hinault et al. 2015). Presumably, both age groups verify the parity rule (i.e., when at least one of the two operands is even, the product is even; otherwise the product is odd like in  $4 \times 13 = 52$ ) in such arithmetic problem verification tasks. This means that, depending on the domain, on the task, as well as on the task environment, young and older adults can use the same or different strategy repertoires. In order to best characterize participants' performance, it is crucial to determine how young and older adults accomplish cognitive tasks and if they use the same strategy repertoires.

### Strategy Distribution

Even when both young and older adults know and use the same strategies and the same number of strategies, they may differ in how often they use each available strategy. Indeed, studies in a variety of domains found that older adults do not use available strategies as equally often as young adults.

Differences in mean percentages with which young and older adults use available strategies have been found in domains as varied as decision making, reasoning, memory, problem solving, language processing, or numerosity estimation. For example, research has found that, compared to young adults, older adults tended to use the optimal strategy (i.e., the strategy that consists in asking the most informative question) less often in inductive reasoning tasks, to use the less efficient computational estimation strategies or numerosity estimation strategies more often when participants were asked to find approximate products to two-digit problems like  $57 \times 89$  or to find the approximate number of dots in dot collections briefly displayed on a computer screen, to use more often the retrieval strategy (i.e., retrieving the correct solutions directly from long-term

memory) (Geary and Lin 1998) when asked to solve simple one-digit addition or multiplication problems, to use plausibility-checking strategies more often to answer comprehension questions about a text they had just read, and to use sentence generation, rote repetition, or interactive imagery strategies to judge sources of information in source-memory tasks.

Note that sometimes, in the same cognitive domains, both age- and no age-related differences in strategy distributions are found. For example, in episodic memory, some research found that to encode pairs of words, young and older adults did not differ in how often they used the sentence generation, interactive mental imagery, repetition, as well as other or no strategies. Other research (Bouazzaoui et al. 2010) found that young and older adults did not use these strategies equally often either when participants encoded pairs of words or accomplished other episodic memory tasks like recognition tasks or like when they had to determine how they use external aids (e.g., drawing lists of items to purchase) in daily-life memory tasks (like remembering grocery shopping lists).

It is important to note that there is no general rule that can be stated regarding the contexts in which young and older adults use available strategies to different extents. Indeed, researchers found that older adults tend to use sometimes simpler strategies more often than young adults and sometimes more difficult strategies more often, independently of relative strategy performance. Thus, age-related differences is characterized sometimes by older adults using simpler and easier strategies more often, sometimes using more complex and harder strategies more often, irrespective of which strategy is most efficient. The only important thing to remember is that it all depends on a number of factors, like characteristics of participants (e.g., their level of education, their profession, their health), the domain and tasks in these domains (e.g., finding a solution vs. determining whether a proposed solution is correct or incorrect), the situations and task instructions (e.g., emphasizing speed vs. accuracy), the type of (easy vs. hard) items, and the cognitive costs incurred by available strategies.

### Strategy Selection

Strategy selection concerns how one strategy is chosen among available strategies on each item. Age-related differences in strategy selection can be assessed by determining how often young and older adults are able to calibrate their strategy choices to task parameters (e.g., instructions, items, type of strategies) and how often to select the most efficient strategy on each item. Crucial to strategy selection are the abilities to choose strategies on a trial-by-trial basis. Such trial-by-trial strategy choice process is in sharp contrast with selecting a given strategy applied on the whole set of items, or with selecting a strategy executed on the first half of items and a second strategy used on the second half of items, or with any other variants of such processes that would dispense participants from making strategy choices on each item. It also differs from random and inconsistent strategy choices across items. Systematic trial-by-trial strategy choices require participants to be able to flexibly switch between different strategies on successive items when the best strategy on successive items differs and to use the same strategy on successive items when the best strategy is the same on these items.

Only in domains where young and older adults have reached a high level of expertise do we find that most participants use a given strategy on almost all items. For example, in simple arithmetic tasks, where participants have to find solutions to simple one-digit addition or multiplication problems like  $3 \times 4$  or  $5 + 2$ , did previous research find that participants use retrieval strategy (i.e., they retrieve the correct answer directly from memory) on over 95% of trials. In some studies, most likely due to cohort effects, older adults have been found to use retrieval on 100% of trials and young adults on around 80–90% of trials (Geary and Lin 1998). Such lack of trial-by-trial strategy selection in older adults most probably stemmed from high level of expertise in arithmetic that made one strategy most efficient on all items, rather than from strategy inflexibility.

In most domains, some strategies are more efficient on some items and other strategies on other items. In such domains, previous research

has found strategy flexibility and calibration of strategy choices to task parameters in both young and older adults. Previous research has also found both age-related differences and similarities in strategy selection. For example, in arithmetic, when participants were asked to select the better of two available rounding strategies to find approximate products to two-digit multiplication problems like  $62 \times 86$  (e.g., rounding both operands to the nearest smaller decades, like doing  $60 \times 80$  and providing 4800 as an estimate), older participants selected the best strategy on each problem less often and less systematically than young adults (Lemaire 2010). Similarly, when asked to select encoding strategy to memorize lists of words, to search information about items to purchase, to combine premises to make inductive inferences, to use linguistic cues to understand sentences or texts, and to accomplish mental rotation and sentence-verification tasks, older adults were less systematic in selecting the best strategy on each item. Some research recently found that, when they selected the best strategy less often than young adults, older adults adopted an easier, cognitively less-demanding approach. They tended to repeat the same strategy on consecutive items even if the best strategies were not the same on these consecutive items, or to use the easiest strategy to execute even if this easiest strategy was not the most efficient (Lemaire 2015).

In many studies, older adults have been found to be less able than young adults to calibrate their strategy choices to item or situation characteristics. For example, when they were asked to encode lists of words, older adults tended to use interactive mental imagery to encode concrete words and sentence generation to encode abstract words less systematically than young adults (Hertzog and Dunlosky 2004). Similarly, when time to encode items in episodic memory tasks was limited, relative to older adults, young adults tended to more systematically and more efficiently adjust their strategy choices relative to an unlimited encoding time condition.

Finally, it is important to note that in a few experiments where participants were instructed to use a given efficient strategy (e.g., “use

interactive mental images to encode as many words as possible when you memorize this list of words”), both young and older adults increased their use of interactive mental imagery to comparable extents (Hertzog and Dunlosky 2004). When the best decision-making strategy was taught to young and older adults, both age groups used it more systematically than when they were not taught such strategy. More generally, in several domains, when information about relative strategy efficacy was provided prior to the experiment, age-related differences in how often young and older adults used the best strategy on each item tended to decrease and sometimes to disappear.

### Strategy Execution

Differences between young and older adults in strategy execution are the strongest and most robust of all age-related differences in strategic variations. Strategy execution refers to relative strategy speed and accuracy. Above and beyond general slowing, previous research has found that older adults tend to be slower and less accurate when they execute strategies. Age-related differences are increased not only when participants execute harder strategies, but also when they execute strategies in most demanding conditions. Examples of most demanding conditions include harder items, situations with high-speed/high-accuracy pressures, under stress, or tasks that are less familiar to participants.

For example, when participants use rote repetition, mental imagery, or sentence generation to memorize pairs of words, older adults obtain poorer performance with each of these strategies than young adults (Hertzog and Dunlosky 2004). When participants are forced to execute rounding-up strategy (i.e., rounding both operands to the nearest larger decades) to find product estimates to all two-digit multiplication problems (i.e., doing  $80 \times 40 = 3200$  to estimate  $72 \times 34$ ) of a given set and to use the rounding-down strategy on all problems of another, matched set of problems, older adults are slower and less accurate than young adults, especially with the most difficult rounding-up strategy. These age differences are larger if participants are asked to execute the

poorer strategy (e.g., the rounding-up strategy on small-unit problems like  $72 \times 34$  and the rounding-down strategy on large-unit problems like  $54 \times 69$ ) (Hinault et al. 2015). Similarly, in episodic memory, age-related differences are larger when participants are asked to execute the interactive imagery strategy on concrete words than when executing it on abstract words (Hertzog and Dunlosky 2004). As another example, as participants had encoded lists of words, age-related differences in participants’ performance were larger after using a deep-encoding strategy (e.g., find a synonym of each word) than after using a shallow-encoding strategy (e.g., count the number of syllables in each word), and these differences were magnified in recognition compared to recall task. As a final example, participants are slower when they switch strategy from one item to the next than when they repeat the same strategy, irrespective of which strategy is the best on each item. Such so-called strategy switch costs have been found to be of comparable magnitudes in young and older adults when participants were allowed to choose among two strategies but to increase in older adults as soon strategies could be chosen among three available strategies on each item (Ardiale and Lemaire 2012). All these findings showed that age-related differences in strategy execution are modulated by a wide variety of contextual factors. Note though that not all contextual factors change age-related differences in strategy execution. For example, participants tend to execute a strategy on a current item more slowly if a harder strategy has been executed on the previous item. Such so-called strategy sequential difficulty effects seem to influence strategy execution in young and older adults to the same extents (Uittenhove and Lemaire 2012).

### Sources of Strategic Variations During Cognitive Aging

In all cognitive domains in which strategic variations have been adequately investigated, researchers have found age-related differences and similarities. These include older adults using fewer strategies, simpler (but sometimes harder) strategies, and some strategies more often than

others, executing strategies more poorly, selecting best strategies less often, and calibrating strategy choices to task constraints less systematically than young adults. These age-related differences in strategic variations are correlated with age-related differences in cognitive performance. Crucial to a deeper understanding of cognitive aging, and age-related changes in cognitive performance, are the sources of these strategic variations during aging. Previous research has shown that age-related differences in strategic variations are modulated by a variety of task parameters, such as strategy, participants, problems, and situation characteristics.

Strategies differ in the number of processes they include as well as the nature of these processes. Some processes are harder to trigger and execute. Therefore, relative strategy complexity is first determined by the number and nature of cognitive process strategies included. A strategy including more and/or harder processes will be taking more time to execute and might be harder to select appropriately. As seen above, aging effects are larger on more complex strategies.

Relative strategy complexity often does not act in isolation on age-related differences in strategic variations. It often interacts with other factors like participants' characteristics. One such participants' characteristic that has recently been greatly investigated is so-called cognitive reserve (Stern 2009). Cognitive reserve refers to the ability to cope with age-related structural and functional changes in the brain with larger neural recruitment to preserve functional abilities. Proxies of cognitive reserve include factors such as education or lifestyle, so that older adults with a better education have higher levels of cognitive reserve. Older adults with higher levels of cognitive reserve have been found to be better able to select the best strategies on each problem and to execute strategies more efficiently (Barulli et al. 2013). One important difference between older adults with high- and low-cognitive reserve concerns available processing resources (Salthouse 2010). Processing resources include working-memory capacities, processing speed, and some crucial executive (e.g., inhibition) and sensory (e.g., visual, auditory acuity) functions. Older adults

with high level of cognitive resources, who often obtain comparable cognitive performance relative to young adults, are also older adults with much less decreased processing resources than other older adults (Park and Reuter-Lorenz 2009). This enables them, for example, to be more efficient at inhibiting irrelevant information, disengaging more quickly from a just-accomplished task to engage in another task or from a just-executed strategy to activate and execute a new more efficient strategy, to be able to temporarily hold more information in working memory as well as to update content information within working memory, to quickly activate relevant information from long-term memory, and to execute cognitive processes more quickly.

Another participants' characteristic that has in some research been found to influence magnitudes of strategic variations during aging is age-related differences in metacognitive skills (Hertzog and Dunlosky 2004). Metacognition refers to cognition about cognition. This includes beliefs as well as knowledge about cognition and cognitive processes and monitoring processes. Such influence may include participants' belief that the selected strategy is the most efficient strategy leading them to not change strategy, independently of whether it is the better or poorer strategy, or the belief that they are unable to select the best strategy on most items leading them to not devote cognitive efforts to systematically try to select the best strategy on each item. It may also include lack of knowledge or partial knowledge of relative strategy efficacy either for a particular item or a set of items (e.g., concrete words are better memorized with mental imagery than with sentence generation). Finally, older adults may be poorer than young adults at performance monitoring, seen in their more poorly determining that they are not executing the selected strategy most efficiently.

Whichever process resources (metacognitive skills, expertise, processing speed, executive functions, working memory) enhance age-related changes in strategic variations, age-related differences in strategic variations, and as a consequence on cognitive performance, may be exacerbated in some situations (like when participants are tested

under high-speed pressures). Such situations usually place greater demands in processing resources, and these increased demands are larger in older adults because of their age-related decrease in available processing resources. Of course, there are individual differences in how greater demands in processing resources influence strategy use and strategy execution in older adults, as some older adults with larger available processing resources are less detrimentally affected by these situations than other older adults. Note that some situation characteristics can also be more beneficial to older adults' performance via greater use of most efficient strategies. To take just one example, instructions encouraging older adults to try to be the most accurate led them to increase their best strategy use relative to no accuracy pressure more often than young adults in arithmetic problem solving tasks.

## Conclusions

Age-related changes in cognitive performance are often accompanied by changes in how young and older adults perform cognitive tasks. When researchers have tried to understand cognitive aging by determining how young and older adults accomplish cognitive tasks, they have found age-related differences in what we called strategic variations (Lemaire 2010). These include strategy repertoire (or which strategies people use to accomplish a task), strategy distribution (or how often they use each available strategies), strategy selection (or how they choose among strategies on each item), and strategy execution (or how they apply each strategy).

In many cognitive domains and tasks, relative to young adults, older adults have often, though not always, been found to use fewer strategies, simpler (though sometimes more complex) strategies, and simpler strategies more often than harder strategies, execute available strategies more poorly especially harder strategies, and select strategies less appropriately (leading them to select the best strategy on each item less often and less systematically) (Uittenhove and Lemaire

2015). These strategic variations during aging are exacerbated in some situations (e.g., like when young and older adults are tested under speed pressures) and in some participants (with some older adults showing patterns of strategic variations close to young adults and other older adults showing poorer strategic behaviors).

One of the crucial underlying features of exacerbated poorer strategic behaviors in older adults seems to be how older adults' available processing resources match demands in processing resources made by the task environment. In some situations, for some items, and for some strategies, the demands in resources will exceed older adults' available resources and more so for some older adults who have low level of cognitive reserve. This leads older adults to be poorer at selecting the best strategy and at efficiently executing strategies, to use fewer strategies, and/or to use the simpler (though less efficient) strategy most often. In other words, age-related changes in strategic variations seem to be a consequence of age-related changes in processing resources. At a more general level, if as often assumed in cognitive sciences, the brain is an optimizing device (i.e., a device that tries to optimize deployment of available resources to cope with necessary demands to successfully accomplish cognitive tasks); age-related changes in strategic behaviors suggest that the brain remains an optimizing device throughout life.

## Cross-References

- ▶ [Cognition](#)
- ▶ [Cognitive Control and Self-Regulation](#)
- ▶ [Psychological Theories of Successful Aging](#)

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## Ageing in a Community Environment Study (ACES) Cohort

Lei Feng

Department of Psychological Medicine, Yong Loo Lin School of Medicine, National University of Singapore, Singapore, Singapore

### Definition

#### Aging

There is no consensus on the definition of aging. Researchers and disciplines define aging differently and often disagree with each other. Based on Kirkwood, aging is defined as a progressive, generalized impairment of function, resulting in a loss of adaptive response to stress and in a growing risk of age related disease. The overall effect of these changes is summed up in the increase in the probability of dying, or age-specific death rate, in the population (Kirkwood TBL 1995). The author of this chapter agrees with Kirkwood's thesis as this definition best suit the context of community-based prospective cohort study.

### Introduction

An aging population with increased life expectancy is leading to higher healthcare spending and an increased expenditure in long-term care. Singapore is one of the fastest aging countries in the world. By 2030, it is projected that 1 in 4 Singaporeans will be 65 years or older with only 2 working adults supporting each elderly resident. The country's healthcare system has to face a growing attendance of elderly with a range of comorbid disorders that may lead to greater physical disability, functional impairment, and subsequent dependency. High quality data are urgently needed for a better understanding of aging and aging-related processes among community-living senior Singaporeans. The Ageing in a Community Environment Study (ACES) is a longitudinal cohort study of community

dwelling elderly Singaporeans that aims to: (1) study the markers and predictors of healthy and functional aging in a community environment; (2) describe the trajectories of cognitive and physical function decline in normal and abnormal aging; (3) identify modifiable risk and protective factors such as diets and life styles for the prevention of cognitive decline, dementia, depression, frailty, and disability.

## Method

ACES is a community-based longitudinal cohort study. Baseline recruitment was started in July 2011 and will be completed by the end of 2016. Subjects are recruited through door-to-door census from Jurong area of Singapore. Inclusion criteria are: (1) Singaporeans or Permanent Residents aged 60 years and above and (2) able and willing to provide written informed consent. Interviews and assessments are performed at a community-based study center in Jurong Point Shopping Center: the Training and Research Academy at Jurong Point (TaRA@JP). ACES cohort has recruited and assessed over 950 study subjects as of 31 December 2015. The first follow-up of the cohort was started in July 2015 and will be completed by the end of December 2019.

## Procedures

There are six study visits at ACES baseline. The *first* study visit involves questionnaire interview and physical performance assessments: (1) Demographic data; (2) Self-rated overall health and health changes; (3) Medical conditions, medications, and supplements; (4) Depression symptoms: the Geriatric Depression Scale (GDS); (5) Anxiety symptoms: the Geriatric Anxiety Inventory (GAI); (6) A Food Frequency Questionnaire (FFQ); (7) Attitude and knowledge of healthy diet; (8) Physical performance: handgrip strength and 6-m walking speed test; (9) Personal and Parents' Parenting Style; (10) Subjective cognitive impairment: the Perceived Deficits Questionnaire (PDQ); and (11) Mini-Mental State

Examination (MMSE). The *second* study visit involves cognitive tests, mental health, and clinical measures: (1) Montreal Cognitive Assessment (MoCA); (2) Repeatable Battery for the Assessment of Neuropsychological Status (RBANS); (3) The Global Mental Health Assessment Tool (GMHAT); (4) Brief Informant Screening Test (BIST); (5) Pittsburgh Sleep Quality Index (PSQI); (6) Vital Signs: blood pressure, pulse rate, body temperature; and (7) the collection of stool sample. Trained medical assessors conduct detailed neurocognitive assessment for all participants who obtained a MMSE total score lower than education specific cutoff values ( $\leq 27$  for subjects without formal education,  $\leq 28$  for primary school education level, and  $\leq 29$  for secondary school and above) or a preliminary diagnosis of dementia based on GMHAT. This will take place at the *third* study visit. The assessment session consists of history taking, brief physical examination, Clinical Dementia Rating (CDR), and a battery of standard neuropsychological tests. Qualified medical assessors conduct psychiatric assessment on participants who have a GDS total score  $\geq 3$ , or a GAI total score  $\geq 5$ , or a preliminary diagnosis of depression/anxiety disorder based on GMHAT. This takes place at the *fourth* visit. The assessment session consists of history taking, and selected modules from the Structured Clinical Interview for DSM Disorder (SCID). All participants who are eligible for neurocognitive assessment or psychiatric assessment are invited to the study center (the *fifth* study visit) for blood sample collection. Regular case conferences are held to obtain consensus diagnosis of dementia, mild cognitive impairment, depressive disorders, and anxiety disorders. Subjects with mild cognitive impairment and age-gender matched controls are selected for the *sixth* study visit as a substudy that focuses on the role of biological markers such as telomere length, oxidative stress, inflammatory cytokines, fatty acids, oxylipins, plant-based bioactive compounds, etc. A total 19 ml blood sample is collected from each subject following standard venipuncture procedure.

At the first follow-up of the ACES cohort, each subject has three sessions of assessment with the

study research nurse or research associate/assistant. The first session (study visit 1) involves questionnaire-based interview on demographics and life styles, clinical measurements (weight, height), screening tests (Geriatric Depression Scale, Geriatric Anxiety Inventory, Mini-Mental State Examination), and physical performance assessment (hand grip strength, 6-m walking speed test, Timed Up and Go Test). Within 2 weeks after the first visit, venous blood and urine are collected from the subjects. Trained research staffs will conduct neurocognitive assessment at the third visit. The assessment session consists of Clinical Dementia Rating (CDR) and a battery of standard neuropsychological tests. Brain magnetic resonance imaging (MRI) are provided to selected subjects who are diagnosed with amnesic mild cognitive impairment or early Alzheimer's diseases, and age-gender matched controls.

## Measures

A brief summary of psychology-related measures in the study protocols are provided as follows:

The 15-item version of the Geriatric Depression Scale (GDS) is used to index the level of depression (Sheikh and Yesavage 1986). This version of the GDS consists of 15 yes/no questions – each worth a point, giving a maximum possible total score of 15. This version has been validated and has demonstrated good psychometric properties in the local context.

The Geriatric Anxiety Inventory (GAI) is used to index the level of anxiety (Pachana et al. 2007). There are 20 agree/disagree items in the GAI, each is worth a point, giving a maximum possible total score of 20. The GAI was validated and has shown good psychometric properties in a similar Asian population.

Sleep-related variables are assessed by the Pittsburgh Sleep Quality Index (PSQI) (Buysse et al. 1989). The PSQI, consisting of 19 questions, assesses sleep components such as sleep duration, sleep latency, sleep disturbance, sleep efficiency, quality of sleep, daytime dysfunction, and use of sleep medications. Each of these is scored from

0 to 3; a global score is obtained by totaling the component scores.

Modified local versions of the Mini-Mental State Examination (MMSE) (Feng et al. 2012) and the Montreal Cognitive Assessment (MoCA) (Liew et al. 2015) are administered as global measures of cognitive function. The MMSE consists of 11 items across cognitive domains such as orientation, memory, attention, and language. The test has a maximum score of 30 with higher scores corresponding to better cognition. The MoCA is a brief cognitive screening tool that assesses cognitive functions in the domains of visuo-executive, naming, attention, language, abstraction, delayed recall, and orientation. The MoCA is scored on a 30-point scale and higher scores correspond to better cognitive status.

Subjective cognitive complaints (SCC) are assessed using the Perceived Deficits Questionnaire (PDQ) (Sullivan et al. 1990). This scale consists of 20 items making up 4 subscales: attention/concentration, retrospective memory, prospective memory, and planning/organization. Subjects are asked to rate on a Likert scale (“0” never, “1” rarely, “2” sometimes, “3” often, “4” almost always) how often they experienced each cognitive problem during the past 4 weeks. Individual item ratings are summed to produce four subscale scores ranging from 0 to 20 and a total score ranging from 0 to 80, with a larger score indicating higher severity.

The Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) is administered as a short battery of cognitive tests (Lim et al. 2010). The battery consists of 12 subtests across 5 indexes: (1) Immediate memory – list learning and story memory; (2) Visuospatial/Constructional – figure copy and line orientation; (3) Language – picture naming and semantic fluency; (4) Attention – digit span and coding; and (5) Delayed memory – list recall, list recognition, story memory, and figure recall. The tests thus yield subtest scores, index scores, and total scaled scores. Individuals were tested with form A of the RBANS. This battery of tests had previously been normed on elderly Chinese in Singapore.

A standard neuropsychological test battery is used to provide more detailed information on

major cognitive domains that decline in aging (Feng et al. 2006, 2009a, 2010). In the Rey Auditory Verbal Learning Test (RAVLT), the examiner reads a semantically unrelated word list (list A) to the examinee in a series of five trials. After each learning trial, the examinee is asked to repeat all the words he or she can remember (RAVLT immediate recall). A second distracter word list (list B) is then presented. In Digit Span Forward, the examiner reads strings of numbers in series with increasing length, and the examinee is asked to repeat the string in the exact order. In Digit Span Backwards, the examinee is asked to say the strings in reverse order. The Color Trails Test (CTT) uses numbered colored circles and universal sign language symbols. For the Color Trails 1 trial, the examinee uses a pencil to rapidly connect circles numbered 1 through 25 in sequence. For the Color Trails 2 trial, the examinee rapidly connects numbered circles in sequence, but alternates between pink and yellow colors. For the Block Design test, the examinee is asked to replicate models or pictures of two-color designs with blocks. The designs progress in difficulty from simple two-block designs to more complex, nine-block designs. Rey Auditory Verbal Learning Test (RAVLT)–Delayed Recall & Recognition: The examinee is asked to recall all the words he or she can remember from list A again (RAVLT delayed recall), followed by the recognition task in which the examiner read aloud a list of 50 words (this list included words from both list A and B and words phonemically or semantically related to them) from which the participants had been instructed to identify the words in list A. In the Verbal Fluency test, the examinee is asked to produce as many words as possible in 1 min from a defined category (the category is animal for this study). In the Boston Naming Test, the examinee is told to tell the examiner the name of each of a series of pictures. The examiner writes down the patient's responses in detail, using codes. In the written version of the Symbol Digit Modalities Test (SDMT), the examinee is asked to write as many numbers as he or she can in the boxes below a series of symbols according to the key provided at the top of the page within 90s. In the oral version,

the examiner records the numbers spoken by the subjects.

A local version of the Clinical Dementia Rating (CDR) scale is used to assesses the severity of dementia (Feng et al. 2009b), with CDR global score 0 = dementia, 0.5 = questionable dementia, 1 = mild dementia, 2 = moderate dementia, and 3 = severe dementia.

## Results

Table 1 presents a summary of demographic and psychological characteristic of the first 900 participants from the ACES cohort. There are more female subjects in this cohort and the years of formal schooling is only 6.06 years. The subjects obtained higher scores on MMSE as compared to MoCA. They reported 1.38 depressive symptoms and 1.15 anxiety symptoms on average.

The study team and collaborators are currently working on over 20 original research articles using data from cohort baseline. Research topics include sleep problems, mild cognitive impairment, subjective cognitive complaints, handedness, depression, anxiety, dietary patterns, nutrients intake, etc. Selected results from current analysis shows:

1. Geriatric Depression Scale and Geriatric Anxiety Inventory scores were both significantly correlated with sleep disturbance (Yu et al. 2015). Geriatric Depression Scale

**Ageing in a Community Environment Study (ACES) Cohort, Table 1** Demographic and psychological characteristics of the study sample

Variable	Value
Age, mean (SD)	68.01 (5.83)
Female,%	66.9
Years of education	6.06 (4.24)
MMSE score	27.9 (2.47)
MoCA score	25.5 (4.01)
GDS score	1.38 (1.93)
GAI score	1.15 (2.47)

scores were uniquely associated with daytime dysfunction, and Geriatric Anxiety Inventory scores were uniquely associated with perceived sleep quality, sleep latency, and global Pittsburgh Sleep Quality Index scores.

2. Subjective Cognitive Complaints (SCC) were associated with older age, lower education level, poorer perception of current and past health, greater number of medical problems, and lower cognitive activity in elderly Chinese Singaporeans. Of these, poorer perception of current health showed the best prediction. SCC was not found to be related to current cognitive impairment, depressive, or anxiety status.
3. The accuracy of detecting mild cognitive impairment was significantly improved when results from multiple tools and demographic information were included in the statistical model. Area Under Curve (AUC) value of the best model was 0.91; the predictors in this final model were MMSE score, MoCA score, Perceived Deficits Questionnaire (PDQ) score, age, gender, race, education, and years of schooling.
4. There were 121 MCI cases and 20 dementia cases from the first 936 subjects (Table 2). The prevalence rate of nonamnestic MCI was higher than that of amnestic MCI. The relative low rate of dementia reflects selection bias as only those who were able to provide written informed consent and visit our study center for interviews and basements were enrolled into the study cohort. So, moderate and severe dementia cases were naturally excluded.
5. The prevalence rates of psychiatric disorders were relatively low: 1.1% for depressive disorders, 0.3% for anxiety disorders, and 0.7% for all other disorders such as mixed anxiety depressive disorder, adjustment disorder, mood disorder due to a general medical condition, etc. Again, the low prevalence rates reflect selection bias as individuals with severe psychiatric disorders were excluded from taking part of the research study.

**Ageing in a Community Environment Study (ACES) Cohort, Table 2** The prevalence of MCI, dementia, and other psychiatric disorders

Diagnosis	N	Prevalence rate <sup>a</sup> (%)
Amnestic MCI	46	4.9
Nonamnestic MCI	65	6.9
MCI – subtype not specified <sup>b</sup>	10	1.1
Dementia	20	2.1
Depressive disorders	10	1.1
Anxiety disorders	3	0.3
Other psychiatric diagnoses	7	0.7

<sup>a</sup>Prevalence rates were calculated using 936 as the denominator based on the last assessed subject

<sup>b</sup>Subtype of MCI was not determined because subjects refused neuropsychological assessments

## Future Plan

A subgroup of subjects from the ACES cohort will join the SG70 Community Ageing Cohort which will be formed in 2017. Deep, longitudinal phenotyping and biosampling will be instituted on a regular basis. The SG70 Community Ageing Cohort will allow the validation of the biological signatures of healthy aging identified in an oldest-old cohort – the SG 90 Longevity Cohort, – as well as providing a platform for further discovery in science. Selected subjects will undergo further tissue biopsies for nested case–control studies.

## Cross-References

- ▶ [Alzheimer’s Disease, Advances in Clinical Diagnosis and Treatment](#)
- ▶ [Mild Cognitive Impairment](#)

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## Aging, Inequalities, and Health

Victoria Liou-Johnson<sup>2,3</sup>, Katie Van Moorleghe<sup>2,4</sup>, Brent Mills<sup>2,4,5</sup> and Ruth O'Hara<sup>1,2,6</sup>

<sup>1</sup>Department of Psychiatry and Behavioral Sciences, Stanford University School of Medicine, Stanford, CA, USA

<sup>2</sup>Sierra Pacific Mental Illness Research Education and Clinical Center, VA Palo Alto Health Care System, Palo Alto, CA, USA

<sup>3</sup>University of California, San Francisco, CA, USA

<sup>4</sup>Palo Alto University, Palo Alto, CA, USA

<sup>5</sup>Veterans Affairs Palo Alto Health Care System, Palo Alto, CA, USA

<sup>6</sup>School of Psychology, The University of Queensland, Brisbane, QLD, Australia

## Synonyms

Ageism; Aging; Aging stereotypes; Older adult discrimination; Older adult health disparities; Older adult stereotypes

## Definition

Aging, according to the Oxford English Dictionary, is defined by the process of getting older, the process of making something appear older than it is, or in reference to something that has reached the end of its usefulness ([Oxford English Dictionary n.d.](#)). “Ageism” refers to discrimination of a person based on age, and in the context of this chapter, to the discrimination of older adults, this is also sometimes called, “gerontophobia.” In Western society, and especially the United States, it is commonly accepted that the greater society is youth oriented, and thus, older adults are less respected ([Hillier and Barrow 2011](#); [Nelson 2002](#)). Stereotypes refer to beliefs and opinions

about people or groups, which may stem from personal experience or societal beliefs. The act of stereotyping may come from a basic need for categorization important for survival; however, stereotypes are often inaccurate, oversimplifications of individual characteristics, as in the case of older adults. Stereotypes are often negative and harmful, causing discrimination toward older adults (Hillier and Barrow 2011). Inequality refers to a difference between the ways in which people, in this case, older adults are treated from other segments of the population. For older adults, inequalities may be based on stereotypes regarding aging but may also be perpetrated between groups of older adults (Hillier and Barrow 2011).

## Background

In modern industrialized nations, humans now live longer than ever before. During the early 1900s, the average life expectancy was between 47 and 55 years (Stuart-Hamilton 2006). In just 100 years, life expectancy has increased on average by 30 years (Aging 2012). This is due, in part, to a better understanding of sanitation but also due to medical and technological advances. Older adults, aged 65 and older, make up an increasing percentage of the world's population, yet negative attitudes toward and stereotypes surrounding older adults, their role in society, and the aging process have sustained. Older adults are more likely than other age groups to experience inequalities on a daily basis, including in healthcare, largely due to age stereotypes and "ageism," an accepted and systemic form of discrimination (Butler 1969; Hillier and Barrow 2011; Nelson 2002, 2015; Stuart-Hamilton 2006). Although stereotypes, whether positive or negative, may not overtly seem harmful, they can negatively impact the way other people interact with older adults and subsequently create additional psychological and medical problems (Hillier and Barrow 2011; Schaie and Willis 2011).

## Aging Stereotypes

When one thinks of older adults, one is bound to think of grandparents or other older adults who have made an impression on his or her life, whether positive or negative; these experiences are likely to be the basis of some stereotypes of older adults. In addition, pervasive messages in popular media promote "age reversing" products and send the message that aging is undesirable. Younger adults who may not have had as many interactions with older adults may often form their impressions of older adults based on caricatures of older adults in television, movies, or print. Limited interactions with older adults, coupled with images presented in the media, may shape a young adult's understanding of older adults completely and may be the difference between an affinity for and or aversion to older adults.

Stereotypes of aging begin in childhood as people begin to develop expectations about their own aging. These stereotypes can be carried into adulthood, where the stereotypes are reinforced by the predominantly negative stereotypes present in North American and European cultures (Levy 2003). Older adults still hold these negative stereotypes formed in childhood and have been found to hold the same negative views of aging as young- and middle-aged adults (Cavanaugh and Blanchard-Fields 2002). Age stereotypes often surround how an individual will function physically, emotionally, and cognitively as an older adult. As such, it is possible that chronic activation of these stereotypes can affect how an older adult actually functions (Levy 2003). Generally, when speaking of stereotypes, negative stereotypes are the first to come to mind and are the most common (Nelson 2002). There are, however, some "positive" stereotypes associated with older adults.

Three main "positive" aging stereotypes have been identified in younger adults. These include the "golden ager," who is active, alert, capable, and independent; the "perfect grandparent," the older adult who is kind, loving, interesting, wise,

and family-oriented; and the “John Wayne conservative,” who is patriotic, religious, conservative, and proud (Schaie and Willis 2011, p. 250). While these ideals many not be viewed as inherently damaging, they may still influence the way younger people interact with older adults, nevertheless (Hillier and Barrow 2011; Schaie and Willis 2011).

The same set of studies identified four main “negative” aging stereotypes consistently reported among younger adults: the “severely impaired” older adult who is slow, incompetent, senile, or feeble; the “despondent” older adult who is depressed, sad, hopeless, and lonely; the “curmudgeon” who complains and is demanding, inflexible, ill-tempered, or prejudiced; and the “recluse” who is quiet, keeps to him- or herself, and is naïve. These stereotypes can negatively affect not only how others view and interact with older adults but how they view themselves (also referred to as “stereotype threat”).

### **Impact of Aging Stereotypes on Healthcare**

Aging stereotypes not only affect the way the general public view older adults but also how medical and mental healthcare providers and healthcare systems deliver services. Older adults are more apt to be labeled with conditions such as mild cognitive impairment, dementia, or depression than younger adults, even in the absence of strong evidence (Hillier and Barrow 2011). These perceptions are likely to affect the way that healthcare is delivered, sometimes causing more harm than good (Robb et al. 2002).

*Effects on Healthcare:* Healthcare providers are not immune to ageist stereotypes. They often fall into the trap of generalizing older adults to be difficult or noncompliant. This is suggested to be one of the reasons there is a shortage of medical and nursing students interested in focusing on geriatric medicine (Eymard and Douglas 2012; Kydd and Wild 2012; Nelson 2011). Many students in the medical field believe that older adults are more difficult to treat, despite training to improve attitudes toward them (Eymard and

Douglas 2012). Additionally, some studies have shown that providers believe that caring for older adults is somehow less technical, less interesting, or more depressing, even though clinicians who work primarily with older adults overwhelmingly agree that they are a fulfilling and rewarding population to work with (Eymard and Douglas 2012; Kydd and Wild 2012). On these grounds, many medical programs have done away with geriatrics programs, instead relying upon one or two courses in medical school to provide didactics on older adult issues

Inaccurate views of older adults have been suggested to negatively impact their ability to access care or, at the very least, access equal care (Nelson 2015; Kydd and Wild 2012; Eymard and Douglas 2012). Many studies have shown that older adults receive unequal care when compared to younger adults (Robb et al. 2002). This type of discrimination occurs across medicine specialties such as oncology, endocrinology, or surgery, to name a few. In many cases, diagnostic testing is not provided to adults over the age of 75 (Robb et al. 2002). This has been attributed to the belief that it would be a “waste” of resources to treat someone who seems to be near their end of life (Kydd and Wild 2012; Robb, Chen, and Haley 2002). Additionally, medical clinicians are more apt to spend less time with older adults, in part due to age bias, increasing the risk of over- or underdiagnosing, which would also lead to an inadvertent withholding of treatment (Robb, Chen, and Haley 2002).

Additionally, research has shown that a lack of training in the area of geriatric pharmacology may lead to medication errors and adverse medication interactions (Keijsers et al 2012). This fear may result in physicians withholding medications especially in older adults with chronic conditions, such as diabetes or emphysema. Older adults with chronic conditions are often denied treatment for unrelated disorders due to a fear of drug interactions; however, this is often an overreaction and alternate formulations may usually be found (Robb et al. 2002). Furthermore, in an extensive review of geriatric pharmacology training, it was found that very little specific training is made in this area, and even though interest in

pharmacology has increased, interest in geriatric pharmacology has not (Keijsers et al. 2012).

While there is an overall disparity between care provided to older adults and that for younger aged adults, this may not be due simply to a negative attitude toward older adults. Lack of experience with older adults is also a contributor. Some medical programs have attempted to combat geriatric-related medicine by incorporating didactics aimed at increasing awareness and exposure to older adults through experiential learning (Robb et al. 2002). Even when there is a desire to work with older adults, there is a paucity of training in geriatric medicine and a lack of opportunity to learn about issues that older adults may face. Compounding this problem is the fact that formerly required courses in geriatric medicine have been discontinued and the Accreditation Council for Graduate Medical Education (the governing body which oversees postgraduate medical training) cited geriatric medicine training as one of the top ten areas that lack compliance (Bragg and Warshaw 2005).

*Effects on Mental Healthcare:* Medical professionals are not the only ones who are susceptible to age stereotypes; mental health professionals may also fall into the same trap (Eymard 2012; Nelson 2011).

While older adults experience many of the same emotions as younger adults, there are unique factors that generally affect older adults more than other age groups. For example, they tend to experience more loss than other age groups and are likely to have more comorbid medical diagnoses than younger adults (Butler et al. 1998; Robb et al. 2012). Although sadness, grief, and depressive reactions in older adults can increase in frequency with the increases in loss (Butler et al. 1998), it has also been shown that as adults age, they focus more selectively on positive interactions, relationships, and experiences to regulate emotions and compensate for negative experiences (Carstensen, Isaacowitz, and Charles 1999). A prevailing stereotype about older adults is that they are more prone to grief and depression or are more likely to isolate themselves (Siegel 2004), which may influence the way that mental healthcare professionals approach working with older adults.

Aging stereotypes are also apt to influence the way that psychological researchers design research studies, as well as the way results are interpreted. For example, many past research studies indicated that older adults were more prone to depression, causing many mental health providers to believe that rates of depression among older adults were greater than other age groups, a view still commonly held today. However, once factors such as gender and socioeconomic status were adjusted for, older adults had significantly lower rates of depression than other age groups (Hillier and Barrow 2011). This is an important point because if researchers are subject to implicit stereotypes of older adults, they will be unlikely to combat these unsubstantiated points of view. Thus, it is important that clinicians and researchers are aware of their own biases, to reduce the likelihood of psychiatric misdiagnosis.

However, even when psychiatric symptoms are correctly diagnosed, age stereotypes can contribute to suboptimal treatment for older adults (Butler et al. 1998). Mental healthcare providers may believe that older adults are more difficult to work with and have a biased view about their presenting symptoms (Siegel 2004). Older adults are often viewed as “stubborn,” “set in their ways,” and “resistant to change.” Similarly, they may be viewed as unresponsive and incapable of self-reflection (Butler et al. 1998) or unwilling to participate in psychotherapy (Robb et al. 2002). Although adult personality is relatively stable, older adults show an ability to change and adapt, and healthy aging has been characterized by flexibility, resourcefulness, and optimism (Butler et al. 1998). Some studies have found that mental healthcare providers, when presented with vignettes of different aged clients, preferred to work with younger clients and often had significantly more negative reactions toward the older adults client (Robb et al. 2002). These implicit biases are likely to cause a barrier for the provider to be open and willing to make a therapeutic bond with his or her patient (Eymard 2012). Older adults are, in fact, capable of actively participating and making meaningful changes in psychotherapy.

Additionally, chronic medical conditions and illnesses can also affect psychological

functioning, given the close association between medical and psychosocial problems (Cavanaugh and Blanchard-Fields 2002; Nelson 2002). Being the first point of contact for many older adults, primary care providers are often responsible for diagnosing older adults with psychological disorders or syndromes, rather than a mental health professional (Nelson 2002). Accordingly, they are also responsible for mental healthcare treatment decisions, and as a result referrals to psychologists or psychiatrists are not regularly made (Nelson 2002). Primary care providers may view reactive emotional responses as symptoms of a chronic and untreatable state (Butler et al. 1998), causing them to over-pathologize symptoms. For example, medical providers are more likely to confer diagnoses of dementia or psychosis on older adults than on younger adults (Butler et al. 1998; Robb et al. 2002). As a consequence, older adults may not receive the appropriate medical and/or mental health treatment.

Finally, inequalities in healthcare also occur within groups of older adults, with evidence of gender inequality in particular. Psychological diagnoses may be informed by gender stereotypes, which can be compounded over a lifetime as one ages (Hillier and Barrow 2011). These issues are likely to result in misdiagnoses, with disproportionate numbers of older women being diagnosed with a psychiatric disorder (e.g., psychoses), when compared to men of similar age (Robb et al. 2002).

*Effects on Health Insurance:* Health insurance fees, which tend to increase with worker age, can constitute a high cost for retaining older workers. Thus, the older worker can be quite vulnerable in a tight labor market, particularly during times of recession. However, as more data is collected and analyzed on health patterns in the workforce, the evidence finds that older adults may cost no more in medical benefits than younger employees. Use of sick leave is also more highly correlated with lifetime patterns developed at a young age than with age itself, again not supporting the stereotypical view of the older adult as subject to illness and absenteeism. However, despite the accumulating evidence to counter the negative stereotypes of older adults in the

workforce, and legal safeguards, age discrimination is often difficult to establish and many cases are not proven (Hillier and Barrow 2011).

Most older adults, in the United States, utilize government insurance programs such as Medicare or Medicaid to help pay for medical care. While this is a helpful service, these programs only cover a specific dollar amount for very specified services and medications. This can cause difficulties if specialty services are required. Some reports indicate that medical care providers may exaggerate claims for services or may order more tests than are needed in an attempt to recoup costs because of the small percentage reimbursed by Medicare or Medicaid, for medical services (Hillier and Barrow 2011). However, this misuse of government-subsidized insurance contributes to tighter regulations of the types of services that Medicare and Medicaid is willing to pay for, which may reduce the care that older adults can access, again, putting them at risk. Some older adults may be able to afford supplemental insurance to cover services and medications that are not accepted by Medicare or Medicaid. However, the cost for supplemental policies is often greater than the benefit received. Additionally, the increasing number of older adults also taxes this system, again, decreasing the per service fee that is paid by Medicare or Medicaid and decreasing access for those older adults who cannot afford to purchase supplemental insurance (Hillier and Barrow 2011).

## Conclusions

It is important to consider the role of how one thinks of older adults, whether implicitly or explicitly, as these ideas may interfere with, or affect, treatment of one's clients or patients. Even the most "well-meaning" stereotypes (e.g., the sweet grandparent or the stoic older adult) may lead to inequalities in care and therefore may lead to preventable detrimental effects. Many studies have shown the effectiveness of geriatric education and/or clinical experiences in changing attitudes of care providers toward older adults. Often times, it is a lack of knowledge or experience with

older adults that creates a reliance upon stereotypes. Time and again, research focused on this area has indicated that didactics and experiential exercises focused on interactions with older adults combat against ageist stereotypes and can change the attitudes of students and clinicians, alike. As a large proportion of the world's population become older adults, focused training on the specific issues that older adults face will be in increasing demand. Additionally, an increase in positive experiences during training programs with older adults, coupled with clinicians specializing in gerontology and/or geropsychology moving into mentorship roles, will prove to be valuable resources and may help to increase the numbers of future clinicians and researchers focused on older adults.

## Cross-References

- ▶ [Age Stereotyping and Discrimination](#)
- ▶ [Attitudes and Self-Perceptions of Aging](#)

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## Agnosia and Related Disorders

Ekaterina Staikova

Emory University Brain Health Center, Atlanta, GA, USA

## Synonyms

Disorders of recognition, disconnection syndromes

## Definition and Background

Agnosias are relatively rare disorders of recognition that can be described as the brain's inability to interpret information received through various sensory channels. By definition, inability to identify a stimulus occurs in the absence of primary sensory deficit. Patients with agnosia have intact vision, hearing, etc. In addition, agnosia cannot be explained by attentional disturbance, language disturbance, general cognitive impairment/dementia, or lack of familiarity with the stimulus. The term "agnosia" was coined by Freud (1891); however, recognition deficit had been described prior to him and referred to as "asymbolia" (Finkelburg 1870), "imperception" (Jackson 1876), and "mindblindness" (Munk 1881). The conceptualization and interpretation of agnosias changed over time as a function on existing models of perception. For example, Lissauer (1890) described two stages of recognition: apperception, which involves constructing visual attributes into a whole, and association, which involves linking the content of perception to semantic knowledge. Based on this model, he distinguished between apperceptive and associative agnosias. In the former, failure in recognition results from some impairment in perceptual representation of the stimulus, although at a higher level than sensation. In other words, patients cannot synthesize what they see into a whole. As a result, they are unable to copy a stimulus or match a sample. Associative agnosia, in contrast, is characterized by failure in recognition despite preserved perceptual representation due to inability to attribute meaning to the correctly perceived stimulus. Patients with associative visual agnosia are able to copy a stimulus but not identify what they copied. Despite preserved copy, there is evidence that perception is not entirely normal in patients with associative agnosia (Farah 2004). Patients often present with visual field deficits, most commonly right homonymous hemianopia. Lissauer also posited that focal lesions and combinations of focal lesions could impair visual, auditory, or somatosensory perception or recognition without affecting these abilities in other modalities. Geschwind (1965) defined agnosia as

a disconnection syndrome. He posited that recognition involves matching perception input to stored knowledge and that agnosia results from disconnection between visual (perceptual) and verbal processes. Geschwind argued, for example, that left mesial occipital lobe damage not only results in right homonymous hemianopia but also prevents visual input perceived by the intact right hemisphere from reaching verbal areas. While disconnection models are compelling, they cannot explain all agnosia syndromes (Catani and Ffytche 2005). The advancement in cognitive neuroscience and neuroimaging technology allowed better understanding of processing networks involved in recognition. New data suggest that it is not necessarily a two-step process but includes parallel processing at cortical and subcortical levels. For instance, Damasio (1989) suggested that perception involves activation of specific neural patterns combined in "convergence zones." He believed that recognition results from activation of neural patterns in a time-locked fashion in response to a specific stimulus.

## Agnosia Types

Agnosias can occur in all sensory systems but are typically modality specific, meaning that while recognition through a particularly sensory modality is impaired, recognition through other sensory channels is intact. For example, patients with visual agnosia would not be able to recognize an object placed in front of them. However, they would be able to pick it up and to identify it through the tactile modality, the sense of touch, once they are holding it. Within each modality, recognition deficits can be general or specific, involving a whole semantic class or individual items within a class.

Visual agnosias are the most common agnosia type defined as inability to identify visually presented material. The impairment can be specific to objects (object agnosia), colors (color agnosia), faces (prosopagnosia), or words (pure word blindness). Each of these conditions may occur in isolation or in various combinations.

The distinction between apperceptive and associative visual agnosias remains useful. Apperceptive visual agnosia usually results from diffuse posterior damage to occipital lobes and surrounding areas, while associative visual agnosia involves left or bilateral inferior occipitotemporal lesions. Both have been associated with carbon monoxide poisoning, mercury intoxication, cardiac arrest, bilateral cerebrovascular accident (CVA), basilar artery occlusion, or bilateral posterior cortical atrophy.

Patients with color agnosia are unable to identify colors by naming or pointing to colors named by the examiner. Several color disturbance syndromes have been described. Central achromatopsia refers to the loss of color vision and is associated with lesion in the optic nerve or chiasm or unilateral or bilateral lesions in the inferior ventromedial sector of the occipital lobe. Color anomia refers to inability to name colors despite intact color perception. Another of visual-verbal disconnection syndromes originally described by Geschwind (1965), this deficit usually results from a lesion interrupting communication between visual cortex and language areas such as infarction in the left posterior cerebral artery. Specific color aphasia is seen in the context of aphasia, with disproportionate deficit in color naming. It usually results from left (dominant) parietal lobe lesions.

The term prosopagnosia, or face blindness, describes inability to recognize familiar faces, including one's own. While individuals with prosopagnosia are able to recognize that a face is a face and to describe some of its characteristics (e.g., beard), they are unable to identify a face by visual input alone. The deficit cannot be attributed to memory loss/dementia or Capgras syndrome, in which the patient believes that familiar persons have been replaced by imposters. Because patients can compensate by relying on voice and other non-facial characteristics, prosopagnosia can be unrecognized for a while and may not be revealed until a family member is encountered in a different context, in the absence of familiar cues. Prosopagnosia can also be more broadly characterized by difficulty identifying objects within a semantic category, which can include both living

beings and inanimate objects (Borenstein et al. 1969). Prosopagnosia is typically acquired and involves bilateral lesions to fusiform gyrus at the junction of occipital and temporal areas. Cases of unilateral lesions to both dominant and nondominant hemisphere have also been described, with greater impairment in right-sided lesions. Developmental/inherited cases have also been reported. Prosopagnosia has been interpreted as a visual-limbic disconnection syndrome. Supporting it is the fact that patients with prosopagnosia appear to have reduced emotional responsiveness to visual stimuli.

Another agnostic syndrome is agnosia for words, also known as pure alexia, alexia without agraphia, or pure word blindness. While it can be considered a linguistic impairment, most patients do not show impairment in other aspects of language. Alexia without agraphia is another example of a disconnection syndrome, wherein the left hemisphere is deprived of the visual input. It involves lesions in the dominant occipital lobe and the splenium of the corpus callosum.

Visual agnosia syndromes demonstrate that different brain structures and pathways are involved in processing of various aspects of visual stimuli. They also support the distinction into ventral and dorsal visual pathways (Ungerleider and Mishkin 1982) that involve different types of visual information. The ventral (what, how) stream projects to the inferotemporal cortex; is involved in the processing of color, texture, etc.; and plays a major role in constructing a perceptual representation of the visual world. Object and color agnosias and prosopagnosia result from damage to this pathway. The dorsal stream projects to the posterior parietal cortex and is involved in processing location, orientation, movement, and object parameters important for visual guidance of movement. Damage to the dorsal visual stream results in deficits in visual spatial processing. Simultanagnosia is often discussed among agnosias and refers to inability to process more than one object or aspect of objects at a time and consequently to integrate objects into coherent visual scenes (Kinsbourne and Warrington 1962). Other disorders of the dorsal visual stream include hemispatial visual

neglect, dressing apraxia, optic apraxia, and optic ataxia. The latter two and simultanagnosia are collectively known as Balint's syndrome.

Auditory agnosias involve impairment in recognition of sounds in the presence of adequate hearing. Verbal auditory agnosia, also known as pure word deafness, describes deficits specific to speech processing. Patients with this rare condition are unable to understand speech, while recognition of other sounds is preserved. The term "pure" refers to the freedom of aphasic symptoms, as reading, writing, and speech are relatively preserved. The disorder is typically associated with bitemporal lesions involving primary and secondary auditory association cortices but has also been documented in unilateral lesions of the dominant temporal lobe. Both lesions result in disconnection of auditory input from language areas of the left perisylvian cortex. While signs of aphasia might be present, the patients are able to recognize linguistic information when audition is not required (written language). Some patients may recognize foreign language and the person speaking but not the semantic content. Paralinguistic aspects of speech (prosody, intonation) can be preserved. Auditory agnosia or environmental sound agnosia is a very rare condition characterized by inability to identify nonspeech sounds. Perceptive-discriminative and semantic-associative forms have been described (Vignolo 1969), characterized by acoustic and semantic errors, respectively. Amusia describes agnosia specific to music perception and refers to inability to appreciate characteristics of heard music. Oftentimes, patients are no longer able to enjoy music. Specific deficits such as vocal amusia, loss of instrumental ability, or the ability to read and write music (musical alexia and agraphia) have been described (Midorikawa and Kawamura 2000). Interestingly, cerebral organization of musical ability depends on degree of experience and skill, with skilled and musically trained individuals more likely to rely on the dominant hemisphere and perceive music analytically. The term cortical deafness has been applied to patients with extreme lack of awareness of auditory stimuli of any kind. It is most

often seen in bilateral cerebrovascular disease affecting the primary auditory cortex. Phonagnosia refers to the loss of ability to recognize familiar persons by voice and is associated with right parietal lesions (Van Lancker et al. 1989).

Tactile or somatosensory agnosias include a less well-understood group of disorders that involve impairment in object recognition through touch that cannot be explained by sensory-motor disturbance. Similarly to visual and auditory agnosias, apperceptive (astereognosis) and associative dichotomy has been described (Wernicke 1895). Subtypes based on the specific features have been proposed. Thus, cortical tactile disorders involve deficits appreciating distinct attributes such as size or shape. There is no evidence of hemispheric lateralization, although spatial attributes are usually impacted in right hemisphere lesions. Lesions in the contralateral postcentral gyrus produce the most severe disorders of cortical tactile sensation, particularly when lesions occur in the hand area. Tactile agnosia refers to inability to identify objects placed in hand. It typically results from lesions to the parietal lobe, particularly primary somatosensory cortex (postcentral gyrus) and somatosensory association cortex. In the last decade, patients who would meet criteria for olfactory and gustatory agnosia have been described in the context of temporal resection for seizure control. The discussion of agnosia syndromes usually includes anosognosia, which refers to lack of awareness into one's deficit and is common in all sensory agnosias. Another similarity is that despite disability in direct object identification, many patients with agnosia demonstrate some knowledge about the stimulus, thus demonstrating implicit or "covert recognition."

### Assessment of Agnosia

When examining a patient with agnosia, it is important to rule out alternative explanations to a recognition deficit such as primary sensory deficit, inattention, aphasia or anomia, memory loss

or dementia, and lack of familiarity with the stimulus. Neuropsychological evaluation/neurobehavioral exam to assess general intellect, memory, linguistic competence, and sensory-perceptual processing is important. To rule out aphasia, it would be important to demonstrate comprehension of commands not requiring objects and the use of objects. Drawing might be impacted by constructional and visuomotor deficits. The possibility of confabulation may need to be considered. Referrals for sensory-perceptual testing (ophthalmologic, audiometric) may be needed. In the tactile domain, each hand should be assessed separately in the performance of basic somatosensory function and discrimination of weight, texture, shape, and substance. Once the presence of agnosia is determined, it is important to assess the nature and extent of the recognition impairment. The process of recognition is complex and includes a wide range of skills. Recognition can be assessed at different levels including the ability to overtly identify a stimulus, semantic knowledge about the object, and covert recognition, which can be shown by correct use in the absence of direct object identification. As discussed earlier, agnosias are usually modality specific. Thus, multimodal deficits are more likely to be due to other causes (Bauer 2009).

### **Agnosia and Neurodegenerative Illness**

The most common etiologies of agnosia are cerebrovascular accidents and traumatic brain injury followed by herpes simplex encephalitis (auditory agnosia), carbon monoxide poisoning (visual agnosia), and hypoxia. Progressive visual agnosia has also been associated with neurodegenerative disorders. Agnosia together with aphasia and apraxia is sometimes referred to as the “A triad” of deficits in Alzheimer’s disease (AD). Disturbances in basic visual, complex visual, and oculomotor functions have all been described in AD, and visuospatial difficulties are often reported by caregivers. Not surprisingly, visual system disorders have been associated with concentration of neuropathology in visual

association cortex. Mendez and colleagues (1990) found that 43% of community-based AD patients had visual complaints. Despite preserved visual acuity, patients showed impairment in recognition of objects (57%), famous faces, spatial locations, and complex figures. More severe dementia was associated with more complex visual disturbances.

Apperceptive visual agnosia is a core symptom of posterior cortical atrophy (PCA), neurodegenerative disease characterized by disproportionate atrophy or parieto-occipital cortex (Benson et al. 1988). The disorder is sometimes considered a variant of AD, and AD pathology is present in approximately 80% of cases. Other etiologies include Lewy body disease, subcortical gliosis, corticobasal degeneration, and prior disease. PCA is characterized by complex visual disturbances, including object agnosia, simultanagnosia, alexia without agraphia, and environmental agnosia. Basic vision remains intact, although visual field deficits may be present. Memory and other cognitive areas are usually preserved until later in the disease when symptoms of various dementia syndromes overlap. Early common symptoms include reading difficulty or difficulty reading an analogue clock. Associative visual agnosia can be observed in semantic dementia before disturbance in semantic memory. Visual spatial deficits can also be observed in other neurodegenerative disorders, as the disease process advances and impacts relevant brain structures and networks. Visual symptoms can occur in the absence of other cognitive deficits but are usually associated with greater dementia severity and contribute to functional impairment.

Patients with visual agnosia may not recognize and misuse common objects (e.g., use detergent instead of shampoo, not be able to use a key). They may misrecognize their surroundings and get lost, particularly in the context of any changes such as road construction or a new billboard sign. Driving for someone with visual agnosia presents significant safety concerns. Simultanagnosia is also associated with significant impairment. Patients are often functionally

blind and unable to navigate their environment. Simultanagnosia also impacts reading ability. Complex visual hallucinations are common in neurodegenerative disorders and usually suggest Lewy body pathology. Patients vary in the extent of visual system pathology and symptoms, and a comprehension interview and assessment are important both for characterization of specific challenges and for compensation strategies.

## Recommendations

While therapeutic success in treating agnosias is often limited by anosognosia, targeted recommendations may improve the quality of life and alleviate some of the difficulties and caregiver burden. Burns (2004) offered three categories of recommendations for agnosia, including alternate cues, verbal, and organizational strategies. Alternate cueing uses cues from other modalities. The rationale for using alternate cues is that agnosias, as discussed above, are modality specific. As such, relying on preserved information pathways may be beneficial. For example, for a patient with visual agnosia, feeling an object by touch may assist with recognition. Patients with pure alexia can learn to read through letter tracing tactually. Many patients with agnosia discover this strategy instinctively. For example, patients with prosopagnosia learn to recognize family members by the sound of their voice and other non-facial characteristics. Patients with pure word deafness may learn lipreading and rely on pragmatic (intonation, gestures) and contextual cues. Tactile cues, such as a piece of Velcro attached to the stove or the doorframe of an area the patient may wish to avoid, can be used to indicate danger. Similarly, soft fabric may be used to mark “friendly objects,” such as a telephone. Preserved aspects of object recognition within the affected modality may also be used. For example, if color recognition is preserved, color cues may assist patients with object visual agnosia. For example, red cues might be used to signal danger (e.g., stove), while green cues might signify

objects that are safe to use. Verbal descriptions may help patients with visual agnosia and simultanagnosia to recognize their surroundings such as a particular room in the home. Audio books might substitute reading for a patient with pure alexia.

Organizational strategies include any techniques aimed at organizing the patient’s living environment to increase their independence. For example, to organize closets, matching garments may be placed on the same hanger. Organizational strategies may be used in combination with alternate cues. For example, organizing clothing by different hangers may provide tactile cues. Color or tactile cues may be used to mark drawer contents. Pantry/refrigerator may be organized so that a patient learns the specific location of certain foods (e.g., fruits are always kept on the bottom shelf). For dementia patients, these strategies might need to be implemented by caregivers. Learning paradigms such as spaced retrieval training might be helpful to teach association between cues. Our search did not reveal any currently available commercial programs or applications for remediation of agnosia; however, this is certainly an area that might see development in the future.

To summarize, agnosias are rare disorders of recognition resulting from brain damage. Agnosias can be found in all sensory systems but are typically modality specific. While cerebrovascular accidents are the most common etiology, agnosias can also be a symptom of neurodegeneration. No disease-modifying therapies are available; however, compensatory strategies might improve patients’ quality of life and alleviate caregiver stress.

## Cross-References

- ▶ [Alzheimer’s Disease, Advances in Clinical Diagnosis and Treatment](#)
- ▶ [Cognition](#)
- ▶ [Cognitive Compensation](#)
- ▶ [Dementia and Neurocognitive Disorders](#)

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## Altruism and Prosocial Behavior

Jennifer C. Lay<sup>1</sup> and Christiane A. Hoppmann<sup>2</sup>

<sup>1</sup>The University of British Columbia, Vancouver, BC, Canada

<sup>2</sup>Department of Psychology, University of British Columbia, Vancouver, BC, Canada

## Synonyms

Benevolence; Charity; Civil service; Compassion; Cooperation; Generosity; Helping; Kind acts; Philanthropy; Selflessness; Self-sacrifice; Volunteering

## Definition

Prosocial behavior is voluntary, intentional behavior that results in benefits for another person. Such behavior is considered to be altruistic if it is motivated by a genuine desire to benefit another person, without any expectation of benefits to oneself (Feigin et al. 2014; Eisenberg and Miller 1987).

Prosocial behavior is the “social glue” that enables people of different ages to live together peacefully and productively. Specifically, prosocial behavior has been defined as “voluntary, intentional behavior that results in benefits for another person” (Eisenberg and Miller 1987, p. 92). The purpose of this entry is to examine motivators or antecedents of prosocial behavior, possible benefits or consequences for the helper, and how the underlying processes may differ across different phases of the adult lifespan.

Imagine the following scenario: For the past 38 years, Charlie, a consumer protection lawyer, has made pro bono work an important part of his law practice, working with disadvantaged clients making claims against large corporations. Early in his career, Charlie's track record of winning these pro bono cases earned him much prestige and was central to his success as an emerging professional. Although career building is no longer a concern for him, Charlie has continued providing free legal counsel to people who could not otherwise afford it and also to his extended family and friends. Being retired now, he gives legal aid to the people he feels close to and cares about, such as his grandson, who recently sought his counsel when suing a fraudulent credit union.

Prosocial behavior can come in many different forms, ranging from small acts of kindness, such as letting someone in a rush go ahead at the cashier, to more sustained acts, such as volunteering for a charitable organization, and even to things one might take for granted, such as looking after one's grandchildren. However, the above example clearly illustrates that motivations for engaging in prosocial behavior may change across the lifespan.

## Antecedents of Prosocial Behavior

There is strong evidence for systematic changes in prosocial behavior across the adult lifespan, suggesting that older adults behave more prosocially than young adults (Midlarsky and Kahana 2007; Sze et al. 2012). The next section reviews a spectrum of possible motivations for engaging in prosocial behavior, from genuinely psychological mechanisms to evolutionary accounts, examines potential age-related differences in these mechanisms, and reviews frequently chosen methodological approaches for studying them.

### Altruism

Social psychological theories often distinguish between altruistic and egoistic motivations for prosocial behavior. Altruistic behavior is typically thought of as the type of prosocial behavior that is

motivated by a genuine desire to benefit another person, without any expectation of benefits to oneself (Feigin et al. 2014; Eisenberg and Miller 1987). Coming back to the above hypothetical scenario, Charlie may be motivated to engage in pro bono work out of compassion for disadvantaged clients who particularly need his support. There is ongoing debate among psychologists over whether purely altruistic behavior does in fact exist (Feigin et al. 2014), and most researchers agree that prosocial behavior tends to also be driven by egoistic (non-altruistic) motivations. These can include a desire to feel good about oneself, to improve one's social standing (such as Charlie wanting to build a reputation at the beginning of his career), or to avoid uncomfortable feelings of sadness, anxiety, or guilt (Feigin et al. 2014; Penner et al. 2005).

Research seeking to disentangle altruistic from egoistic motivations of prosocial behavior typically uses experimental paradigms that manipulate aversive arousal, social evaluation, or rewards and link them to prosocial intentions, prosocial responses to hypothetical scenarios, or actual prosocial behavior (Penner et al. 2005). Furthermore, survey methods have been used to explore volunteering motivations including egoism and altruism (Konrath et al. 2012; Midlarsky and Kahana 2007).

### Empathy

An alternative approach to examining antecedents of prosocial behavior is to delineate the specific skills that enable individuals to understand complex social situations and behave prosocially. For example, individuals may be empathic (de Waal 2008) independently of whether their prosocial behavior is primarily altruistically or egoistically motivated. Hence, Charlie might have offered pro bono services over the years because he is the kind of person who has a very sensitive radar for other people's needs.

A large body of research has investigated the empathy-altruism link across species, including humans (Feigin et al. 2014), suggesting that there may be an evolutionary basis for this ability (de Waal 2008). In humans, emotional empathy, defined as a merging of emotional contagion and

compassion, seems to be particularly closely associated with prosocial behavior (Eisenberg and Miller 1987). Unlike cognitive empathy (the ability to engage in perspective-taking), emotional empathy has been shown, in cross-sectional but not in longitudinal research, to be higher in older adults than in younger adults and seems to account for age-related differences in prosocial behavior (Grühn et al. 2008; Sze et al. 2012). This increased emotional empathy in today's cohort of older adults, as compared to young adults, may reflect older adults' desire to help others and engage in emotionally meaningful experiences or age-graded cultural expectations to recognize and fulfill others' needs (Sze et al. 2012). Emotional empathy is frequently assessed via physiological arousal (skin conductance, heart rate), nonverbal emotional cues (facial movements, gestures, vocalizations), or self-reports of empathy (de Waal 2008; Eisenberg and Miller 1987).

### **Kin Selection**

Unlike the psychological theories described above, evolutionary accounts of prosocial behavior have focused on the survival benefits of prosocial behavior. For example, kin selection theory (Feigin et al. 2014; Penner et al. 2005) holds that individuals are particularly motivated to help members of their own family because this ultimately helps their own genes survive. Linking this back to the altruism-egoism distinction, kin selection then becomes, in a sense, both altruistic and egoistic. It is altruistic to the extent that an individual may sacrifice his or her own well-being to help a blood relative; at the same time, kin selection may also be seen as egoistic because it serves to propagate one's own genes (Feigin et al. 2014). Several studies have documented preferential helping for kin over unrelated individuals, even when this contradicts social norms (Penner et al. 2005).

Of note, kin selection theory can be extended to apply to prosocial behavior directed toward grandchildren. In other words, post-reproductive adults can still improve their inclusive fitness (the likelihood that others who share some of their genes will survive) by investing resources in

their grandchildren (Coall and Hertwig 2010). This idea is also in line with the "grandmother hypothesis," which explains the relatively long post-reproductive period of women based on the survival benefits for not just their own children but also for their grandchildren (Coall and Hertwig 2010). Although particular attention has been paid to the role of grandmothers, evolutionary-based theories of grandparental investment also apply to grandfathers, although this depends on paternity certainty (how sure the grandfather is that the child in fact carries his genes; Coall and Hertwig 2010). Going back to the example of Charlie, the help he devotes to protect his grandson could be an illustration of kin selection. This is assuming that Charlie believes that his grandson is biologically related to him; kin selection theory would not apply to adopted grandchildren. One could make a stronger case for kin selection if Charlie were a woman because the maternal grandmother, for example, is certain of her relationship with her daughter and her daughter's relationship with her grandchildren. Regardless of Charlie's gender, however, kin selection theory cannot account for the time Charlie spends with other young *pro bono* clients to whom he is not biologically related. To explain this, one would need to invoke other, more psychological mechanisms.

It is not possible to directly test or falsify evolutionary theories of prosocial behavior in human beings. However, in line with kin selection predictions, experimental work has found that people are more likely to help those to whom they think they are more genetically related (Penner et al. 2005). Animal models and research in the area of genetics have supplemented these findings to provide more support for the overall concept of kin selection (de Waal 2008; Penner et al. 2005).

### **Age- and Future Time Perspective-Related Differences in Prosocial Motivations**

There is solid evidence for age-related differences in prosocial behavior in the literature (Wilson 2000). Below, the authors introduce two prominent lifespan theoretical models that provide potential explanations for why this may be the case. The model of generativity is built on the idea that adults have to master distinct challenges

as they move across different life phases, with the mastery of earlier challenges predicting the likelihood of succeeding with later challenges (Erikson 1982). Generativity, which is thought to peak in mid-life and continue until later in life, may be defined as the need to make a contribution to the well-being of the next generation, along with a sense of responsibility for those younger in age (McAdams et al. 1998). Hence, by virtue of their position in the life course, middle-aged and older adults may be particularly motivated to engage in behaviors that help younger individuals thrive (Schoklitsch and Baumann 2012). Going back to the legal aid example, Charlie may indeed be driven by generative goals when he assists younger clients – does he perhaps wish to bestow a tradition of social justice-oriented legal action that will inspire generations to come? Generativity may also reflect a desire to leave a lasting legacy, thus combining altruistic with egoistic connotations (Maxfield et al. 2014). Nevertheless, the end result is that society reaps the benefits of older adults' generative investments. Survey methods have been used to investigate associations between generativity and prosocial behavior across the lifespan, indicating that both tend to peak in mid-life and continue to be high in older age (Keyes and Ryff 1998), although cohort effects cannot be ruled out because age differences in generativity have been found mainly cross-sectionally, not longitudinally (Schoklitsch and Baumann 2012). Generative motivations have typically been investigated through autobiographical methods, self-reported motivations and behavior, and personal goal analysis (Schoklitsch and Baumann 2012).

According to socioemotional selectivity theory, the recognition of future time becoming more limited prompts motivational shifts away from autonomy or knowledge acquisition goals typically found in young adults and toward emotionally meaningful social goals that focus on close others, possibly including generative themes (Carstensen et al. 2003; Lang and Carstensen 2002). Coming back to the illustrative scenario, Charlie's motivation to provide pro bono services may have been guided by knowledge acquisition goals early in his career, whereas later in life, he

may have come to the conclusion that his limited time left is too valuable to be spent on anything but the people he really cares about and feels close to, like his grandson. Predictions originating from socioemotional selectivity theory have frequently been tested using cross-sectional survey methods and experimental methods (Carstensen et al. 2003). For example, hypotheses derived from this theory have been tested directly in a study of volunteering motivations (Okun and Schultz 2003). Although socioemotional selectivity seems to be a very relevant framework for understanding prosocial behavior across the lifespan, to our knowledge, no research has yet directly investigated the effects of changing future time horizons on prosocial behavior; correlational and experimental work is needed to fill this gap.

## Consequences of Prosocial Behavior

When one thinks of prosocial behavior, the implication typically is that this kind of behavior benefits the recipient, whether emotionally, financially, or otherwise (Penner et al. 2005). Importantly, however, behaving prosocially may also benefit the actor – the person who is helping or giving to others. Indeed, prosocial behavior has well-documented physical health, cognitive, and psychological well-being benefits, particularly in old age (Midlarsky and Kahana 2007; Van Willigen 2000; Wilson 2000). The benefits of prosocial behavior for the giver, if known, may also drive motivation to engage in such behavior, thereby reinforcing a positive cycle that builds both prosocial behavior and health and well-being. The following section describes some of the key benefits of prosocial behavior that have been documented in experimental, experience-sampling, and longitudinal work, using volunteering as a case study for prosocial behavior.

### Volunteering, Health, and Well-Being

The majority of research on prosocial behavior in older adults looks specifically at volunteering, which can be defined as “any activity in which time is given freely to benefit another person,

group, or organization” (Wilson 2000, p. 215). Typically, volunteering involves some commitment of time and effort (not just a single act of kindness) and serves to benefit people outside of one’s family. Hence, volunteering is a special, but readily recognized, form of prosocial behavior. Volunteering is especially relevant for today’s aging population as it may be a vehicle to stay connected and make an active contribution to the functioning of society past retirement (Fried et al. 2004; Midlarsky and Kahana 2007). Furthermore, volunteering has recently attracted a lot of attention for its health-promotion potential in old age (Midlarsky and Kahana 2007; Wilson 2000). This section will discuss some of the key documented benefits for physical health, cognitive functioning, and social integration and well-being.

A well-known volunteering program for older adults is the Experience Corps (Fried et al. 2004), which successfully integrated older volunteers into public elementary school programs to help vulnerable children improve their reading, problem solving, and other social-cognitive skills. Findings from this program document a host of benefits for the older adult volunteers themselves, including but not limited to physical health benefits such as increased physical activity and reduced declines in measures of physical strength and health (Fried et al. 2004).

Volunteering has also been linked to reduced cognitive decline in old age. For example, findings from the Georgia Centenarian Study reveal that, among the oldest old, leading an engaged lifestyle (which involves volunteer work) is associated with higher cognitive functioning in domains that typically have a strong age gradient, namely, orientation skills, attention, memory, arithmetic, motor skills, and language abilities (Martin et al. 2009). This is in line with the idea that volunteering encourages people to learn and adapt to new situations and to make use of their knowledge and skills, thereby helping to maintain cognitive abilities.

Volunteer activities also have well-documented social and well-being benefits. For example, participants in the Experience Corps program, compared to controls, reported having

more people to whom they could turn for help (Fried et al. 2004). It seems that a key benefit of volunteering is that it facilitates building high-quality social relationships that may serve as social support resources in old age (Fried et al. 2004). Furthermore, participating in volunteer work can make older adults feel needed and appreciated, which can improve their overall sense of well-being (Midlarsky and Kahana 2007). For instance, findings from the Americans’ Changing Lives study demonstrate positive associations between volunteering and both life satisfaction and perceived health (Van Willigen 2000). Importantly, this study revealed that participating in volunteer work had greater well-being benefits for adults over age 60 years than for their younger counterparts, which further speaks to protective effects of prosocial behavior in old age specifically (Van Willigen 2000). With few exceptions (Fried et al. 2004; Midlarsky and Kahana 2007), the vast majority of research on the social and psychological well-being benefits of volunteering has employed cross-sectional and longitudinal survey methods.

### **Other Forms of Prosocial Behavior and Links with Well-Being**

In line with the research on volunteering described above, recent longitudinal and experimental work has also demonstrated the benefits of other, more discrete forms of prosocial behavior. For example, spending money on others has been shown to have a more positive impact on happiness than spending money on oneself in cross-cultural samples across the lifespan (Dunn et al. 2008). Other experimental work looking at young adult samples has revealed that engaging in small acts of kindness can increase positive emotions in individuals who are socially anxious (Alden and Trew 2013), and dyadic studies confirm that short-term prosocial behaviors give an emotional boost to the helper as well as the recipient (Weinstein and Ryan 2010). The benefits of small or short-term prosocial behaviors on well-being continues to be a hot topic, and these recent trends in social psychology could be fruitfully extended to older samples. Further research is needed to also explore potential cognitive and

physical health benefits of small, short-term prosocial behaviors.

## Future Directions

The literature on motivations and consequences of prosocial behavior is rich in findings and in implications for social engagement and well-being across the lifespan. This next section will selectively focus on some avenues that may be worth pursuing.

### Methodological Directions

While experimental paradigms are typically used to study discrete prosocial acts, such as donating to charity or helping a confederate (Dunn et al. 2008; Weinstein and Ryan 2010), more sustained prosocial behavior, such as formal volunteering, is more often studied using cross-sectional and longitudinal designs that incorporate a variety of data sources (Wilson 2000). There are challenges and limitations to each of the above research designs, for example, laboratory and field experiments are limited with respect to the conclusions that can be drawn regarding how and to what extent people behave prosocially in their everyday lives. Prosocial behavior has been found, in fact, to be very situation specific and hence can vary from day to day or from hour to hour. The use of methods such as experience sampling can help resolve this issue; a key advantage of experience sampling is that it allows researchers to investigate behavior and associated cognitions and emotions as they arise naturally in participants' daily lives (Bolger and Laurenceau 2013). An experience-sampling study could be used, for example, to investigate the short-term, dynamic emotional antecedents and consequences of lawyers' engagement in different kinds of pro bono work over the course of a 2-week period. A promising avenue of research involves combining experience-sampling and experimental methods, in order to assess prosocial behavior (and its antecedents and consequences) in the most scientifically rigorous manner while taking into account the daily life context in which it occurs.

### Lifespan Development Knowledge Gaps

In order to understand lifespan developmental changes in prosocial behavior, its antecedents, and its consequences, it is important to include participants of varying ages in a given study. However, the current literature tends to use different approaches when investigating prosocial behavior in young adult samples as compared to older adult samples. Specifically, the vast majority of experimental work in psychology relies on the recruitment of university student samples, who also tend to be WEIRD: from Western, Educated, Industrialized, Rich, and Democratic societies (Henrich et al. 2010). Experimental investigations of older adult volunteers in the Experience Corps (Fried et al. 2004) and field studies of older adults' helping behavior (Midlarsky and Kahana 2007) are notable exceptions to this trend. Further intervention studies (with appropriate controls) in this vein are needed to look at long-term outcomes of sustained volunteerism in older adults. Furthermore, such studies should include middle-aged adults in order to better understand what will motivate them to be active volunteers by the time they leave the labor force and to what extent the benefits of volunteering might extend to this age group.

Many studies of volunteering in older adults also investigate underlying motivations (Wilson 2000). However, although much is known about the benefits of volunteering, less is known regarding whether achieving these benefits depends on volunteers' motivations for their work. For example, it might be interesting to determine whether volunteering that is driven by generativity or that which is driven by socioemotional selectivity produces greater benefits – or if perhaps both sources of motivation need to be there in order for volunteering to be maximally satisfying for older adults. There are a few intriguing studies in this area showing, for example, that volunteering may reduce mortality in old age, but only when volunteers are driven by other-oriented (more altruistic) reasons for volunteering (Konrath et al. 2012).

### Emotion Regulation and Cognitive Decline

Behaving prosocially is potentially an effective means of regulating one's emotions, as it can

activate neural pathways related to reward (Moll et al. 2006), reduce the emotional distress of seeing a person in need (Feigin et al. 2014), and help solidify positive relationships with others. However, effective emotion regulation (such as the ability to deal with emotional complexity and high-arousal negative emotion) relies on cognitive resources that decline with age (Charles 2010; Labouvie-Vief 2003). As a result, older adults might find it more difficult to put their emotion-regulation skills into action (Charles 2010). Hence, despite their great capacity for empathy and altruism, age-normative cognitive decline could become an obstacle to older adults pursuing and reaping the emotional rewards of prosocial behavior. Further research is needed to investigate the possibility of direct linkages between emotion-regulation abilities and prosocial behavior as people age.

### Implications for Policy and Practice

Given what is known about the health and well-being benefits of volunteering and other forms of sustained prosocial behavior in old age, what can be done to encourage these kinds of behavior in an aging society? From a public policy perspective, society might do well to offer more opportunities for volunteering, as well as leisure activities with a generative focus, for older adults. Businesses, schools, or nonprofit organizations could provide volunteering opportunities through which retired experts can make meaningful contributions. For example, senior experts could provide counsel to young individuals who are starting a new business. Older adults who held management or other high-level positions during their careers could also continue applying their supervisory skills in community volunteering settings, maintaining their status as leaders. Such programs can capitalize on older adults' skills and experience in ways that benefit them and also society at large (Fried et al. 2004).

### Conclusion

Prosocial behavior is a fundamental ingredient of life across the adult lifespan. This entry has

explored the antecedents or motivations of prosocial behavior and how these may shift over the lifespan, and has discussed various health and well-being benefits of behaving prosocially. Further research in this area needs to directly examine developmental trajectories and outcomes of prosocial motivation and behavior by including older, middle-aged, and young adults in the same study, making use of longitudinal methods whenever possible. It will also be interesting to expand our current knowledge by looking at a variety of short-term as well as sustained kinds of prosocial behavior in the context of adults' daily lives. This area of inquiry promises to inform a social model of health promotion that fosters active social engagement throughout adulthood and into old age and that at the same time benefits society.

### Cross-References

- ▶ [Aging and Psychological Well-Being](#)
- ▶ [Intergenerational Relationships](#)
- ▶ [Loneliness and Social Embeddedness in Old Age](#)
- ▶ [Psychological Theories of Successful Aging](#)
- ▶ [Socioemotional Selectivity Theory](#)

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## Alzheimer's Disease, Advances in Clinical Diagnosis and Treatment

Kathleen A. Welsh-Bohmer  
 Departments of Psychiatry and Neurology, Duke  
 University Medical Center, Durham, NC, USA

### Synonyms

Dementia of the Alzheimer's type

### Definition

Alzheimer's disease (AD) is a progressive, irreversible brain disorder that is the most common cause of dementia in later life. It is characterized clinically by a profound impairment in new learning and memory recall along with deficits

commonly in expressive language, complex problem-solving, and visuospatial functions. Neuropathologically the signature of the disease includes abnormal processing and aggregation of two proteins:  $\beta$ -amyloid and tau protein, which leads to the formation of amyloid plaques and intraneuronal fibrillary tangles. Fluid and imaging biomarker tests are now available to measure these abnormalities to facilitate reliable AD diagnosis and staging across the disease continuum.

## Introduction

Alzheimer's disease (AD) is a progressive, irreversible brain disorder that is the most common cause of dementia in later life. Although typically conceptualized as a disorder of old age with symptom onset commonly in the eighth decade of life, AD is now recognized to be a chronic disease in which the underlying neuropathology begins to accrue decades before memory problems are appreciated. Clinically the disease begins insidiously, generally when the individual is in their mid-60s or older. The earliest signs typically include impaired recent memory function and trouble in word retrieval. These problems become increasingly more pronounced as the disease progresses, leading to deficits in complex problem-solving, spatial judgment, and motor performance. Ultimately, as the neural destruction evolves, increasing levels of disability result, culminating in total dependence on others for basic needs related to nourishment, toileting, and self-care. Individuals who survive to the late stages of AD eventually are bedbound and in a vegetative state. They typically succumb to the disease due to complications related to severe brain compromise, such as aspiration pneumonia.

With advances in healthcare, more and more people are living into old age (after age 65) and late old age (after age 80). This increase in longevity brings with it a concomitant rise in age-associated illnesses. As a result, Alzheimer's disease is now the leading cause of late-life dementias globally, and it is overall the sixth leading cause of death in the USA, following

heart disease, cancer, lower respiratory disease, accidents, and stroke. At present, the disease is estimated to affect nearly 5.4 million Americans and over 36 million individuals globally (G8 Dementia Summit 2013). As the world population continues to age, the numbers are expected to climb dramatically over the next 40 years. By the year 2020, over 76 million individuals will have AD globally, and this number will nearly double to over 135 million by 2050, a number which does not include individuals in the milder stages of disease. The annual costs for medical care will be staggering. In the USA alone, the healthcare costs (Medicare and Medicaid) for AD are currently estimated at 148 billion dollars (Alzheimer's Association Facts and Figures 2015). Absent a treatment to slow the trend, these numbers will exceed 1.1 trillion dollars annually by the year 2050.

Despite considerable advances in understanding the basic biology of the disease, there is currently no cure for the disease nor are there any disease modifying treatments available that can alter the inevitable course of the disease. Without a way to mute the effects of the disease, the public health outlook is grim. Families will bear the greatest burden for care and costs, providing informal care to those affected by the disease, often at personal expense as they exit the work force early to respond to the "around the clock" care needs. In anticipation of the growing economic and social impact of this disease as the population ages, national plans addressing Alzheimer's disease have been enacted by the G8 countries in Europe and by the USA. Each plan is aimed to reduce the numbers of individuals affected by Alzheimer's disease with stated goals of developing effective therapeutics by the year 2025 that could limit the impact of the dementia by either halting Alzheimer's disease altogether or slowing its inexorable progression.

This entry provides a conceptual overview of the clinical, neuropsychological, and neuropathological features of Alzheimer's disease. In this context, we discuss the advances in understanding the genetics and underlying pathogenesis of disease which have resulted in the development of

antemortem biomarkers to facilitate diagnostic reliability across the continuum of disease. The last section of the entry then turns to consider treatments, summarizing the currently available medications and the continuing efforts to identify disease modifying therapies that will delay the onset and progression of disease once it has begun.

## Characteristic Features of Alzheimer's Disease

Alzheimer's disease (AD) was first described in 1906 by Dr. Alois Alzheimer who reported the clinical characteristics and the underlying brain pathology in his patient, a 51-year-old woman who progressed to end-stage dementia and eventually succumbed to the disease (see Ballard et al. 2011 for review). Initially believed to be a rare problem, AD is now recognized as a common disorder of late-life that involves the slow, indolent progression of neuropathological change over the course of decades in the brain. Beginning with subtle memory problems, the fully expressed clinical syndrome includes prototypical impairments in four key cognitive domains, referred to as the "4 As" of Alzheimer's disease: "Amnesia, Aphasia, Agnosia, and Apraxia." The memory disorder, or the "amnesia" of AD, is characteristically a pronounced anterograde memory disorder involving difficulties in the learning and retention of new information. This problem is consistently one of the earliest and most distinguishing features of AD throughout the disease course, with deficits detectable in the presymptomatic stages. Later, expressive aphasia emerges along with difficulties in form vision and recognition (agnosia) and impairments in problem-solving and the execution of common tasks involving motor integration (apraxia).

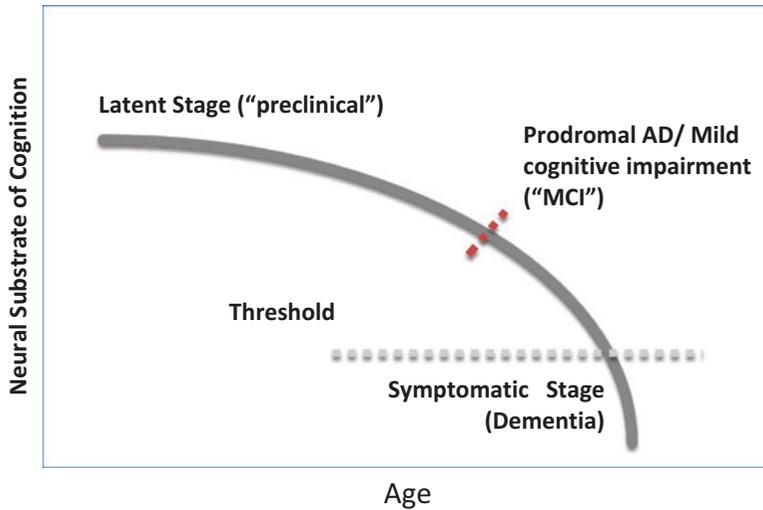
At postmortem examination, the disease is characterized by three pathological hallmarks, appreciated since the early descriptions of Alzheimer in 1906. They include (1) an abnormal aggregation of a viscous small peptide,  $\beta$  amyloid, surrounding by cellular debris outside the neuron, termed the "amyloid plaque"; (2) tangled bundles

of neurons called "neurofibrillary tangles"; and (3) a loss of synaptic connections between neurons. These changes are not uniformly distributed across the brain but rather are regionally confined to specific cellular laminar areas within the medial temporal lobe area and throughout the associational cortices of the frontal, temporal, and parietal lobes (Arnold et al. 1991). Essentially spared, even into the late stages of the disease, are the sensory and motor cortices.

Although the disease follows a fairly predictable course, there can be some variability in the clinical expression of symptoms, depending on the regions of the brain affected. Regardless of the profile of impairments expressed, the clinical course of disease is one of the inexorable progression which passes through essentially three identifiable stages of disease (see Fig. 1), defined on the basis of a combination of both clinical and biological features. These stages include a latent or "preclinical" stage (Sperling et al. 2011), a prodromal or "mild cognitive impairment" stage (Albert et al. 2011), and the full symptomatic stage of AD dementia (McKhann et al. 2011). Each of these stages is described below along with the role of biomarkers in enhancing diagnosis reliability at each stage (Jack et al. 2010).

## Preclinical AD

The preclinical stage of the disease is the clinically silent stage of the disease, in which the affected individual appears cognitively healthy despite the appearance of cortical  $\beta$ -amyloid (A $\beta$ ) deposition within discrete regions of the cerebral cortices along with tau pathology and tangle formation in the trans-entorhinal cortices, brain circuits responsible for learning and memory function (Hyman et al. 2012, for review). Prospective, longitudinal data collections within large epidemiological cohorts and clinical series indicate that subtle changes in neurocognition may be observed for nearly a decade before a diagnosis of AD is made, even though the individual's performance may remain within the normal range (Vos et al. 2015). Analysis of cognitive trajectories across a number of studies suggests that the



**Alzheimer's Disease, Advances in Clinical Diagnosis and Treatment, Fig. 1 Alzheimer's disease chronic disease model.** Alzheimer's disease is now recognized as a chronic disease developing over decades in brain and divided into three stages: preclinical stage where disease is latent, prodromal disease where mild cognitive symptoms are apparent, and a fully symptomatic stage when dementia is evident. Each stage provides avenues for therapeutic

intervention. Prior to the silent stage, there is an opportunity for primary prevention in subjects at risk for the disease. As symptoms or pathology express, secondary prevention approaches are aimed at stopping, reversing, or slowing disease progression. At the symptomatic stages, typically the target for therapies is to delay or slow progression

earliest changes are typically in episodic memory performance and aspects of higher executive function, occurring on the order of 7–9 years prior to receiving a clear AD diagnosis. Other cognitive domains, including verbal fluency, change more proximally to dementia onset, within approximately 3 years, whereas simple attention and speed domains remain relatively unchanged until dementia is diagnosed (see Attix and Welsh-Bohmer 2006, for review).

### Prodromal AD/Mild Cognitive Impairment

The prodromal stage of AD or "mild cognitive impairment (MCI)" is the early symptomatic phase of the disease at which time the memory impairment for recent events or other cognitive disorders are particularly prominent but function remains fairly to normal. The individual is able to attend to their usual activities unassisted but may be less efficient and is often more reliant on auxiliary aids, such as reminders and calendars, to

bolster function (Albert et al. 2011). Clinically, the symptoms can be highly variable early in the process, and hence MCI may be confused on routine screening for the more common experience of age-associated forgetfulness. However, more detailed clinical evaluation with the inclusion of neuropsychological assessment permits the detection and discrimination of mild cognitive impairments from the more benign effects of normative aging. The recent introduction of new AD diagnostic criteria (see Table 1) facilitates diagnostic reliability through a consideration of the clinical signature specific to AD and the incorporation of available fluid and imaging biomarker information. Depending on the criteria used, the early symptomatic stage of the disease is either referred to as the "prodromal" AD (Dubois et al. 2007), "mild cognitive impairment" due to AD (Albert et al. 2011), or a "mild neurocognitive disorder" due to AD (American Psychiatric Association 2013). The criteria differ in some aspects from one another as can be seen in Table 1, with the DSM-5 capturing a broader spectrum of transitional disorders, whereas both the NIA-AA

**Alzheimer’s Disease, Advances in Clinical Diagnosis and Treatment, Table 1** Diagnostic criteria for mild pre-dementia stage of Alzheimer’s disease

<p>IWG-criteria Prodromal AD (Dubois et al. 2007)</p>	<p>NIA-ALZ Association Mild Cognitive Impairment (Albert et al. 2011)</p>	<p>DSM-5 Mild Neurocognitive Disorder (APA DSM5 Manual 2013)</p>
<p>Presence of early and significant episodic memory impairment (alone or with other cognitive/behavioral problems) and includes both (i) a gradual and progressive course from family or patient report over &gt; 6 months and (ii) there is objective evidence of impaired memory on memory tests such as cued recall or encoding tests</p>	<p>Cognitive concern reflecting a change in cognition from usual baseline reported by the individual, a knowledgeable informant (such as a family member) or the clinician’s own observation. This can be based on historical information from subject and/or informant or it includes actual observed evidence of decline</p>	<p>Evidence of modest cognitive decline from previous level of performance in one or more cognitive domains based on either an informant report or objective evidence such as neuropsychological testing Capacity to perform everyday activities (instrumental activities of daily living) is maintained although greater effort or compensatory strategies may be needed</p>
<p>In vivo evidence of AD pathology, from either: (i) CSF tau/AB levels studies (ii) Amyloid PET imaging (iii) AD autosomal dominant genetic mutations</p>	<p>Objective evidence of impairment in one or more cognitive domains, typically including episodic memory early in the course. This can be established by formal or bedside testing of multiple domains</p>	<p>Not occurring exclusively in the context of delirium Not explained by another mental disorder such as major depression or schizophrenia</p>
<p>No sudden onset or early occurrence of gait disturbance, seizures, or major or minor prevalent behavior changes</p>	<p>Preservation of function in abilities to carry out instrumental activities of daily living although greater effort, time, and/or compensatory strategies are needed</p>	<p>The disorder is not better explained by cerebrovascular disease, another neurodegenerative disorder, or another medical explanation</p>
<p>No focal neurological signs, no early extrapyramidal signs, and no early hallucinations or cognitive fluctuations</p>	<p>Etiology is consistent with AD pathophysiological process with evidence of longitudinal decline when possible and history of AD genetic factors when relevant</p>	<p>Probable AD as cause of the mild neurocognitive disorder is supported if there is a genetic mutation from family history or genetic testing</p>
<p>No other medical condition that is severe enough to account for the presentation</p>	<p>Vascular, traumatic, and other medical causes responsible for cognitive decline are excluded</p>	<p>Mild neurocognitive disorder due to possible AD is diagnosed in the absence of a causative gene and all three of the following are met: (i) Clear evidence of decline in learning/memory and one other domain based on history or serial neuropsychological testing (ii) Slow and indolent decline in cognition without extended plateaus (iii) No evidence of mixed etiology</p>
	<p>Biomarkers indicating a high likelihood that the MCI is due to AD include a positive biomarker of Aβ deposition (CSF Aβ<sub>42</sub>, PET amyloid imaging) and a positive biomarker of neuronal injury (CSF tau/phosphorylated tau; hippocampal volume or medial temporal atrophy by volumetric measures or visual rating; FDG-PET imaging)</p>	

criteria of MCI and the Dubois criteria for prodromal AD are focused on diagnosing early symptomatic disorders due specifically to Alzheimer's disease.

## Fully Symptomatic AD Dementia

At the fully symptomatic, dementia stage of the disease, the memory problems remain prominent; however, there are also pervasive impairments across areas of problem-solving, language expression, visuospatial function, and other aspects of intellectual ability (Attix and Welsh-Bohmer 2006, for review). These cognitive issues, superimposed on the episodic memory disorder, make it increasingly difficult for the patient to function normally in everyday life (McKhann et al. 2011). Patients become increasingly reliant on others to assist in daily routines, including meal preparation, transportation, bill paying and financial decision-making. By definition, the individual has progressed to "dementia" when the ability to function independently is no longer possible.

This stage of the disease typically lasts for 8–10 years and covers a broad range of functional disability, from mild disruption in instrumental activities of daily living (e.g., bill paying) to some dependence on others for self-care, to end-stage total care. To assist in tracking disease course, the severity of the dementia is often parsed using different methods, such as the Clinical Dementia Rating Scale (CDR; see Attix and Welsh-Bohmer 2006). The CDR breaks the dementia of AD into severity stages, ranging from very mild (CDR = 0.5), mild (CDR = 1.0), moderate (CDR = 2), and severe (CDR = 3), depending on functional abilities within six different domains (memory, communication, independence in self-care, interest in home and hobbies, bladder and bowel function, and overall awareness with the environment). A global composite score, referred to as the sum of boxes (CDR-SB), can be generated by summing ratings across each of the six domains, permitting a continuous measure of observed cognition and functional abilities. This composite

score is more sensitive than categorical ratings of dementia (mild, moderate, severe) in detecting changes in function over time and is useful in staging the disease in practice, research, and clinical trials.

## Clinical Variants of AD

It should be noted that AD can present in an atypical fashion, where memory is not the prominent early feature. Although less common, visual, language, and frontal variants of AD have been described. In these instances, the initial presenting symptoms may consist of a complex visual system disturbance, such as Balint's syndrome, a fluent aphasia, or a notable dysexecutive disorder, respectively. These variants of AD are very rare and typically have an earlier age of onset than the common form of the disease. Determining the true prevalence of these unusual forms of AD has been difficult due to very few neuropathological studies which permit firm conclusions as to causation of what is presumed to be atypical AD (see Attix and Welsh-Bohmer 2006 for review). However, on both imaging and postmortem evaluation, the brain areas affected by the pathology tend to parallel the abnormal symptoms such as involvement of left hemisphere language areas in instances of aphasia and parietal/occipital involvement in conditions with complex visual system disorders.

## Neuropsychological Characterization

Neuropsychological evaluation is an important first step in the characterization of memory disorders occurring in normal aging and AD. This assessment permits the systematic documentation of deficits across multiple cognitive processing domains which can then be mapped to their associated brain systems. AD and other common causes of dementia in later life, including vascular disease, Parkinson's disease, and depression, have unique cognitive signatures reflecting differing underlying neurobiology and neural systems involvement. Consequently, based on both the pattern and extent to which a patient's

performance deviates from age- and education-based normative values, the clinician can draw inferences as to the likely explanation for the cognitive disorder and the degree of impairment.

The characteristic neuropsychological profile of AD dementia is among the best understood of the neurodegenerative conditions of aging (Attix and Welsh-Bohmer 2006). The memory processing problem of AD is one involving impaired "consolidation" of new information from a limited capacity, short-term memory store into a more permanent, longer-term memory store for later use and retrieval. Problems in consolidating information can be demonstrated on verbal episodic learning measures, such as story recall and supra-span word list learning tests, with rapid forgetting of the verbal information over a span of 30 min or less (Attix and Welsh-Bohmer 2006, for review).

Contrasting the memory disorder of AD, forgetfulness in cognitive aging is ascribed to inefficiencies in "encoding" new information (learning) and "retrieval" of this information from a more permanent memory store. Tests such as the Free and Cued Selective Reminding Test (FCSRT) as well as other memory procedures that have built in prompts or recognition procedures are clinically useful in distinguishing between AD and other disorders. These procedures permit distinctions between recall deficits due to AD, encoding/retrieval inefficiencies observed in normal aging, and attentional deficits that can occur in situations of anxiety or depression. Cognitively normal subjects are able to demonstrate recall of newly learned information when retrieval and encoding supports are applied, whereas the use of these same techniques does not appreciably change recollection in AD subjects (Dubois et al. 2007). Building on these observations, some of the newly emerging diagnostic criteria for AD now include recommendations for specific memory techniques to include in the standard assessment of early staged AD to facilitate diagnostic certainty (Dubois et al. 2007).

As mentioned, although memory impairment is the cornerstone of the AD diagnosis, many other aspects of cognition are affected in the disease and need to be assessed, both to secure the

diagnosis and to facilitate treatment and medical management efforts. Acquired problems in expressive language often emerge early in the disease course and leads to blocking on words or "anomia." As the problem becomes more acute, the patient will often resort to circumlocution, a tendency to describe the word eluding recall. To assess language expression, tests of visual naming and word fluency are commonly used (Attix and Welsh-Bohmer 2006). Typically, patients with the anomia of AD will do poorly on tests of visual memory and category fluency where they are required to generate examples of items in the category of interest (e.g., animals). Curiously, word generation to a letter such as the commonly used F-A-S task remains intact, suggesting that the problem is not in language retrieval but rather in retrieval of specific examples from semantic knowledge stores. Comprehension and repetition also remain preserved at this point in the illness. However, these abilities also change as the disease progresses. Ultimately, deficits in speech expression become more extreme and the burden of conversation falls increasingly on the listener. Impairments in verbal comprehension begin to emerge during the later stages of dementia, making it increasingly difficult for patients to process more than one task at time. These problems in performing single and multistep commands can be established with tests of verbal comprehension such as the Token Test.

Subtle issues with visuospatial function often surface early in the disease leading to issues in spatial navigation even in familiar territory. Later in the disease these problems become more pronounced, and difficulties involve impaired vision perception difficulties in well coordinating motor movements. The problems in perception can contribute to "agnosia" which refers to the ability to understand the environment. And the deficits in spatial and motor coordination lead to "apraxia," the ability to complete common motor tasks such as manipulating utensils, dressing correctly, and navigating effectively in a familiar environment. While at the later stages of the disease, when the full syndrome of AD dementia is expressed, neuropsychological testing may not be required for documenting and characterizing these obvious

problems. Within the early stage of disease, neuropsychological testing of visuospatial, construction, and perceptual functions can be quite useful in documenting subtle processing problems that are not at all obvious in conversation or on mental status screening. Deficits in visuospatial function can be elicited using tests of constructional copy, involving simple and more complex designs. Other tests examine judgments of spatial alignment, form vision, or visual conceptualization and abstraction.

## Neuropathological Signature

### Biological Basis of Alzheimer's Disease

Although the cognitive signature of AD is now very well understood, the biological causes underlying this complex condition are not completely resolved. Three dominant hypotheses of disease causation include what are called the cholinergic, amyloid cascade, and tau hypotheses. The first of these hypotheses, the cholinergic hypothesis, conceptualized AD as a disease involving the cholinergic system, the main neurotransmitter system innervating the hippocampal memory system. The hypothesis was supported by two fundamental observations. First, age-dependent memory change had been shown to be closely related to cholinergic system integrity. Second, the pathology of AD was correlated with the extent of cell loss in the nucleus basalis of Meynert, the source of cholinergic afferents to the hippocampal memory system. The cholinergic hypothesis drove initial drug development in the 1980s–1990s (Schneider et al. 2014, for review), but was found to be an incomplete explanation of the aggregation of amyloid and tau pathology seen in the disease.

More recent hypotheses focus around the abnormal processing of amyloid and tau, as the key constituent proteins involved in amyloid plaque formation and neurofibrillary tangles, respectively (Ballard et al. 2011). The amyloid hypothesis has been the most influential of the hypotheses in the last decade, leading to the identification of drug treatment targets, and is the basis of many of the current drug development efforts.

The hypothesis essentially proposes that there is a chain of cellular events in predisposed individuals which results in an abnormal processing of the amyloid precursor protein (APP) leading to an incorrectly cleaved peptide product, amyloid- $\beta$  ( $A\beta$ ). The increased production and impaired clearance of  $A\beta$ , particularly the oligomeric form of the peptide, proves neurotoxic. As a consequence, this abnormal  $A\beta$  deposition initiates a pathogenic cascade which results in tau phosphorylation, neurofibrillary tangle development, cell death, and the concomitant emergence of clinical symptoms. Support for the amyloid hypothesis of AD pathogenesis has come from the field of genetics. Known mutations in genes encoding APP accelerate amyloid- $\beta$  production in gene carriers and result inevitably in an early onset form of AD. Other gene mutations have been identified in two other genes, presenilin 1 (PSEN 1) and presenilin 2 (PSEN 2), each of which has a primary effect on  $A\beta$  processing and plaque formation and also leads to an early onset form of the disease (Vos et al. 2015, for review).

Although the amyloid hypothesis is well accepted as an explanation of the plaque formation occurring in AD subjects (Jack et al. 2010), this hypothesis is a source of debate as an explanation that can fully explain the neurodegeneration occurring in the disease. By definition, amyloid plaque formation is present in all cases of AD, but aggregation of  $A\beta$  is also observed in aged individuals who do not manifest any clinical signs of the disease. There also is poor correlation between the level of overall aggregation of  $A\beta$  and both the extent of clinical impairment and apparent neurodegeneration upon which the dementia rests (Small and Duff 2008; Ballard et al. 2011, for review). Further, if  $A\beta$  accumulation is an essential “upstream” event in AD, it is unclear how this aggregation incites intracellular hyper-phosphorylation of tau, a key cellular event observed in AD. The failure of a number of recent clinical trials using  $A\beta$  lowering agents gives further pause to the amyloid hypothesis (Cummings et al. 2014). In these trials, there was no clinical improvement in patients with mild to moderately severe staged disease, despite an overall reduction in  $A\beta$  deposition indicating appropriate target

engagement. Although it is argued that the compounds were aimed at the wrong stage of the disease and should be implemented in the preclinical stage to be effective, an alternative interpretation is that amyloid dysregulation alone may be an insufficient explanation for the neurodegeneration occurring in AD. Other mechanisms may need to be considered to explain the emergence of clinical dementia.

The tau hypothesis has generated considerable attention and is focused around abnormal processing of tau protein within neurons resulting in tangle formations. Tau protein is an important constitutional protein within the neuron, playing a role in microtubule stabilization and cellular transport (see Small and Duff 2008, for review). In its abnormal phosphorylated state, as occurs in AD, the protein forms cross-linkages leading to microtubule instability, impaired axonal transport, loss of synaptic connections, and cell death. Support of this hypothesis is a tight correlation between the extent and distribution of tangle formations, loss of synapses, and the cognitive disorder of AD. For this reason, tau is considered crucial to AD pathogenesis. However, as in the other hypothesis, it remains unresolved as to how tau processing and amyloid aggregation are linked together (Small and Duff 2008).

Other hypotheses under investigation include (1) a role of genetics in driving both tau phosphorylation and A $\beta$  clearance, (2) impaired homeostasis of cerebral iron and problems with myelin repair, (3) environmental influences altering blood–brain barrier permeability to opportunistic pathogens, and (4) altered immune response and an unresolved inflammatory response or some combination of these and other mechanisms. While each explanation has some support for observed cellular abnormalities in AD, none of these explanations are considered mutually exclusive. Rather, the pathogenesis of AD is now conceptualized as involving a number of complex events mediated by unique cellular pathways that ultimately involve amyloid aggregation, tangle formation, synapse loss, and cell death. Triggering events, while not completely known, are likely influenced by a number of host risk conditions including genetic factors as mentioned.

Understanding the pathophysiological pathways involved in AD and the interactions between these pathways to cause the disease is crucial for the development of effective treatments.

## Genetics of Alzheimer's Disease

Whatever its role in AD pathogenesis, it is now well understood that genetics has a fundamental effect in AD risk and symptom onset. As already described, gene mutations in APP, PSEN1, and PSEN2 are causal linked to both an overproduction of A $\beta$  and an early onset form of AD. However, these genes account for less than 5% of all cases of AD, leaving the vast majority of AD cases unexplained by genetic mutations. In the more common late-onset form of AD, common variations in several other genes have been identified as increasing risk of disease and leading to an earlier symptom onset (see Ballard et al. 2011; Lambert et al. 2013 for review). The most consistently associated risk gene is *ApoE*, a gene that is important in cholesterol metabolism and also plays a role in immunity, inflammation, and endosomal vesicle recycling. The gene also appears to have an effect on APP trafficking and AB production.

For nearly 15 years, this gene was the only established risk factor for late-onset AD. With the advent of new genome-wide sequencing approaches, other gene loci have been identified. In a recent meta-analysis involving over 74,000 cases of AD and controls, 19 loci including APOE were identified as reaching genome-wide significance as associated with AD (Lambert et al. 2013). Interestingly, the second strongest signal to date is within the *SORL1* gene, a gene that is associated with increased risk of both autosomal dominant and sporadic forms of AD. It is the first gene related to late-onset forms of AD that directly connects abnormal trafficking of APP to the late-onset form of AD. Other genes identified have roles in amyloid and tau processing and in inflammation and immune function. Some new genes were identified with roles in other fundamental cellular functions, including hippocampal synaptic function, cytoskeletal function, and

axonal transport. This now provides new mechanistic insights into late-onset disease and possibly some new target pathways for drug development.

## Biomarkers of Alzheimer's Disease

Based on a better understanding of the underlying biology of AD, biomarkers are identified which track the disease and can be applied to facilitate diagnostic decision-making and disease staging. The five scientifically established biomarkers included in the new diagnostic criteria for AD are (1) cerebrospinal fluid (CSF) measures of A $\beta$ 42, (2) CSF level of total tau (t-tau) and phosphorylated tau (p-tau), (3) positron emission tomography (PET) amyloid imaging, (4) structural magnetic resonance imaging (MRI) measures of hippocampal volume loss and cerebral atrophy, and (5) regional hypometabolism on fluorodeoxyglucose (FDG) PET. The use of these biomarkers in clinical diagnosis is based on a theoretical model of how AD unfolds pathologically over time (Jack et al. 2010; Fig. 2).

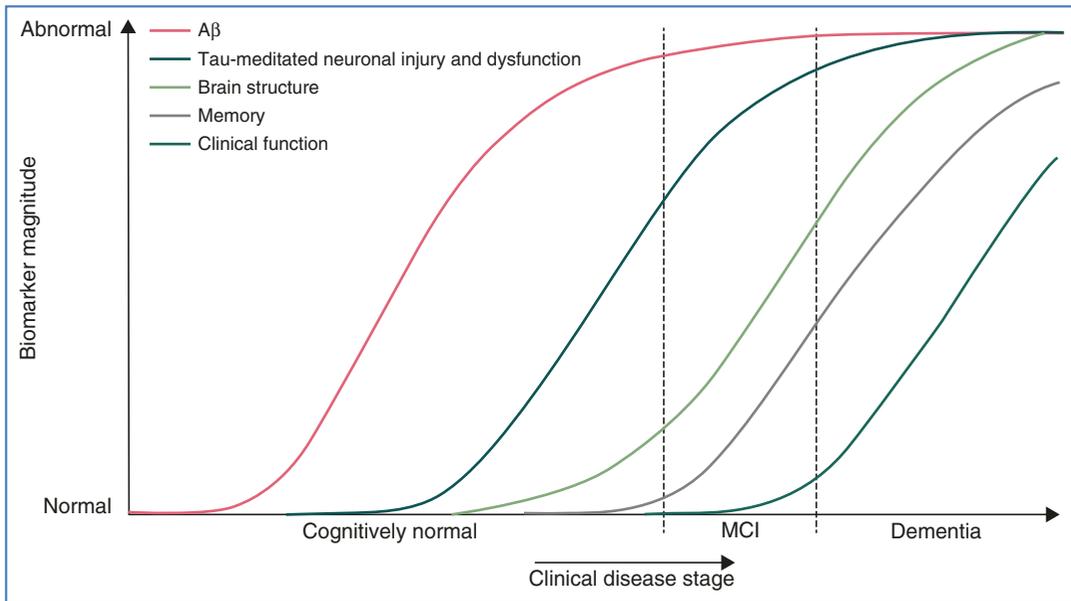
According to the initial model, A $\beta$  deposition is an early initiating event in the pathogenic cascade, measured by low levels of CSF A $\beta$ 42 or high uptake of amyloid PET tracers. Shortly thereafter, once amyloidogenesis has commenced, there are detectable elevations in levels of CSF t-tau and p-tau, markers correlated with postmortem neurofibrillary tangle burden and neuronal degeneration at autopsy. Later, as neuronal dysfunction becomes more pervasive and neurodegeneration ensues, there are measurable changes in memory, brain volume on MR imaging, and glucose utilization on FDG-PET imaging. Validation of the model is based on accumulating evidence that the biomarkers mirror the pathophysiological progression of the disease. Although the relative temporal emergence of the biomarkers is still debated, the presence of these biomarkers in the context of clinical disease helps affirm a diagnosis of MCI or AD dementia. Their presence in cognitively healthy subjects suggests preclinical disease and provides a testable framework for *in vivo* staging of asymptomatic illness (Vos et al. 2015). As clinical trials in earlier stages

of disease get underway, these biomarkers are being used to improve subject identification (Sperling et al. 2011). Change in these markers in response to therapy may also serve as indicators of target engagement as well as surrogates tracking disease progression.

## Treatments for Alzheimer's Disease

Treatment trials leverage genetic risk factors and evidence of AD biomarkers as interventions move to earlier stages in the disease course (Reiman et al. 2016). Currently approved medications were developed in symptomatic disease and are prescribed in mild AD and in MCI. All four compounds are considered symptomatic treatments, improving attentional focus but not altering the underlying neuropathology of the illness (Schneider et al. 2014). Each has demonstrated modest effects on cognition over the course of 6 months in patients with mild to moderate AD. The cholinesterase compounds include donepezil, introduced in 1996 (1997 in the UK), rivastigmine approved in 2000 (1998 in Europe), and galantamine made available in 2001 (2000 in Europe). Later, in 2002 in Europe and 2003 in the USA, the N-methyl-D-aspartate (NMDA) receptor antagonist, memantine, was approved for use in moderate to severe AD (Schneider et al. 2014). No other new compounds have been approved for AD over the last 13 years, despite a number of promising agents that have effectively engaged therapeutic targets.

The reasons for the lack of recent AD clinical trial successes are likely complex and involve a combination of (1) imperfect study designs, such as heterogeneous patient populations with an admixture of diagnoses, (2) focus on compounds that are targeted on wrong disease mechanisms, and (3) attempt to implement therapies that alter the pathological targets but are introduced at the wrong stage of disease. In overcoming these challenges, the current generation of trials uses AD biomarker evidence to improve patient selection, focuses on a broad array of disease targets, and attempts to match the right treatment to the right stage of disease, based on current models of the



**Alzheimer's Disease, Advances in Clinical Diagnosis and Treatment, Fig. 2** Original dynamic biomarkers of the AD pathological cascade model. A $\beta$  amyloid is identified by CSF A $\beta$ 42 or PET amyloid imaging. Neuronal injury and dysfunction are identified by CSF tau or FDG-PET. Neurodegenerative atrophy is measured by

structural MRI (Republished with permission of Lancet Neurology from article entitled "Hypothetical model of dynamic biomarkers of the Alzheimer's pathological cascade" Author: Clifford R. Jack Jr et al., *Lancet Neurology* 9:119–128, 2010; permission conveyed through Copyright Clearance Center, Inc., April 13, 2016, # 11555434)

unfolding of the disease pathophysiological cascade over time.

Many of the current therapeutic efforts are now positioned earlier in the disease continuum to test the efficacy of therapeutic compounds in postponing, reducing risk, or completely preventing the clinical onset of AD (Reiman et al. 2016). These so-called "secondary prevention" trials include the Anti-Amyloid Treatment in Asymptomatic Alzheimer's "A4" study which is testing amyloid-based therapeutics for the sporadic form of the disease in individuals with high amyloid deposition visualized on functional brain imaging. The Alzheimer's Prevention Initiative (API) of the Alzheimer's Disease Cooperative Study (ADCS) is a program that includes cognitively healthy participants who are at high risk of AD based on their genetic background and age. The API-ADAD study examines large families or "kindreds" with evidence of autosomal dominant AD transmission; the API-APOE4 study examines subjects who have at least one e4 allele.

The Dominantly Inherited Alzheimer Network Trials Unit (DIAN-TU) is examining promising treatments in individuals with known causative mutations for AD in the PSEN1, PSEN2, or APP genes. All three clinical trial programs described are supported through public-private partnerships positioned between the US National Institute of Health and industry partners. Another global trial to delay the onset of clinical signs of MCI due to AD is the TOMMORROW study. This investigation, unlike the others summarized, is entirely industry sponsored. It is designed with two goals. The first of these is to qualify a genetic biomarker risk algorithm comprised of two AD risk genes (APOE, TOMM40) for assigning 5 year risk of developing MCI due to AD. The second concurrent goal is to evaluate a novel agent which acts on cellular bioenergetics, a low-dose pioglitazone, in delaying the onset of MCI due to AD in cognitively normal, high risk individuals based on the genetic risk algorithm.

## Non-pharmaceutical Approaches: Modifiable Risk Factors of Alzheimer's Disease

Beyond pharmaceutical trials, large-scale epidemiological studies have suggested a host of both modifiable and unmodifiable factors that contribute to the lifetime risk of AD and different mechanistic aspects of the disease. The most consistent behavioral health factors tied to AD risk include (1) smoking, (2) poor diet (high saturated fat and low vegetable intake), (3) cognitive inactivity, (4) diabetes, (5) physical inactivity, and (6) depression (Xu et al. 2015). Because these factors represent treatable conditions, the implication is that by addressing these factors when present, it may be possible to reverse some of the adverse health trends and, when done on a large scale, could have a substantial impact on global public health. Recent public health statistical models support this premise (Norton et al. 2014). A modest theoretical reduction (10–20% over the next several decades) in the prevalence of the seven major risk factors associated with AD (low education, diabetes, smoking, midlife hypertension, obesity, physical inactivity, and depression) could have a remarkable impact on the future prevalence of AD in 2050, amounting to potentially 8–15% fewer cases worldwide or 9–16 million fewer affected individuals (Norton et al. 2014).

At the individual patient level, the ultimate test of the clinical effectiveness of these interventions in reducing AD risk rests on the results of randomized clinical trials. To this end, a number of trials are underway examining individual behavioral interventions involving diet, exercise, cognitive interventions, or their combination. Recent findings from a large clinical trial in Finland, the FINGER study, are particularly encouraging. This study examined the impact of modifying unhealthy lifestyle behaviors with a multicomponent approach. Preliminary data after 2 years of observation suggests that such intensive interventions can have a measurable influence on cognitive and vascular health (Ngandu et al. 2015). In this trial of over 600 cognitively healthy individuals at high risk for vascular disease, those individuals who were randomized to

lifestyle interventions involving diet, exercise, cognitive training, and vascular risk monitoring showed significant neuropsychological improvements over 2 years compared to those who received regular health monitoring and information about healthy lifestyle (Ngandu et al. 2015). Future studies are needed to determine the impact of behavioral approaches such as these on individuals with either mild memory disorders or with brain evidence of preclinical disease. However, the current data suggest that attention to modifiable health conditions may serve to preserve optimal brain health in aging and may be important in forestalling dementia in patients who are at risk of AD and related conditions.

## Conclusions

AD is a highly complex, chronic disease evolving over decades in the brain and involving not only multiple pathological mechanisms but a broad network of interconnected brain systems. Progress in understanding the neuropsychological expression of disease and the neurobiology of the disease now permits early detection of true cases of disease and more confident diagnoses. The early identification of silent preclinical disease provides a strategy for drug development during a point in the illness when intervention is most likely to have an impact. Success in treating AD will likely require a range of therapeutic agents which are applied strategically either alone or in combinations at different points in the illness. Additionally, it is likely that the therapies applied will not be confined to pharmaceuticals. Rather, optimal approaches will likely need to use a personalized approach that considers the entire patient, existing health conditions, lifestyle, and other variables. Treatments will need to be multimodal and involve both drug compounds and behavioral lifestyle approaches. The challenges ahead will be in determining the optimal combinations and how to personalize these therapies to each patient at differing stages of disease. Tools developed through neuropsychology and brain imaging will continue to be fundamental to patient care and will likely provide the optimal

metrics both for tracking response to treatment as well as for gauging overall function and quality of life in the various stages of this chronic progressive disease.

## Cross-References

- ▶ Behavioral and Psychological Symptoms of Dementia
- ▶ Dementia and Neurocognitive Disorders
- ▶ Frontotemporal Dementia (FTD)
- ▶ Person-Centered Care and Dementia Care Mapping
- ▶ Semantic Dementia
- ▶ Vascular and Mixed Dementia

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## Andropause, Understanding the Role of Male Hormones in the Aging Process

Monique M. Cherrier

Department of Psychiatry and Behavioral Sciences, University of Washington School of Medicine, Seattle, WA, USA

### Synonyms

Late-onset hypogonadism (LOH); Partial androgen deficiency of the aging male (PADAM)

### Definition

Andropause or late-onset hypogonadism (LOH) is frequently defined as low serum testosterone (T) accompanied with symptoms. Symptoms may include reduced sexual function, loss of vigor, muscle weakness, osteoporosis, low mood or depression, weight gain, insulin resistance, and potential cognitive symptoms.

Serum levels of total testosterone and bioavailable T (T that is not bound to sex hormone-binding globulin) decrease with age in men (Moffat et al. 2002; Tenover et al. 1987; Tenover 1992). While there is some variability with regard to the criteria for andropause, there is general consensus that a diagnosis of andropause in older men requires the presence of low T accompanied by the presence of symptoms of low testosterone (Matsumoto 2002). The European Male Ageing Study (EMAS) defined the diagnostic criteria for LOH to include the simultaneous presence of reproducibly low serum T (total T <11 nmol l<sup>-1</sup> and free T <220 pmol l<sup>-1</sup>) and three sexual symptoms (erectile dysfunction, reduced frequency of sexual thoughts, and morning erections). By these criteria, only 2% of 40- to 80-year-old men have LOH (Huhtaniemi 2014). Common causes of LOH in older men include obesity and impaired general health, and

these are more common causes of low T than chronological age.

In addition to the impact on health factors, there is some evidence of an association between low T and low mood or depression (Khosravi et al. 2015) as well as impaired cognition (Cherrier 2009) although findings are equivocal. Several epidemiological, cross-sectional studies involving large groups of healthy older males have reported bioavailable or free T to be significantly and positively correlated with tests of global cognitive functioning (Yaffe et al. 2002; Barrett-Connor et al. 1999) and measures of attention (Hogervorst et al. 2004) and measures of visuospatial ability and semantic and episodic memory (Moffat et al. 2002; Thilers et al. 2006). Older hypogonadal men evidence significantly poorer performance for visual memory, verbal memory, divided attention, and visuospatial rotation compared to eugonadal men and are at greater risk for developing dementia (Moffat et al. 2004).

Indications, and consideration for treating andropause with T supplementation, can include patient motivation to improve symptoms and prevention or reduction of risk for frailty, immobility, and improvement of cognition. Several studies have revealed a beneficial impact of T treatment in older men for sexual functioning, muscle strength, and quality of life (Srinivas-Shankar et al. 2010; Kunelius et al. 2002).

In addition, there is some indication of beneficial effects on cognition for older men with low or low normal T levels and with mild cognitive dementia and/or Alzheimer's disease (Cherrier et al. 2005, 2015) although not all studies have shown a beneficial effect (Maki et al. 2007; Kenny et al. 2004).

T treatment, like all interventions, includes medication-related effects which may include acne, polycythemia (increased red blood cells), possible increase in prostate-specific antigen or prostate growth, edema, gynecomastia, and sleep apnea. Consideration of treatment for andropause or LOH should be discussed with the medical provider with consideration given to the treatment goal and all the important health factors of the patient (Cunningham 2013).

## Cross-References

### ► Gender Differences in Memory and Cognition

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## Anxiety and Cognition

Sherry A. Beaudreau<sup>1,2,3</sup>, Andrew J. Petkus<sup>4</sup>,  
Nathan Hantke<sup>1,6</sup> and Christine E. Gould<sup>1,5</sup>

<sup>1</sup>Department of Psychiatry and Behavioral Sciences, Stanford University School of Medicine, Stanford, CA, USA

<sup>2</sup>Sierra Pacific Mental Illness Research Education and Clinical Center, VA Palo Alto Health Care System, Palo Alto, CA, USA

<sup>3</sup>School of Psychology, The University of Queensland, Brisbane, QLD, Australia

<sup>4</sup>Department of Psychology, University of Southern California, Los Angeles, CA, USA

<sup>5</sup>Geriatric Research, Education, and Clinical Center (GRECC), VA Palo Alto Health Care System, Palo Alto, CA, USA

<sup>6</sup>Sierra Pacific Mental Illness Research, Education, and Clinical Centers (MIRECC), VA Palo Alto Health Care System, Palo Alto, CA, USA

### Synonyms

Neurocognitive functioning in late-life anxiety disorders; Neurocognitive functioning in the context of late-life anxiety symptoms

### Definition

Older adults reporting elevated anxiety symptoms have been shown to exhibit lower global cognitive functioning and lower performance in specific cognitive domains, namely, speed of information processing, memory, and effortful cognitive abilities known collectively as cognitive control (Beaudreau and O'Hara 2008). Anxiety is also frequently observed in older individuals with cognitive impairments, such as dementia (Beaudreau and O'Hara 2008).

### Global Cognitive Performance

Scientific evidence bridging late-life anxiety and cognitive performance has focused primarily on nonclinical older samples without cognitive impairment (Beaudreau and O'Hara 2008). Even among older adults with no psychiatric diagnosis, greater severity of self-reported anxiety symptoms correlates with worse global cognitive functioning in most cross-sectional studies (Beaudreau et al. 2016). Further, clinical levels of anxiety were found to increase the risk of global cognitive decline 1–5 years after baseline testing in one study (Sinoff and Werner 2003). Other longitudinal studies did not find an effect of anxiety on global cognitive decline (DeLuca et al. 2005; Okereke and Grodstein 2013). Thus, while elevated anxiety may be associated with worse global cognitive performance, findings regarding anxiety severity and global cognitive trajectories are mixed.

### Attention and Information Processing Speed

Studies on specific cognitive abilities suggest that older adults with elevated anxiety perform worse in some cognitive domains relative to older adults reporting minimal anxiety (Beaudreau and O'Hara 2008). Community-dwelling older adults who report more severe anxiety symptoms have been noted to have slower information processing speed (Beaudreau et al. 2016) and greater declines over time (Petkus et al. *in press*), with some evidence that more anxiety and depressive symptoms together impact speed of processing in community samples (Beaudreau and O'Hara 2009). Poorer divided attention and simple attention for spatial information also have been reported in older adults with higher anxiety (Beaudreau and O'Hara 2008; Derousene et al. 2004). Elevated anxiety, however, was not significantly associated with simple attention for repeating digits aloud (Derousene et al. 2004; Wetherell et al. 2002) or sequencing digits by connecting the dots on a trail-making task (Mantella et al. 2007).

Thus, performance on tasks that are more complex or require more effortful attention might be lower with elevated anxiety, but there is limited evidence that anxiety influences simple tasks of attention.

### Cognitive Control

Complex cognitive processes, collectively referred to as executive functioning or cognitive control, have been of increasing interest with regard to late-life anxiety (Beaudreau et al. 2013). Though many definitions for these abilities exist, the most recent conceptualization includes tasks that require a person to maintain a goal or switch goals. This conceptualization of cognitive control has been examined using the Stroop task, which requires the person to say the ink color of color words that are purposely incongruent (i.e., the word “blue” written in red ink). In older nonpsychiatric community samples, inhibitory ability appears to be lower in those with more severe anxiety symptoms (Beaudreau and O’Hara 2008). This association is not attributable to depressive symptoms as an independent predictor or in interaction with anxiety symptoms in community elders, suggesting that anxiety may be uniquely related to inhibition. Ability to shift set (i.e., alternating between numbers and letters sequentially) is worse in individuals with generalized anxiety disorder (GAD) than in nonpsychiatric controls (Mantella et al. 2007) and also poorer in elders with more anxiety symptoms (Booth et al. 2006; Yochim et al. 2013). Nevertheless, poorer set shifting was also found in individuals carrying a diagnosis of major depressive disorder (MDD; Mantella et al. 2007) or with greater depressive symptoms (Yochim et al. 2013) suggesting that these findings are not anxiety specific. Further, in the Mantella et al. study (2007), the MDD group performed worse than the GAD and nonpsychiatric control groups on a very basic cognitive control battery. This finding suggests that the nature of cognitive control difficulties in anxiety compared with depression is distinct and likely more global in late-life depression than in anxiety.

### Memory

Memory is another complex cognitive ability that might be compromised with elevated anxiety

(Beaudreau and O’Hara 2008; Beaudreau et al. 2016). Nonclinical older samples have demonstrated worse learning and delayed memory for verbal information in the context of more severe anxiety symptoms (Booth et al. 2006), though the association might not be linear. Specifically, mild and severe anxiety could both be detrimental to memory performance, and moderate levels could be facilitative in older adults – potentially best represented as an inverted U-shaped relationship (Bierman et al. 2005). Other nonpsychiatric older adult studies have also found an association, independent of depressive symptoms, between higher state anxiety and greater declines in visual recognition memory over time (Petkus et al. *in press*). In psychiatric samples, general memory performance has been shown to decline faster in older individuals with MDD and a co-occurring anxiety disorder (GAD or panic disorder) than MDD alone (DeLuca et al. 2005). In an investigation comparing older individuals with GAD, MDD, and nonpsychiatric controls, Mantella and colleagues (2007) found that both GAD and MDD groups had poorer delayed memory performance compared with controls; thus, memory issues may not be specific to anxiety. Only the GAD group (and not those with MDD), however, had significantly poorer immediate memory recall compared with controls. This could be due to older persons with GAD having trouble encoding new information due to attentional problems, or because they lose recent information more quickly, possibly due to inefficient learning strategies related to poorer cognitive control abilities. The latter hypothesis of inefficient learning strategies being unique to anxiety is posited from recent evidence showing that in nonpsychiatric elders, elevated anxiety and depression were both associated with more difficulty in learning new information; however, anxiety alone was associated with less efficient categorization strategies (Yochim et al. 2013). Future studies that examine the underlying memory processes in GAD would help determine mechanisms behind the findings regarding memory performance in GAD.

### Other Cognitive Abilities

Less research has focused on other cognitive abilities such as language and visuospatial abilities.

Though one investigation found that the ability to generate synonyms for words was poorer in the context of greater state anxiety (Wetherell et al. 2002), other studies found that confrontational naming of objects based on line drawings was not associated with anxiety severity in nonpsychiatric (Beaudreau and O'Hara 2009) or psychiatric older samples (i.e., Mantella et al. 2007). Thus, generally speaking, there is no clear evidence that anxiety impacts language in older adults.

Visuospatial ability may potentially be compromised in the presence of elevated anxiety, although only one study has reported on this to date. Older adults with higher state anxiety demonstrated poorer visuospatial skills based on a block design task (Petkus et al. *in press*). Preliminary findings from an investigation of community-residing older adults, however, found no associations between anxiety symptom severity and visual-spatial abilities based on a line orientation task (Beaudreau et al. 2015).

### Cognitive Models

Eysenck's processing efficiency and attentional control theories are broadly applicable to late-life cognitive performance in individuals with both nonpsychiatric and psychiatric anxiety. Eysenck proposed that anxious states divert cognitive resources to threatening stimuli and away from cognitive tasks. He postulates that this overtaking of cognitive resources interferes with attentional control during inhibition, task shifting, and working memory monitoring or updates (Eysenck et al. 2007). Marchant and Howard (2015) extended Eysenck's theory to hypothesize that worry or anxiety incurs a cognitive debt with regard to compensatory strategies. Specifically, a person's ability to compensate for cognitive losses due to neurodegenerative disease diminishes in the presence of anxiety because it taxes cognitive resources. This tendency for anxiety to usurp precious cognitive resources, combined with normal, age-related cognitive loss, has been proposed as a double jeopardy in anxious, older individuals (Beaudreau et al. 2013).

### Summary

Late-life anxiety has associations with global cognitive performance and with more complex

cognitive processes, namely, divided attention and information processing, cognitive control, and memory. Late-life anxiety and depression overlap in some areas identified as reduced for cognitive control ability, such as set shifting. Other areas of reduced cognitive control performance appear unique to anxiety, for instance, inhibitory ability and categorization. These dampened cognitive control abilities in late-life anxiety could potentially drive lowered performance in other complex cognitive processes, such as memory. Evidence for associations of anxiety with other cognitive abilities, including simple attention, language, and visuospatial ability, derives from few studies and less theoretical support. Continued development of a framework that combines theoretical work regarding anxiety grabbing attentional resources and cognitive decline due to normal aging is most salient to understanding these associations.

### Anxiety in Individuals with Cognitive Impairment

A second line of inquiry with regard to anxiety and cognition in older adults has been to determine if anxiety is more common in older individuals with cognitive impairment and more recently whether anxiety increases the likelihood of incident cognitive impairment. This research has mostly focused on dementia, but mild cognitive impairment (MCI) has been studied as well. Higher rates of anxiety symptoms are observed with more severe cognitive impairment, i.e., dementia (Beaudreau and O'Hara 2008). In particular, the likelihood of clinically significant anxiety triples in MCI compared with older adults with no cognitive impairment (Geda et al. 2008). The presence of anxiety in MCI and dementia has been reported as high as 43% and 80%, respectively (Lyketsos et al. 2002). Both amnesic and non-amnesic subtypes of MCI have been linked to chronic and severe anxiety (Andreescu et al. 2014).

The presence of anxiety symptoms also increases over time in dementia (Brodaty et al. 2015), and these symptoms have been

shown to lead to additional behavioral and cognitive issues (Ferretti et al. 2001), which can create further challenges to the person with dementia, the caregiver, or both. In addition, anxiety symptoms double the risk of Alzheimer's disease in persons with MCI over a 3-year time frame (Palmer et al. 2007). Anxiety emerged as an independent risk factor for Alzheimer's disease (AD) in participants with amnesic MCI enrolled in the Alzheimer's Disease Neuroimaging Initiative (ADNI), a longitudinal investigation with recruitment sites around the world (Mah et al. 2015). The median follow-up was 3 years. Anxiety remained significant after accounting for memory loss, depression, and baseline volume for areas of the brain typically associated with AD pathology and neurodegeneration (hippocampus and, within it, the entorhinal cortex). Remarkably, anxiety predicted faster atrophy of the entorhinal cortex. Results suggest that anxiety exerts an effect on the entorhinal cortex both directly and indirectly. The authors contend that these results argue for anxiety as a risk factor for dementia rather than a prodromal stage of dementia.

### Biological Models

Neurotoxic effects of habitual stress on the brain have been a popular model linking late-life anxiety and cognitive impairment (Carlson 2004). In particular, the hypothalamic-pituitary-adrenal (HPA) axis produces the stress hormone cortisol. Chronic elevation of cortisol due to stress anxiety can have damaging effects on the brain, especially the hippocampus (Lupien et al. 1998), a critical area for learning and memory, and the prefrontal cortex (Kremen et al. 2010), important for cognitive control.

Genetic factors are also implicated in the association between anxiety and cognitive dysfunction. Shared genetic vulnerabilities have been shown to explain as much as 36–80% of the correlation between anxiety and cognitive performance (Petkus 2014). Genetic factors common to anxiety and dementia partially explain the increased risk of developing dementia in older adults with elevated anxiety (Petkus et al. [under review](#)). Gene polymorphisms, particularly Val66Met polymorphism of the *BDNF* gene (Suliman et al. 2013; Ward et al. 2014) and the

*Apolipoprotein E ε4* variant (Michels et al. 2012; Reynolds et al. 2006), have been identified as potential contributors to both anxiety and cognitive impairment. These and other genetic vulnerabilities likely interact with environmental risk factors, particularly early life stress or abuse (Heim and Nemeroff 2001), setting the stage for both anxiety and cognitive impairment.

Chronic medical conditions, such as cardiovascular disease (Mozaffarian et al. 2015) and high blood pressure (Carmichael 2014), are also associated with elevated anxiety and poorer cognitive performance. Both of these medical conditions have been associated with white matter changes in the brain that have been implicated in reduced cognitive control abilities (Carmichael 2014). In addition, thyroid disease has been linked to both anxiety and cognitive functioning. Thyrotoxicosis and Graves' disease, diseases with hyperthyroidism, have been associated with more severe levels of anxiety symptoms in younger (Gulseren et al. 2006) and older adults (Brandt et al. 2014). Hyperthyroidism may also produce cognitive problems, although the results have been mixed (Yudiatro 2006; Lilesvant-Johansen 2014). Though not a medical condition per se, it is worth noting that amyloid beta deposits, common in AD, may be moderated by anxiety symptoms (Pietrzak et al. 2015). In particular, older individuals with no cognitive impairment demonstrated faster cognitive decline in the presence of high amyloid beta concentration and high anxiety. Thus, biological models suggest that the etiology underlying association between anxiety and cognitive decline is multifactorial including, but not limited to, the neuronal, environmental, genetic factors and specific chronic medical conditions.

### Conclusion

To date, there is overwhelming support for associations between elevated anxiety and reduced cognitive ability in older individuals. Further, the higher frequency of anxiety among cognitively impaired individuals is now substantiated with prospective investigations showing anxiety as a risk factor for developing dementia. While anxiety

shares some cognitive characteristics with depression, the evidence base clearly shows that aspects of reduced cognitive performance and risk for cognitive impairment have unique associations with anxiety not otherwise explained by depression. Further delineation of these associations could lead to identification of different anxiety subphenotypes distinguished by distinct cognitive profiles, which could have implications for treatment as well as prevention of cognitive impairment.

## Cross-References

- ▶ [Anxiety Disorders in Later Life](#)
- ▶ [Aging and Attention](#)
- ▶ [Aging and Inhibition](#)
- ▶ [Cognitive Control and Self-Regulation](#)
- ▶ [Depression in Later Life](#)
- ▶ [Emotion–Cognition Interactions](#)
- ▶ [Executive Functions](#)
- ▶ [Mental Health and Aging](#)

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## Anxiety Disorders in Later Life

Gert-Jan Hendriks

Pro Persona Institute for Integrated Mental Health Care, Centre for Anxiety Disorders “Overwaal,” Nijmegen, The Netherlands  
 Radboud University Nijmegen, Behavioural Science Institute, Nijmegen, The Netherlands  
 Radboud University Medical Centre, Department of Psychiatry, Nijmegen, The Netherlands

## Synonyms

Anxiety disorders in older adults; Late-life anxiety disorders

## Definition

Anxiety disorders are generally characterized by both excessive fear and irrational, fearful thoughts that are difficult to control and negatively affect daily functioning. Additionally, avoidance behaviors are often used as a strategy to reduce those excessive feelings of fear and anxiety. Anxiety disorders are the most common mental disorders across the life span. With the introduction of DSM-5 in 2013 (American Psychiatric Association 2013), obsessive-compulsive disorder, post-traumatic stress disorder, and acute stress disorder moved from the anxiety disorder section into two separate sections: obsessive-compulsive and related disorders, and trauma- and stressor-related disorders. DSM-5 anxiety disorders seen in older adults include panic disorder, agoraphobia, social anxiety disorder, generalized anxiety disorder, and specific phobia.

## Introduction

Several epidemiologic studies have revealed that anxiety disorders are the most prevalent mental disorders in later life. Most of these studies are limited to European and North American populations. As a result of conceptual and methodological differences between studies, prevalence rates differ widely. Most studies showed a prevalence of late-life anxiety disorders between 6% and 10% (Bryant et al. 2008). These disorders have a chronic life course that often begins early in life with a median age of onset of 11 years (Kessler et al. 2005). An onset of anxiety disorders in older adulthood is less common with only 1% appearing for the first time at age 65 years or older (Kessler et al. 2005). Although research into late-life anxiety disorders has grown in recent years, it is still in its infancy, and there still is a large gap to bridge compared to, for example, studies on late-life depression. Studies examining how anxiety presents differently in young versus older adults are limited, and well-conducted treatment studies in elderly patients are still scarce.

Despite the frequent appearance of anxiety disorders in later life, older adults suffering from

anxiety tend to be underdiagnosed and undertreated. These disorders may go unnoticed due to the chronicity of their course, the overlap of anxiety symptoms with other common comorbid psychiatric and medication issues, and the misinterpretation of avoidance behaviors as age appropriate rather than a sign of a psychiatric disorder. First, anxiety into late adulthood may go undetected because of their chronic course that starts often early in life. This is in contrast to depression or dementia, which may be easier to detect due to a marked appearance at a later age. Specifically, depression has a median age at onset of 32 years, and 27% of individuals have their first depressive episode at 65 years or older, and most dementias appear for the first time after age 60. Second, with regard to comorbidity, other disorders (e.g., depression) may mask the existing anxiety symptoms, increasing the likelihood that the anxiety disorder goes unrecognized. This becomes especially difficult when chronic medical conditions like pulmonary or cardiovascular diseases are also present, might fully or partly explain the origin of anxiety. Third, “ageism,” which in this context refers to the misinterpretation of abnormal behaviors as age appropriate, may hinder the diagnosis and thus proper treatment of late-life anxiety disorders. Avoidance behaviors after a heart attack are, for instance, often deemed understandable and an adequate, adaptive response, but could underlie a larger issue with anxiety. In addition, being retired and often receiving support in and around the home, elderly people may increasingly and successfully avoid anxiety-provoking situations, like traveling by car or visiting crowded shopping malls unattended, without raising suspicions of a more serious affliction. These aforementioned issues contribute to differences in late-life anxiety presentation in older adults compared to younger adults, which may hinder proper recognition and diagnosis. Underdiagnosis of anxiety disorders could lead to the assumption that they are a minor health problem in later life. The following sections challenge this presumption and provide an overview of the empirical research on late-life anxiety disorders.

## Epidemiology

Recently a systematic review and meta-analysis provided data on the global prevalence of anxiety disorders (Baxter et al. 2013). These data showed substantial variation across different regions in the world. The mean current prevalence of anxiety disorders was 7.3% and ranged from 5.3% in African countries to 10.4% in Western countries. The global 12-month prevalence ranged from 7.6% to 17.7%. Prevalence rates on specific anxiety disorders were not provided. Overall anxiety disorders were twice as common among women compared to men. Compared to Western countries, the risk for experiencing anxiety disorders was 20–50% lower in non-Western countries. Older age (>55 years) was associated with a 20% lower prevalence of anxiety disorders compared with younger age groups. Additionally, a recent meta-analysis of late-life mental disorders in Western countries showed current and lifetime prevalence rates for specific late-life anxiety disorders: 0.88% and 2.63% for panic disorder, 0.53% and 1.00% for agoraphobia (with and without panic), 4.52% and 6.66% for specific phobia, 1.31% and 5.07% for social phobia, and 2.30% and 6.36% for generalized anxiety disorder (Volkert et al. 2013).

Studies of the global burden of disease reveal that mental and substance use disorders are the fifth leading disease category of global disability-adjusted life years (DALYs) accounting for 7.4% of total disease burden (Whiteford et al. 2013). Within this category anxiety disorders account for the second most common cause of DALYs (overall 14.6%), whereas depression is the first cause accounting for 40.6% of DALYs among almost all countries (except Eastern Europe where alcohol use disorders were the second cause) and among almost all age categories (except drug use disorders between 20 and 35 years). The burden for anxiety disorders rises rapidly in childhood, peaks between 15 and 25 years, and declines with increasing age afterward.

## Clinical Features and Diagnostic Issues

### Underdiagnosis and Undertreatment in Late-Life Anxiety

Underdiagnosis and undertreatment of late-life anxiety are reflected in the available epidemiological data. A longitudinal epidemiological study in the Netherlands showed that a mere 2.6% of elderly patients reporting anxiety symptoms consulted a psychiatrist, and only 3.8% were seen by health professionals at a mental health outpatient clinic. In this sample of older adults reporting anxiety symptoms, the use of antidepressants was also extremely low (3.8%), although 25% were prescribed benzodiazepines. Six years later the use of benzodiazepines had increased to 43%. The prescription of antidepressants had doubled to 7%, and referral to mental health facilities raised to 14% (Schuurmans et al. 2005). The findings are important because benzodiazepines are, relative to antidepressants, not the first-line agents for the management of anxiety disorders and are associated with serious drug-related hazards such as a possible aggravation of cognitive difficulties (e.g., memory problems), becoming dependant, and an increased risk of falls and fractures.

The National Comorbidity Survey – Revised (NCS-R), conducted in the United States, has also confirmed the increased overall risk of elderly people (aged over 60 years) going untreated for mental disorders in general relative to their younger counterparts: compared to younger adults between, respectively, 18–29 years, 30–44 years, and 45–59 years, older adults were, respectively, 4.8, 3.8, and 2.4 more times likely of being untreated for a mental health disorder (Wang et al. 2005).

### Although Partially Overlapping, Later-Life Anxiety Disorders and Depression Need to Be Distinguished

The widespread assumption that depression almost always accompanies late-life anxiety could lead some clinicians to prefer a diagnosis of mixed anxiety-depression syndrome over a

diagnosis of an anxiety disorder in an older patient. Nevertheless, this concern may not be warranted given that mixed anxiety-depression syndrome has a prevalence of only 1.8% in older adults (Bryant et al. 2013). Although there is a clear evidence of a large overlap in anxiety and depression in older adults, studies have uncovered more differences than similarities between late-life anxiety and depression. Whereas a quarter of the elderly participants diagnosed with an anxiety disorder also met the DSM-IV criteria for a comorbid major depression; approximately half of those diagnosed with major depression satisfied the criteria for a comorbid anxiety disorder. Although anxiety and depressive symptoms partially overlapped, they could also be distinguished from each other. Whereas late-life depression was associated with an older age at onset and an external locus of control (i.e., attributing success or failure to outside influences or believing that events in one's life are caused by uncontrollable factors), the risk profile for late-life anxiety disorders was more complex, consisting of a combination of vulnerability factors, daily stressors (e.g., chronic medical comorbidity, functional limitations), life events (e.g., recent losses), and social problems (e.g., smaller social network, less emotional support). These differences in comorbidity patterns and risk factors suggest that late-life anxiety and depression are distinguishable diagnostic entities.

### **Age of Onset and Course of Late-Life Anxiety Disorders**

The NCS-R data showed that when compared to mood disorders, anxiety disorders generally have the youngest age at onset (Kessler et al. 2005). As noted in the previous section, the median age of onset was 11 years, with 75% of all anxiety disorders starting before the age of 21 years and only 1% starting after the age of 65 years. These figures correspond with an observed global rapid increase in the burden of disease of anxiety disorders before the age of 15 and a peak between the age range 15–25 (Whiteford et al. 2013). Although prospective posttreatment follow-up studies in

adult populations (18–65 years) gauging the clinical course of anxiety disorders for 10 or more years are scarce, existing evidence reveals the chronicity of symptoms and relative high relapse risk for anxiety disorders in general (Lenze and Wetherell 2011). The recovery rate for anxiety disorders following treatment varied from 40% to 60%, and relapse rates during a several-year follow-up period remained high. Given that the greater majority of adults suffering from anxiety disorders do not receive adequate treatment, it can safely be concluded that anxiety disorders tend to start at a young age and are highly likely to be chronic, with a fluctuating course into late adulthood and thus contributing to a relatively high prevalence in later life.

### **Late-Life Anxiety Disorders Should Not Be Regarded as a Minor Health Problem**

Clinicians and researchers are often inclined to consider anxiety disorders in older adults a minor health problem that does not seriously impair their quality of life, but the opposite is true (Lenze and Wetherell 2011). Firstly, as mentioned earlier, empirical findings show that late-life anxiety disorders are frequently associated with psychiatric (e.g., with major depression and other anxiety disorders) and medical comorbidity (e.g., cardiovascular disease). Secondly, the quality of life is affected in older people with anxiety to levels that are comparable to what has been observed in older adults suffering from major depression; they experience significantly more decline in physical health, general well-being, and social and overall functioning and more health-care utilization compared to asymptomatic elderly. Finally, late-life anxiety is associated with an increased risk of mortality and for dementia.

### **The Diagnosis of Late-Life Anxiety Disorders May Be Complicated by Age-Related Variables**

Medical and cognitive comorbidity can pose a challenge to accurate diagnosis and treatment of late-life anxiety disorders. Most elderly people with anxiety problems tend to attribute their symptoms to physical causes and existing medical

conditions (Wolitzky-Taylor et al. 2010). Moreover, the process of aging is often associated with more physical illness and other physical symptoms. Overall, more than 80% of the older adults are diagnosed with one of more chronic physical illnesses (Wolitzky-Taylor et al. 2010). Symptoms of anxiety and depression in older adults often coincide with serious somatic conditions, especially cardiovascular involvement, chronic obstructive pulmonary diseases (COPD), hyperthyroidism, and vestibular problems. Thus, separating anxiety disorders from “normal” anxiety induced by medical problems and procedures may be difficult. In addition, cognitive decline and dementia seem to be interrelated with anxiety in later life in a bidirectional way, which can also complicate or obscure the presence of an anxiety disorder in an older patient.

Further, receptiveness to sharing personal information with a provider can also pose a challenge to treating anxiety in older patients. The current generation of elderly may be less open in sharing psychological problems than the younger generations and may therefore have been struggling with anxiety symptoms for many years without ever receiving adequate treatment. A prospective cohort study showed that less than 5% of the elderly patients confronted with psychological problems consulted their general practitioners (Shah et al. 2001). The question whether they are reluctant in communicating their personal problems or whether they lack the necessary verbalizing skills to do so remains.

Finally, it is plausible that aging may lead to phenomenological differences with younger adults suffering from similar anxiety disorders and therefore possibly making an accurate diagnosis more difficult.

### **Phenomenological Age-Related Differences**

The main arguments to differentiate between anxiety disorders in young and middle-aged individuals and older adults are the supposed differences in phenomenology and outcome in the two age bands. However, the criteria for the differentiation of early and late-onset anxiety seem fairly arbitrary, and the threshold age range in previous studies varied from 25 to 60 years. Some studies

based their differentiation on analyzing epidemiological data calculating a best fitting cutoff age between 25 and 30 years (Tibi et al. 2013). Epidemiologically based studies showed that a later onset of anxiety disorders was associated with less severity and a better outcome. Other studies used a threshold age of 55–65 years (Ritchie et al. 2013) to differentiate between early and late onset. Also, in these studies an onset at older age was associated with less severity and better outcome. An unambiguous, proper, and valid definition of early- and late-onset anxiety disorders is as yet not available.

Differences in cognitive (i.e., worry), emotional (i.e., feeling keyed up), and physical symptoms (i.e., heart palpitations) between younger and older adults with anxiety problems have mainly been studied in undiagnosed or outpatient populations with elevated anxiety or mixed symptoms (Gould and Edelstein 2010). It is demonstrated in these populations that, relative to the values obtained in younger individuals, older age, and especially onset at an older age, is associated with fewer cognitive and emotional symptoms of anxiety, as well as a decrease in physiological arousal. Additionally, older adults may experience more tolerance of uncertainty. In general, the experience of negative feelings and the intensity of emotional responses appeared to decrease with progressing age. This may be attributable to a natural, age-related decrease in emotional responsiveness, i.e., a dampening of affective reactivity. Additionally, elderly people tend to be more in control of their emotional life and better able to cope with stressful life events. So far, however, these factors have never been systematically examined, and mentioned assumptions are hypotheses at the present time.

Most studies are conducted in older adults with generalized anxiety disorder. It was observed that older adults with generalized anxiety disorder showed fewer symptoms compared to younger adults (Miloyan et al. 2014b). Compared to the younger age categories trouble in concentrating, feeling dizzy/lightheaded and gastrointestinal symptoms like nausea and upset stomach are more prevalent in late-life generalized anxiety disorder. Also the worry content differs in later

life. Older GAD patients worry more about health and the well-being of loved ones, whereas their younger counterparts worry more about work, finances, and social relations.

Phenomenological age-related differences were also studied in elderly patients diagnosed suffering from panic disorder with/without agoraphobia. Furthermore, the phenomenology of panic attacks in younger and older adults has also been investigated in nonclinical populations and populations with mixed anxiety disorders. It was demonstrated that, relative to the values obtained in younger individuals, aging and onset at an older age are associated with a decrease in both cognitive and affective anxiety, as well as in physiological arousal. It is suggested that normal age-related psychophysiological changes and the latter symptom onset are responsible for these differences, which would explain why panic disorder with/without agoraphobia has been considered to be a less severe disorder later in life (Flint et al. 1998; Hendriks et al. 2010; Segui et al. 2000; Sheikh et al. 2004). These findings could explain a declining severity of physiological (e.g., lower increase in the heart rate frequency during panic attacks) and cognitive symptoms of anxiety (e.g., agoraphobic cognitions like the fear of going crazy or losing control) in late-life panic disorder. However, differences in age-related differences in agoraphobic avoidance, a core symptom in panic disorder with agoraphobia, were not found.

Also in social phobia, an age-related reduction in number of symptoms was observed. However, a core symptom profile accounting for the diagnosis of social phobia and consisting of both social phobic cognitions and social phobic avoidance behaviors remains the same across all age categories (Miloyan et al. 2014a).

It may also be important to differentiate between an early and a late onset of the complaints in older patients with social phobia, and other late-life anxiety disorders, because age of onset may likewise have a differential impact on the presence and severity of specific symptoms. Nonetheless, insufficient information about age of onset in older adults with social phobia symptoms are available at this time.

### Assessment of Anxiety in Older Adults

The use of semi-structured clinical interviews, like the Anxiety Disorders Interview Schedule or the Structured Clinical Interview for DSM disorders, is the gold standard in diagnosing anxiety disorders in the general population. In general, self-report instruments are used to assess severity of symptoms of anxiety disorders and to evaluate treatment effects. A major limitation of the available instruments, especially instruments for the specific anxiety disorders, is both the absence of validation studies of these instruments in older adults and the lack of research on the assessment of late-life anxiety. Psychometric evidence is sufficient for the use of the Penn State Worry Questionnaire to assess severity of worry in older adults (Crittendon and Hopko 2006). Additionally, the Beck Anxiety Inventory, the Geriatric Mental Status Examination, and the Geriatric Anxiety Inventory are also valid instruments for assessing general anxiety symptoms in older adults (Therrien and Hunsley 2012). Finally, the short version of the Geriatric Anxiety Inventory, consisting of 5 items, may be a psychometrically sound instrument for use in large-scaled epidemiological studies or for screening purposes in older adults in primary care (Byrne and Pachana 2011).

### Treatment

For young and middle-aged adults, powerful, evidence-based, and guideline-recommended treatments are available for all anxiety disorders. Numerous meta-analytic studies confirmed the efficacy of both cognitive behavioral therapy (CBT) and antidepressants (selective serotonin reuptake inhibitors (SSRIs) or tricyclic antidepressants (TCAs)) or the combination. Recent meta-analytic findings showed that both treatments improved also quality of life (Hofmann et al. 2014a, b). CBT and SSRIs/TCAs are also assumed to be effective in older adults diagnosed with anxiety disorders (Pinquart and Duberstein 2007). However, to date empirical evidence on the efficacy of these two treatments in adults aged 65-plus years is scarce since randomized controlled trials (RCTs) testing both CBT and

SSRIs/TCAs and direct comparisons of the two treatment arms in older and younger adults are lacking. In older adults reporting anxiety-related complaints, the symptoms may often not be recognized as serious, and the possibility of a psychological disorder is hence most often overlooked, leaving many patients undiagnosed and undertreated. The diagnostic focus often primarily concerns the patient's physical problems and the reassurance that no physical abnormalities have been found. Even if diagnosed adequately, the older patient is seldom offered a targeted and evidence-based treatment. Thus, rather than antidepressants, CBT, or both, the two treatments of choice for anxiety disorders, benzodiazepines are often prescribed.

The extensive research into the treatment of anxiety disorders in younger adults is in stark contrast to the small number of randomized controlled studies focusing on late-life anxiety disorders. The outcome of the relatively few findings from studies focusing exclusively on elderly patients is analyzed in several meta-analytic reviews. Both CBT and antidepressants (SSRIs or TCAs) may also be the optimal treatments for the management of anxiety disorders in older adults, although it is suggested that the efficacy of CBT in the treatment of anxiety disorders is lower in older adults compared to younger adults (Wetherell et al. 2013a). No differences were found between CBT and other psychological treatments in the treatment of late-life generalized anxiety disorder (Goncalves and Byrne 2012; Gould et al. 2012; Hendriks et al. 2008; Pinquart and Duberstein 2007). However, direct age comparisons of the efficacy of CBT within the same study are scarce. To date, only one study compared the outcome of CBT in younger and older adults suffering from panic disorder with agoraphobia and found no differences in outcome between the two age bands (Hendriks et al. 2014). Additionally, studies combining pharmacological and psychological treatment are also lacking. In the only study published so far, CBT augmented response on escitalopram in older adults suffering from generalized anxiety disorder and both interventions prevented relapse at the long term (Wetherell et al. 2013b).

It is suggested that CBT protocols originally developed for younger adults should be adapted to the specific needs and preferences of older adults. Proposed adaptations are focusing on education, frequently repeating treatment rationale, frequent use of reminders, offering help in practicing homework, and adherence enhancement. Although the very few studies have demonstrated that adaptations in CBT improved treatment outcomes for late-life anxiety, these studies were small, and findings are preliminary. Generalized anxiety disorder is by far the most studied anxiety disorder in older adults. Studies on the treatment of panic disorder with/without agoraphobia are scarce and absent in as well late-life social phobia, agoraphobia as specific phobias.

## Cross-References

- ▶ [Cognitive Behavioural Therapy](#)
- ▶ [Comorbidity](#)
- ▶ [Depression in Later Life](#)
- ▶ [Psychological and Personality Testing](#)
- ▶ [Worry in Later Life](#)

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## Aphasia in Later Life

Linda Worrall<sup>1</sup>, Tanya Rose<sup>1</sup>,  
Caitlin Brandenburg<sup>1</sup>, Alexia Rohde<sup>1</sup>, Karianne Berg<sup>2</sup> and Sarah J. Wallace<sup>1</sup>

<sup>1</sup>The University of Queensland, St Lucia, Brisbane, QLD, Australia

<sup>2</sup>Norwegian University of Science and Technology, Trondheim, Norway

### Synonyms

Aphemia; Dysphasia

### Definition

“Aphasia is an acquired selective impairment of language modalities and functions resulting from a focal brain lesion in the language-dominant hemisphere that affects the person’s communicative and social functioning, quality of life, and the quality of life of his or her relatives and caregivers” (Papathanasiou et al. 2013). This definition incorporates the main components of

commonly accepted definitions of aphasia. Aphasia is an acquired disorder, not a developmental disorder. It is selective to the language pathways of the brain. Aphasia results when there is damage to the language-dominant hemisphere, usually the left hemisphere, and the most common cause of aphasia is stroke. Focal lesions that cause aphasia may also include brain tumor and head trauma, such as gunshot wounds. However, as Papathanasiou and colleagues (Papathanasiou et al. 2013) point out, the language difficulties sustained after a head injury may be intrinsically bound to cognitive difficulties. This is also the case in more generalized language deficits that occur in dementias. To distinguish aphasia from other language impairments, Code (1989) highlights that aphasia can be described as impacting on core linguistic components including lexical semantics, syntax, morphology, and phonology. Put simply, aphasia is a problem with talking, understanding, reading, and/or writing. The provided definition also extends beyond the person with aphasia to describe the impact of aphasia on those around them.

### Introduction

The word aphasia originates from the Greek “a” (without) and “phásis” (speech), literally meaning “speechless.” While the prefix “a” indicates a complete loss, the term aphasia is commonly used to describe both the total loss and partial impairment of language. Hollowell and Chapey (2008) describe four principles important to include in a definition of aphasia:

1. Aphasia is neurogenic in that there is some form of damage to the brain.
2. Aphasia is acquired in that there is a partial or complete loss of language function in a person who had previously developed some language ability.
3. Aphasia involves language problems in that the individual with aphasia may have a problem with formulation and interpretation of linguistic symbols, i.e., aphasia is multimodal.
4. Aphasia is not a problem of sensation, motor function, or intellect (p. 3).

The definition of aphasia has evolved in parallel with treatment philosophies and health frameworks, shifting from a sole focus on impaired language modalities to incorporate the broader impacts of the condition on the person and their significant others. The World Health Organizations' International Classification of Functioning, Disability, and Health (World Health Organization 2001) is a conceptual framework that is often used to describe the impact of aphasia. In reference to this framework, the *health condition* is the stroke or brain injury that has caused the aphasia. The *impairment* is the language impairment that results from the loss of functioning to the language pathways of the brain. This may have a broad effect on *activities* and *participation* in life roles. For example, when communication activities such as conversing, telephoning, writing letters, and reading books are limited, participation in education, work, and leisure roles may be restricted. Both *personal and environmental factors* may impact the person's ability to communicate, with the major environmental factor being the communicative ability and support of key conversational partners such as family and friends.

The majority of people living with aphasia are above the age of 65. This is due to the increased incidence and prevalence of stroke in the older population (Go et al. 2014), with stroke being the main cause of aphasia. Approximately 65% of all strokes occur in individuals 65 years or older (Go et al. 2014; Rothwell et al. 2005). Incidence refers to the new cases identified in a given period of time and prevalence to the number of people living with the condition in a given period of time. Relating this to aphasia, Engelter et al. (2006) studied the incidence of aphasia in first-ever ischemic strokes (i.e., strokes caused by a blockage of blood flow to the brain). The number of people diagnosed with aphasia in this study increased from 15% for people below the age of 65 to 43% in people above the age of 85 years. This is an increased risk of aphasia of 3% for each year of the stroke patient's age.

The impact of aphasia in older people has been described by Davidson and colleagues (2003)

who compared the everyday communication activities in healthy older people and older people with aphasia. This study showed that there were both similarities and differences between these two groups. People with aphasia engaged in the same type of communication activities but had fewer communication partners and less engagement in social interactions than their healthy counterparts. Communication situations that were affected by aphasia were information sharing, maintaining and establishing relationships, and telling one's story. All of these situations are important to maintaining a person's feeling of belonging and having a chance to share one's wisdom and life experiences, feelings, and opportunities which are related to aging (Birren and Schroots 2000). In another study by Davidson et al. (2006), the same results were evident. People with aphasia were shown to have fewer friends than healthy older people, something that may lead to isolation and loneliness and more dependence on family and friends.

## Classifying Aphasia

Aphasia impacts individuals differently, and various classifications have been devised to help categorize these differences. The most commonly used dichotomy for describing and grouping types of aphasia is between *nonfluent* and *fluent* aphasia. People with *nonfluent aphasia* have halting, effortful language, often producing few words with no connecting words or grammatical elements (e.g., "Dog...feed"). In contrast, people with *fluent aphasia* have a "flow of language" which sounds similar to a speaker without aphasia, but that often lacks meaning (e.g., "Well see he came and did that, but then the other happened so I left"). Another commonly used dichotomy is based on level of comprehension deficit. *Expressive aphasia* is a term used to describe impaired expressive abilities (i.e., difficulty speaking/writing) when the individual has relatively intact comprehension abilities (i.e., understands spoken/written language). In contrast, *receptive aphasia* is a term used to describe impaired

comprehension abilities, regardless of the individual's expressive abilities.

More detailed subclassifications of aphasia exist as a way of grouping the various presentations of this communication difficulty, helping to guide treatment. A commonly used classification system is the Bostonian or Connectionist classification system (Murray and Clark 2005). This classification system contrasts language characteristics, specifically language fluency (i.e., nonfluent versus fluent language), naming ability, comprehension ability, and repetition skills to form different aphasia subtypes, each associated with a specific brain location. Aphasia subtypes in this classification system are Wernicke's, Broca's, transcortical sensory, transcortical motor, transcortical mixed, anomic, conduction, and global aphasia (Murray and Clark 2005).

The language characteristics observed in an individual with *Wernicke's aphasia* include fluent language and poor comprehension skills, with the individual producing flowing but "empty" speech, sometimes producing jargon or nonsense words. These difficulties are proposed to occur as a result of damage to Wernicke's area of the brain (i.e., the posterior section of the superior temporal gyrus). *Transcortical sensory aphasia* presents similarly to Wernicke's aphasia, except that a strong ability to repeat words or phrases is retained, and a person may exhibit echolalia. In contrast, a classic presentation of *Broca's aphasia* would be halting speech consisting mainly of content words (nouns, verbs) but with few grammatical elements (agrammatism). Comprehension in Broca's aphasia is relatively intact. This type of aphasia is linked with damage to Broca's area of the brain (i.e., the anterior portion of left hemisphere). *Transcortical motor aphasia* is similar to Broca's aphasia, but again with preserved repetition and possible echolalia. *Mixed transcortical aphasia* is a combination of both sensory and motor transcortical aphasias, where both expressive and receptive language abilities are poor, but repetition remains intact. *Conduction aphasia* is associated with damage to the arcuate fasciculus (or parietal lobe in general) and is characterized by impairments in repetition of words or phrases which exceed any expressive or receptive

difficulties. *Anomic aphasia* is an aphasia type characterized by word-finding difficulties, with minimal impairment in grammar or receptive language. *Global aphasia* refers to a severe impairment of both expressive and receptive language and is associated with extensive damage to the language-dominant hemisphere (usually the left). It should be noted that while formal classifications provide a common language for describing aphasia, not all cases will fit exactly into a single aphasia type. Furthermore, aphasic language impairments can change over time, for example, if people with global aphasia are able to recover a substantial amount of their language skills, their aphasia may resolve into a Broca's or transcortical motor type.

Types of aphasia also exist outside of the standard Bostonian/Connectionist classification system. For example, *primary progressive aphasia* is a type of aphasia which results from progressive neurological disease, rather than stroke or traumatic brain injury (Murray and Clark 2005). Thus, this type of aphasia is unique, as language deficits worsen over time, unlike other types of aphasia where the individual's language abilities remain stable or improve over time. In order for aphasia to be classified as "primary progressive aphasia," rather than dementia, the impact on language must be independent of impairments in cognitive functions.

There are also types of aphasia classified according to an alternate site of lesion in the brain. *Subcortical aphasia* occurs when language deficits result from injury to the subcortical areas of the brain (e.g., thalamus, internal capsule, basal ganglia), which are not typically associated with language processing (Murray and Clark 2005). This type of aphasia is considered to be rare. *Crossed aphasia* describes language impairments that are present following injury to the right hemisphere, which is considered to be uncommon as language is usually lateralized to the left side of the brain in both right- and left-handed people (Murray and Clark 2005). Crossed aphasia does not follow any particular pattern of impairment and can co-occur with the cognitive-communication deficits usually associated with right hemisphere damage.

## Assessing Aphasia

Aphasia is a complex and multifaceted communication disorder. Assessment of aphasia involves evaluating several aspects of language functioning and potential social consequences. A thorough assessment should determine the following: *presence of aphasia*, *nature of aphasia*, and *social consequences of aphasia*:

1. **Presence of aphasia:** The acquired nature of aphasia onset is one of the key clinical features instrumental in assisting the assessment and identification of the condition. As stroke is the predominant etiology for aphasia, the identification of aphasia is often intrinsically linked with the onset of stroke symptoms. Like other acquired neurological injuries, the site and extent of brain lesion influences the characteristics of the condition and the likelihood of aphasia diagnosis. The characterization of lesion site through medical imaging is therefore a key element in guiding the identification and providing preliminary diagnostic evidence in which to guide clinical decision-making.

In addition to underlying etiology, an assessment must consider other explanations for language deficit. Aphasia is defined as a “selective impairment of language” (Papathanasiou et al. 2013) where deficits can be directly attributable to impaired expression or understanding of spoken or written language alone. In practice, however, poor language test performance does not automatically imply presence of aphasia. Other conditions such as hearing deficits, motor or sensorimotor limitations, visual impairment, cognitive deficits, and even vocalization difficulties may all result in poor language test scores (Spreeen and Risser 2003). Accurate identification of aphasia and the process of differential diagnosis can be complex and multifaceted. The prevalence of neurological conditions such as dementia, neuromuscular conditions such as Parkinson’s disease, and age-related cognitive decline in older populations adds increased complexity to accurate disease identification. Identification of and assessment of aphasia therefore require

thorough knowledge not only of current language functioning but also the patient’s medical, social, and communicative history to ensure the individual’s presentation is correctly attributed to the right condition (Chapey 2008).

2. **Nature of aphasia:** After the presence of aphasia has been ascertained, the nature of the language deficits may be explored. This may involve a diagnosis of aphasia type, based on the classification systems described earlier. Aphasia varies widely in its clinical presentation, and individual patient performance across different language modalities can vary significantly. Comprehensive and multimodal assessment of language performance is required to identify areas of deficit as aspects of language may appear unimpaired unless specific attention is paid to investigate them (Spreeen and Risser 2003).

Six different areas of language functioning are typically examined in the assessment of aphasia. Spontaneous speech tasks examine expressive language functioning which often include picture description tasks or an evaluation of general conversational interaction. Repetition tasks can vary in complexity from single-phoneme repetition to repetition of multisyllabic words or phrases. Comprehension of spoken language assesses a patient’s ability to follow simple commands or answer “yes” or “no” questions of varying levels of abstraction and difficulty. Assessment of word-finding ability can examine the ability to name pictures or different objects. Reading and writing abilities are also assessed which include evaluation of the comprehension of written words or phrases as well as writing abilities, such as a patient’s ability write their own name (Spreeen and Risser 2003; LaPointe 2011). Comprehensive aphasia assessments are useful to provide multimodal examinations of language functioning with tasks of varying length and complexity. Often other clinically relevant factors such as attention, orientation, and patient alertness are also noted during these examinations (Brookshire 2003). Such evaluations enable an estimation of overall severity as well as a sense of the patient’s communicative

strengths and weaknesses (LaPointe 2011). In addition to assisting with diagnosis, such assessments assist with guiding the selection of treatment goals and planning intervention.

3. **Social consequences of aphasia:** Aphasia is a condition which can have detrimental impact upon a patient's functioning and quality of life, and it is important to assess these impacts in addition to traditional language assessment (Lam and Wodchis 2010). The social and psychosocial influence of aphasia extends across the continuum of recovery from hospital to the community. People with communication difficulties have been found to be six times more likely to experience an adverse event while they are in the hospital (Bartlett et al. 2008). Evaluation of the impact on a patient's communicative and social functioning in this acute phase is an important element in the assessment of aphasia. Further into the recovery, people with aphasia can experience significant depression and anxiety (Shehata et al. 2014). A study of over 66,000 hospital-based residents in Ontario found that aphasia diagnosis demonstrated the largest negative relationship to health-related quality of life when compared with 75 other diseases and conditions (Lam and Wodchis 2010). Assessment of aphasia should endeavor to provide a comprehensive evaluation of aphasia beyond the physical and behavioral features of the condition to include the social and psychosocial functioning of the individual and their social environment.

### **Aphasia from the Point of View of People with Aphasia**

When defining a complex, chronic condition like aphasia, it is important to consider to perspective of the person with aphasia and their families. Parr et al. (1997) completed in-depth interviews with 50 adults with aphasia which explored their understanding of aphasia, based on the lived experience. The adults interviewed had been living with aphasia for approximately 5 years or more. Analysis of the interview information revealed five primary considerations when responding to

the question: "What is aphasia?" Firstly, *aphasia can affect different aspects of language*: When the ability to put ideas into language is very impaired, people with aphasia may rely on using words such as "yes" and "no" and communicate through their facial expressions, gestures, and tone of voice. Nearly all people with aphasia have wording-finding difficulties, like the experience of having a word at the "tip of your tongue." Some people with aphasia speak in very short phrases, while others may speak in sentences. However, putting words into grammatical sentences may be problematic due to difficulty organizing the way words should go together. The ability to spell, write, and read can also be difficult. Less obvious may be the difficulty in understanding others, despite being able to hear. Many people with aphasia find it more difficult to follow what is being said when they are stressed, tired, or when there is background noise and distractions. Secondly, *aphasia is different for different people*: Some people with aphasia may be hesitant when talking and use only the "key words." Others may have an outpouring of words and find it challenging to be specific and to convey information precisely. Thirdly, *the severity of aphasia varies for different people*: Some people living with aphasia may have occasional difficulties with their language, for example, finding the right word to use or having problems reading complex information, while others may only be able to say a few phrases. As Parr and colleagues (1997) state, "Aphasia is not straightforward or simple" (p. 5). Fourthly, *aphasia changes with time*: The type of language difficulties can change and the severity and impact can also change. For example, in words of a gentleman with aphasia, "The stroke took my language. I was left with only two words... I knew I'd had a stroke but I couldn't tell anyone that I knew. I didn't have the words to say anything" (Green and Waks 2008). Eight years later the same gentleman stated, "I now have many thousands of words and I can write hundreds, though not always completely. I am happy phoning anyone... I still have some trouble with the subtlety of language, particularly with jokes. But my language allows me to be completely independent..." (Green and Waks 2008).

Some people may regain language skills soon after onset, but for many people aphasia is chronic in that their aphasia never completely disappears, and they and their family and friends need to adjust to living with a communication difficulty that affects many aspects of their daily lives. Lastly, *aphasia does not affect intelligence*: In the words of a lady living with aphasia, “My mind is one hundred per cent. . .speaking is bad” (Parr et al. 1997). When describing aphasia, Parr and colleagues (1997) emphasize that people with aphasia are “able to think, feel, remember and plan, even though their language is not working. Aphasia damages the lines of communication going in and out. . .not. . .intelligence” (p. 5).

Due to the many different types of aphasia and impacts, aphasia can be difficult to describe and define. This difficulty is evident in the definitions of aphasia provided by both people with aphasia and their family members. Some living with aphasia have a good understanding of aphasia, while others continue to lack a basic understanding many years after the aphasia started. For example, adults with aphasia have described their aphasia in terms of language breakdown (Parr et al. 1997): “I know the right word, but the wrong word comes out” (p. 106). “Aphasia is no speech or conversation” (p. 107). Yet when defining aphasia, another stated, “All I know is that I don’t know what aphasia is” (p. 107).

## Conclusion

In conclusion, a definition of aphasia has been provided that refers to the core elements that need to be present for a diagnosis of aphasia to be made. Aphasia after stroke is more prevalent in older people and the impact of aphasia in later life particularly affects important communicative activities of older age such as relationships and storytelling. Commonly used classification schemes are described. The link between the conceptualization of aphasia is demonstrated by how aphasia is assessed. Finally, the true experts, people with aphasia themselves, describe aphasia in their own words.

## Cross-References

- ▶ [Aging and Quality of Life](#)
- ▶ [Cognition](#)
- ▶ [Cognitive and Brain Plasticity in Old Age](#)
- ▶ [Cognitive Neuroscience of Aging](#)
- ▶ [Communication with Older Adults](#)
- ▶ [Dementia and Neurocognitive Disorders](#)
- ▶ [Disability and Ageing](#)
- ▶ [Language, Comprehension](#)
- ▶ [Language, Discourse Production and Communication](#)
- ▶ [Language, Naming](#)
- ▶ [Primary Progressive Aphasia](#)
- ▶ [Semantic Dementia](#)
- ▶ [Traumatic Brain Injury](#)

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## Apraxia

Lafaiete Guimarães Moreira<sup>1</sup>, Jonas Jardim de Paula<sup>2</sup> and Malloy-Diniz Leandro Fernandes<sup>3</sup>

<sup>1</sup>Universidade Fundação Mineira de Educação e Cultura - FUMEC, Belo Horizonte, Minas Gerais, Brazil

<sup>2</sup>Faculdade de Ciências Médicas de Minas Gerais, Instituto Nacional de Ciência e Tecnologia em Medicina Molecular, Federal University of Minas Gerais, Belo Horizonte, Minas Gerais, Brazil

<sup>3</sup>Department of Mental Health, Instituto Nacional de Ciência e Tecnologia em Medicina Molecular, Federal University of Minas Gerais, Belo Horizonte, Minas Gerais, Brazil

Apraxia is a neurological disorder which affects the ability to perform skilled and purposeful

movements. It is important to note that the disability in the apraxic patient is not explained by impairment in gait, tremor, weakness, intellectual or verbal comprehension, and motor and/or sensorial deficits. Among the core symptoms in apraxia are the incapacity to perform motor acts on verbal command, mimics, use of tools, and to organize the sequence of movements to conclude an action. Nonetheless, apraxia comprises several subtypes and its heterogeneous clinical manifestation affects the severity and specificity of the deficits.

The term apraxia derives from the greek *a* (absence of) + *prassein* (ability to perform). The disorder has been described previously by another neurologist. The German philosopher and philologue Heymann Steinthal (1871) was probably the first to use the term to refer to a clinical manifestation frequently observed in aphasic patients (e.g., impairment in use of tools previously used in everyday life, such as a fork or a pencil). An in-depth description of apraxia was provided some years later in the pivotal work of the German physician, Hugo Karl Liepmann. Liepmann described in 1900 the clinical case of the patient MT who presented impairment in performing gestures using the right hand and head (including face and tongue) in the absence of deficits in the left hand. But his key finding was reported in 1908, with the comparison between two groups of brain damaged patients classified according to the hemisphere affected. In this study, Liepmann described the independence between aphasia and apraxia, as some patients suffered from this disorder without the former. Furthermore, Liepmann argued that the left hemisphere was dominant both for language and motor control (Liepmann 1900, 1908).

Another important contribution derived from Liepmann's work was the idea that apraxia is not a unitary syndrome. Furthermore, Liepmann proposed a neuropsychological model describing how we plan movement including its form and spatiotemporal properties. According to this model, the sequence from plan to action involves several regions in the left brain hemisphere including the recovery of the movement and its meaning (related to the left parietal lobe), the

association of this information to sensorimotor (which contains the “innervatory pattern” of the movement) areas, and finally the transmission of the appropriate information to primary motor areas (responsible for the movement execution). These processes were related to the movement of the right limb. Considering the left limb, information had to be conducted from the left hemisphere to the right motor areas via corpus callosum.

According to Pearce (2009), Liepmann described three types of apraxia:

1. Ideational apraxia – incapacity to perform movements in their ideal form and spatiotemporal characteristics and consequent deficits in use (and simulation to use) of tools.
2. Ideomotor apraxia – even with preservation of retrieval process of the form and spatiotemporal characteristics of a movement, it is disconnected from the innervation pattern related to movement generation. In this case, the patient will present the understanding of what has to be performed but there will be an incapacity to perform or imitate meaningful movements on verbal command due to the lack of synergy between the knowledge and the sensorimotor pattern to generate the movement.
3. Motor, innervatory, or limb-kinetic apraxia – the sensorimotor representation of movement is not sufficient to activate the primary motor components of the movement. This disorder affects the speed, coordination, and performance of fine motor movements.

Some of contemporary models of apraxia were based on the work of Liepmann and his conception of gesture formulation in time and space (for a good review we suggest Petreska et al. 2007). Among these models, we will highlight two that have received more attention and have been more frequently used in later works.

In the 1990s, building on the cognitive processing model of language of the time, Rothi et al. (1991) described an updated version of the model initially proposed by Liepmann. They proposed the existence of different routes of processing: a route of lexical semantic nature to the familiar gestures (which stores the knowledge

of the actions and motor learning program, processing the meaning and the known gestures, be it transitive or intransitive) and another non-lexical route for unfamiliar gestures (which allows playback of gestures perceived by a motor visual conversion mechanism, central to the processing of new or meaningless gestures). Despite its wide pragmatic value, the model of Rothi et al. had difficulty explaining the selection of a tactile route (The handling tool is not compromised, even when gestures started by verbal or visual stimuli are), as well as the imitation of meaningless gestures (Petreska et al. 2007).

Cubelli et al. (2000) reviewed the model of Roth et al. and reinforced the conception that the processing of gesture information occurs following a set of steps, ranging from the input (recognition) to the output (production) of gestures. They added the module of direct transcoding for visual stimulus (responsible for suitable motor programming) and the gesture buffer module (responsible for representing the short-term memory of gestures as a whole).

The model described by Cubelli et al. (2000) presents a hierarchical organization according to the following steps:

- **Step I:** there is the identification of the nature of the stimulus (auditory/verbal or visual).
- **Step II:** the information undergoes a stage of gesture of identification; there is a search for the appropriate motor action knowledge based on prior experiences of the individual in the use of the tool or object. The posterior parietal cortex seems to be responsible for the ability to properly position hands to use tools, based on motor representations already known about this tool.
- **Step III:** there is the implementation of knowledge, save in a kind of motor formula, that represents intended actions. The connection between the parietal and premotor areas are responsible for coding vision-for-action, and they are involved in abstract knowledge motor required for proper control of the gesture, depending on the context. The connection of the parietal lobe with the supplementary motor area is associated with the beginning of

the movement in the specific sequence of multiple combined movements. Subcortical structures, such as the basal ganglia, are involved in the initial learning of motor actions. If the gesture is already known, the parietal premotor circuitry is activated. In the case of use or imitation of a new tool, subcortical structures mediate the process.

- **Step IV:** Finally, the motor command would be executed by the motor cortex.

More recent theoretical models of cognition argue that our representational capacity is based on the brain's sensorimotor system, which also supports the semantic content of these representations in terms of the way we interact with our bodies in the environment (Gallese and Lakoff 2005). According to this "embodied cognition" model, motor plan actions would be a consequence of our prior experience with objects and its manipulation and also by employing compensatory strategies that change the motor act, especially in the use of tools according to sensory feedback (Osiurak et al. 2015).

Rounis and Humphreys (2015) argue that limb apraxia can be explained by the model of *affordance competition*. According to this model, objects elicit some prototypical and prepotent actions. For example, a pen affords to be held to write. A motor behavior is generated by parallel and competitive processes involving both available outcomes and demands for a specific gesture. In ideational apraxia, the affordance of some specific characteristic of an object could lead to the activation of a wrong pattern of gesture. In ideomotor apraxia the selection of movements to perform a gesture could be influenced by this competition. Some effectors (response to a stimulus), less important or effective to a specific action, can be selected instead of a more appropriate effector (e.g., utilization behavior, wherein the person automatically uses objects placed in his front by examiner, even when asked to do another action).

## Brain Systems Related to Apraxias

As to regions or brain structures activated during the motor act, there is a vast literature highlighting

specialized regions representing well-defined features of motor act. In a revision about limb apraxia in Alzheimer's disease, Lesourd and colleagues (2013) suggested that the superior parietal lobe is involved in the production phase of the movement, the inferior parietal lobe supports both the mechanical and sensorimotor knowledge involved in the action, and the anterior temporal lobe stores the semantic knowledge about tool use.

This hypothesis would account for the most traditional concept of apraxia as a disorder which involves a conceptual mechanism (to form a representation of the action) and an executive mechanism (which implements the motor commands). These mechanisms interact in a dynamic way: the environmental feedback in response to action changes the conceptual system and then the executive system. The constant communication between the three brain regions involved with the conceptual-executive system and their connection with the basal ganglia and thalamus seem essential for adequate gesture production.

Although initially conceptualized as lateralized system in the left hemisphere, more recent studies suggest involvement of both hemispheres, according to the task specificities and complexity involved in the gesture. The premotor cortex would be the main responsible area for transformation of a general gesture concept in a specific gesture conception that finally would be implemented by the motor cortex (Johnson-Frey 2004; Wheaton and Hallet 2007; Goldenberg 2009; Peeters et al. 2013). An incipient literature has suggested that different categories of action are distinctively coded in distributed and overlapping patterns of neural responses that subserve a higher-level and more abstract representation of distinct finalized motor action categories as transitive, intransitive, and tool-mediated (Handjaras et al. 2015).

## Apraxias: Subtypes for Clinical Practice

In the clinical neuropsychological literature, there are many descriptions of apraxia subtypes

(Osiurak and Le Gall 2012). The classical differentiation between ideomotor and ideational apraxias remains useful even nowadays. *Ideomotor apraxia* is related to the capacity to regulate the motor programming of a gesture. This patient knows the meaning of a gesture and the tools involved and knows how to use them. Nonetheless, the motor gesture fails in terms of timing, coordination, and organization of the gesture in space. Patients suffering from *ideational apraxia* present impairment in the performance of a sequence of motor acts to execute a complex task. For example, the patient may fail to use objects in a correct sequence to conclude a task which demands multiple steps. According to Gross and Grossman (2008), *conceptual apraxia* is related to the deficit in knowledge of the meaning of the action and its relation to objects. For example, a patient might fail to know the meaning of a hammer or the action required to use this tool.

Other types of apraxias are frequently described in neuropsychology and can be defined in terms of selectively affected effectors or a specific motor ability impaired Petreska et al. (2007). One example of apraxia related to specific effectors is *buccofacial apraxia* in which a patient fails to produce movements involving the face, mouth, tongue, or even larynx and pharynx. The deficit can be evidenced in simple tasks like blowing a candle. Another example is the *limb kinetic apraxia*. In this disorder, patients cannot perform precisely acts using upper or lower limbs. According to Rounis and Humphreys (2015), limb apraxia is a very heterogeneous disorder and can affect the planning of a sequence of gestures, its conceptual representation, or even its implementation. Therefore, this disorder can also be classified in terms of the dichotomy ideational versus ideomotor. Considering apraxias related to specific abilities, the main example is the *dressings apraxia*. In this disorder, patients fail to dress in a correct way.

Finally, *constructional apraxia* is a disease which affects the capacity of coordinate sensorial and motor information to construct elements in two or three dimensions. Patients suffering from this disorder often fail to make a drawing (even by

copying) or construct objects using small pieces like cubes or puzzles.

In some cases, apraxia can be the outcome of abnormal brain development. This disorder is frequently referred to as *dyspraxia or developmental apraxia*. It is important to note that this is different from adult apraxia, as in the case, the disorder leads to the loss of a previously skilled gesture. Dyspraxia involves impairment in learning or performing motor gestures during childhood (Vaivre-Douret 2014).

### Apraxia in Pathological Aging and Its Clinical Assessment

In pathological aging, such as in Alzheimer's disease (AD) and other dementias, apraxia is a very frequent deficit, but it is often neglected in clinical assessment (Lesourd et al. 2013). Apraxia is relatively common in neurocognitive disorders, including AD, Lewy body dementia (DLB), vascular dementia (VD), frontotemporal dementia (FTD), Huntington's disease dementia (HD), and even mild cognitive impairment (MCI) (Smits et al. 2014; Johnen et al. 2014; Nagahama et al. 2015). Nagahama and colleagues (2015) analyzed the ability of patients with dementia to imitate a series of gestures and found impairment in different types of dementia, especially when performing bimanual gestures, with worse performance observed in patients with LBD, followed by subcortical VD and AD. Ozkan and colleagues (2013) reported a different pattern in which apraxia was more frequent in AD than subcortical VD, but in both conditions the syndrome was more common than in MCI patients.

Apraxia can also be used in the differential diagnosis of the behavioral variant of FTD from other types of dementia, even in mild stages of dementia, according to Johnen and colleagues (2014). More interestingly, their study suggests a specific pattern of impairment, in which pantomime of object-use is lower in AD when compared to FDT but pantomime of signs shows the opposite pattern. Imitation of finger postures more impaired in AD than in FDT, but this latter group showed pronounced difficulties in the imitation of

face postures, where AD patients do not. A study compared the ideomotor apraxia profile of AD and HD and found more prominent symptoms in the latter (Holl et al. 2011). Not only do the subtypes of apraxia or its specific symptoms vary according to each dementia subtype, but also the clinical progression may be different depending on the etiological mechanism of the dementia, as seen in Chandra et al. (2015). Signs of apraxia are also a strong predictor of impairment in activities of daily living in pathological aging (Farias et al. 2009).

Structured batteries for the assessment of apraxia in dementia and MCI are still scarce and often suffer from lack of psychometric validity and reliability. Although motor tests which can be used to assess apraxia may be found in different neuropsychological batteries for dementia (e.g., Mattis Dementia Rating Scale (Mattis 1988) and Mini-Mental State Examination (Folstein et al. 1975)), they are often too brief or designed for screening. In that sense, they do not allow the clinician a more detailed analysis, including the subtype/classification of apraxia. On the other hand, several independent tests for apraxia were developed in the last decades, yet most of them were designed for laboratory/experimental purposes and hardly fit the validation and standardization demands for clinical use (Lesourd et al. 2013).

Recent studies have proposed interesting tasks for the assessment of this syndrome. Smits and colleagues (2014) analyzed the validity and reliability of the Van Heugten Test for apraxia in older adults without cognitive disorders, MCI and mild AD patients. The test showed good psychometric properties, including inter-rater agreement, test-retest stability, correlations with cognitive measures, and significant group differences between the three groups. The Apraxia Screen of Tulia (AST) is a bedside test to quickly assess apraxia, based on a previously published battery (TULIA) (Vanbellingen et al. 2011). The test is composed of 12 gestures to be performed by the patient. It showed high reliability and validity for the detection of apraxia in a sample of stroke patients. In a more clinical perspective, Nagahama and colleagues (2015) used only six gestures in their

study and achieved a high percentage of correct classifications between different types of dementia and normal aging. In a previous review (Leiguarda and Marsden 2000), the authors described a series of steps for the assessment of both cognitive systems involved in apraxia, conceptual and production, and suggested a useful classification of errors (temporal, spatial, content, and others) which can be clinically observed in patients' behavior.

## Conclusion

Apraxia is a broad concept which encompasses several types of diseases that in turn have in common specific deficits in motor action. Although it is often neglected in neuropsychological assessment, it has a fundamental role in the differential diagnosis of some diseases and shed light on the organization and functioning of motor behavior in healthy individuals. Is apraxia a concept, a disease, a symptom of other diseases? Please clarify.

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## Assessment of Functional Abilities in Older Adults (BADLs, IADLs)

Julieta Camino and Eneida Mioshi  
Faculty of Medicine and Health Sciences,  
University of East Anglia, Norwich, UK

### Synonyms

Independence; activities of daily living

### Definition

The assessment of functional abilities in older adults refers to a comprehensive assessment to determine the level of independence that older adults have when performing activities of daily living. This assessment enables the planning of therapeutic interventions, social care and clinical support, and also supports clinical reasoning in detecting early signs of dementia.

## The Importance of Being Active in Healthy Aging

Due to the ongoing growth of elderly populations in modern societies, the issue of how to maintain and improve the functional abilities of aging people has become a matter of urgency, in order to help to live independently in the community and, furthermore, to enhance the quality of their lives (Glass et al. 1999).

The traditional focus of research on aging has been on general health, but the idea of functional capacity has recently gained more attention. It was not until the 1950s that the significance of function in health and illness was given its proper recognition, as the numbers of older and disabled persons grew and the prevalence of chronic disease increased.

For people to lead fulfilling social lives, health and functional ability are crucially important: the level of functional ability determines the extent to which they can cope in the community independently, take part in events, visit other people, use the services and facilities provided by organizations and society, and generally enrich their own lives and those of the people closest to them. An active lifestyle is widely accepted as being closely linked with better health and longer life (Mendes de Leon 2003).

A growing body of evidence suggests that the extent to which older people are engaged in their social environment (visits to theaters, sporting events; shopping; gardening; meal preparation; card, game playing; day or overnight trips; paid community work; and unpaid community work) is associated with a clear survival benefit, irrespective of whether this engagement is defined by specific social or productive activities or by the nature and quality of their social relationships. Moreover, participation in leisure activities unconnected to fitness can also increase longevity and has other positive health effects for older adults (Glass et al. 1999), as recent studies have suggested (Mendes de Leon 2003; Strout and Howard 2012).

As such, lack of social engagement, as well as social isolation, and infrequent participation in social activities may be risk factors for cognitive impairment in aging. Taking part in stimulating

social activities, having an extensive social network and a socially integrated lifestyle may also reduce the risk of dementia (Sørensen et al. 2008).

## The Definition of Functional Abilities and Functional Status

The WHO has defined *functional status* as a person's ability to carry out the activities necessary to ensure well-being. The integration of three domains of function is at work here: biological, psychological (cognitive and affective), and social. Consequently, functional assessment is drawn from a model which looks at how the interrelationship of these domains contributes to overall behavior and function.

In 2001, the current International Classification of Functioning, Disability, and Health (ICF) (WHO 2001) was published. It shifted the relationship of health and functioning from the consequences of a disease or condition to the result of complex interactions among the individual, the environment, and the disease or condition. The new ICF was designed taking into consideration this biopsychosocial/integrative approach. This system is comprised of three main components: body functions and structures, activities and participation, and contextual factors (environmental and personal factors). Further theoretical research and instrument development examined key constructs of functional health: activities of daily living (ADLs), instrumental activities of daily living (IADLs), and psychological and social variables. The functional ability of elderly people is central to how well they cope with activities of daily living, which in turn affects their quality of life. In this chapter, focus will be given on basic and instrumental activities of daily living (BADLs and IADLs), one of the key aspects encompassed in functional abilities.

## Functional Decline Associated with Aging

Impairment in ADLs, to a certain extent, is part of normal aging. There is a progressive slow decline

in functional abilities, which accompany the aging of the body, and is therefore considered normal. Healthy older adults will often undergo subtle declines in their independent management of instrumental activities of daily living (IADLs). While the rates of IADL dependence have fallen among older adults in recent years, the prevalence of these same declines and their negative impact on individuals, caregivers, and the healthcare system are still considerable and highlight how important it is to identify clinically useful predictors of everyday functioning that may play a part in psychological interventions. Among the recognized risk factors for IADL disability among healthy older adults are demographics (e.g., sex), depression, medical comorbidities, and certain psychosocial factors (Kiosses and Alexopoulos 2005). Neurocognitive impairment is another independent risk factor for concurrent IADL problems among older adults. Functional disability due to age-related chronic or debilitating conditions is therefore common among older adults, and its prevalence is expected to increase as the population ages, particularly among the oldest old (Gitlin et al. 2009).

### **Cognitive Factors Contributing to Functional Decline in Old Age**

Among the strongest and most reliable cognitive predictor of IADL problems in older adults is deficit in episodic memory (EM). Episodic memory involves conscious gathering of information acquired in a particular place and at a particular time, and a deficit in EM was especially associated with problems in regard to older adults managing their own medication (Koehler et al. 2011).

Consequently, one might postulate that age-related declines in prospective memory (PM) would also increase the risk of IADL problems. PM is the complex cognitive process of successfully carrying out a delayed intention, or “remembering to remember.” When compared to their younger counterparts, older adults can experience mild-to-moderate declines on laboratory tests of PM. Aging may have a significant effect on PM because of the latter’s strong reliance on

internal control mechanisms (i.e., self-initiated retrieval), which depend heavily on prefrontal systems, that are often affected in older adults (Woods et al. 2012).

Given the global nature of the decline in speed of processing and working memory that occurs with age, one might expect that older adults would have substantial difficulties in managing the affairs of everyday life or maintaining a good level of performance on the job. Decline in tests of executive function (e.g., complex attention, verbal fluency, and planning) is expected to a certain extent, and these, when present, have shown to be associated with a natural decline in ADL performance (Piguet et al. 2002). This is however not a consensus: there is considerable evidence that older adults function well and that cognitive declines documented in the lab might not have as negative an effect as one would expect on everyday domains of behavior. In a similar vein, it has been noted that a question that frequently arises when evidence for aging-related neurocognitive decline is presented is “why are the effects not more noticeable in everyday life?”. Moreover, the DSM-IV-TR (American Psychiatric Association) directs that in order for a diagnosis of dementia to be warranted, cognitive deficits must result in a decline from previously higher levels of occupational or social functioning. This instruction to exclude from dementia diagnosis adults who exhibit cognitive deficits absent of decline in occupational or social functioning suggests a perspective that normal aging often leads to some cognitive decline without accompanying decline in everyday functions (Tucker-Drob 2011).

Another common problem in older adults is apathy, which is associated with cognitive and functional impairment in the elderly with preserved cognition. Apathy is a disorder of “will,” i.e., “the human power, potency or faculty to initiate action.” A reduction of this capacity sees affected individuals manifest diminished desire, goal formulation, and voluntary behavior – characteristics central to an operational definition of apathy proposed by Marin 25 years ago (Marin 1991). Apathy can lead to cognitive impairment and functional disability in

older adults. In the Cache County Study, elders without cognitive impairment and presenting with apathy scored lower in cognitive tests and reported a decrease in the level of their daily functioning (Onyike et al. 2007).

## The Emergence of Standardized Functional Assessment in Older Adults

For the past 20 years, research has been dedicated to achieving an objective and comprehensive direct measure of the functional performance of the elderly.

The historical context of the increased life span prompted specialists to ask the following questions regarding the older adult's independence: "Can the person perform activities as previously?" "Does the person require direct assistance or specialist equipment to independently and safely carry out their daily activities?" For this reason, assessment of functional ability often includes an evaluation of the individual's ability to carry out various activities of daily living (ADLs).

ADLs can be further categorized as basic ADLs (BADLs) or instrumental ADLs (IADLs). BADL refers to various self-care activities such as eating, dressing, personal hygiene, and mobility in and outside the house, while IADL functions are related to more complex tasks such as household management, carrying out activities outside the home, use of public transport, cooking meals, etc. As such, functional rating scales aid in the identification of impairments, functional limitations, and participation and can serve as tools that monitor changes over time as well as in response to interventions (e.g., outcome measures).

Still, when selecting ADL tools, one needs to consider their measurement characteristics and psychometric properties (reliability, validity, sensitivity, and specificity) to avoid or reduce observer bias.

## Functional Scales for Older Adults

There are many instruments for ADL assessment, including widely used scales for ratings of BADL

and IADL, originally developed for general geriatric assessment. Several scales were later developed for Alzheimer's disease, and they are normally used in other dementias.

This section will address the most common ADL scales used in clinical and research settings involving healthy aging and dementia patients.

### The ADL Index (Katz 1963)

The Katz Index of Independence in Activities of Daily Living (Katz ADL) assesses functional status as a measurement of the person's ability to perform activities of daily living independently (Katz et al. 1963). The Index identifies the quality of performance in the six functions: bathing, dressing, toileting, transferring, continence, and feeding. People are scored yes/no for independence in each of the six functions. A score of 6 indicates full function, 4 indicates moderate impairment, and 2 or less indicates severe functional impairment.

Score ratings should be based on the current state and not on the ability to carry them out; the scale is usually completed by a professional. It is considered that a patient who refuses to perform a function is considered incapable of carrying out that function with regard to the scoring on the item in question.

*Validity and Reliability:* No formal reliability and validity reports could be found in the literature.

### The Lawton Instrumental Activities of Daily Living (Lawton and Brody 1969)

The Lawton Instrumental Activities of Daily Living (IADL) Scale is an instrument used to assess independent living skills among older adults and may be used in the community setting, clinic, or hospital (Lawton and Brody 1969). The type of tasks evaluated are more complex than the basic activities of daily living as measured by the Katz ADL Index or the Barthel Index. It takes 5–10 min for a trained interviewer to assess ability in eight complex daily living tasks such as using the

phone, grocery shopping, preparing meals, housekeeping, laundering, using transportation, taking medications, and managing finances. The assessment can be delivered with a written questionnaire or via an interview with the informant. The clinician can complete the scale using information about the patient, from an informant (person's family member or carer), the patient himself/herself, or recent notes.

The main purpose of the instrument is to identify how a person is functioning at the present time and to identify improvement or deterioration over time. Persons are rated according to their highest level of functioning in that category. A summary score ranges from 0 (low function, dependent) to 8 (high function, independent).

*Validity and Reliability:* Inter-rater reliability was established at 0.85. Of note, inter-rater reliability was determined with a small sample of 12 subjects (Lawton et al. 1982).

*Advantages and Disadvantages:* There are three fundamental issues: low sensitivity, does not address all IADLs, and is gender biased. Historically, women were scored on all eight areas of function; men were not scored in the domains of food preparation, housekeeping, and laundering. However, current recommendations are to assess all domains for both genders.

### Functional Assessment in Dementia

Some assessments of function have been specifically designed to detect changes due to dementia. This section presents the most common functional tools used in dementia.

### Alzheimer's Disease Cooperative Study Activities of Daily Living Inventory (ADCS-ADL) (Galasko 1997)

The ADCS-ADL scale is an informant-based inventory consisting of 23 items that assess both basic and instrumental activities of daily living, i.e., functional performance, of people with Alzheimer's disease (Galasko et al. 1997). It takes 15 min to administer, and it can be completed by someone who spends at least 2 days a week with the person.

The ADCS-ADL inventory offers a detailed outline of each activity and asks the carer to describe observed actions or behaviors. The necessary information is taken from the past 4 weeks. If a person did attempt to perform the ADL, the informant is asked to pick the single most accurate definition of the patient's level of performance from a list of descriptions of alternative methods of doing the ADL. For an ADL in which different methods of performance do not apply, the informant is asked if the subject usually carries out the ADL "independently" (the highest level), "with supervision" (needing verbal instructions during ADL performance, an intermediate level of ability), or "with physical help" (a lower level of performance).

*Validity and Reliability:* Good test-retest reliability (ranging from 0.41 to 0.70) over 1–2 months. Correlations between the ADCS items and the MMSE total score range from 0.28 to 0.70.

### Disability Assessment for Dementia (DAD) (Gelinas and Gauthier 1999)

The Disability Assessment for Dementia (DAD) Scale is targeted at individuals living in the community who have cognitive deficits such as Alzheimer's disease and other dementias (Gelinas et al. 1999). Tasks include basic (dressing, hygiene, continence, and eating) and instrumental ADLs (meal preparation, telephoning, housework, taking care of finance and correspondence, going on an outing, taking medications, and ability to stay safely at home), as well as leisure activities (activities that are beyond self-maintenance and are for the purpose of recreation). The DAD helps delineating areas of cognitive deficits which may impair performance in ADL. Scores can be broken down in regard to initiation, planning, and execution.

The DAD is administered through an interview with the caregiver, taking 15 min, and is a measure of the actual performance in ADL of the individual as observed over a period of a fortnight prior to the time of the interview.

Each item is scored: 1 point = able to, 0 point = not able, or non-applicable = N/A.

*Validity and Reliability:* Internal consistency coefficient is reported at 0.96, the intraclass correlation reported at 0.96, and the test-retest reliability also has excellent ratings (Gelinas et al. 1999). The convergent validity for the DAD is supported through the instrument's correlation with the Global Deterioration Scale. The usefulness of this scale has been demonstrated in numerous clinical trials.

### **Functional Activities Questionnaire (FAQ) (Pfeffer 1982)**

The Functional Activities Questionnaire (FAQ) measures instrumental activities of daily living (IADLs), such as preparing balanced meals and managing personal finances (Pfeffer et al. 1982). It is an informant-based questionnaire that can be given to either patient or carer, and it takes approximately 5–10 min to be completed. The individual answers 10 items relating to daily tasks which are needed to live independently. A scale ranging from independence (0) to dependence (3) is used for responses.

The total score ranges from 0, reflecting the fully preserved capacity, to 30, indicating maximum functional dependency. A cutoff point of 9 (dependent in 3 or more activities) is recommended to indicate impaired function and possible cognitive impairment.

*Validity and Reliability:* The FAQ is a consistently accurate instrument with good sensitivity (85%) to identify an individual's functional impairment. The FAQ demonstrates high reliability (exceeding 0.80). Tests of validity have been performed on the FAQ, establishing it as an instrument for the bedside and research being able to discriminate among different functional levels of individuals and being able to predict neurological exam ratings and mental status scores such as the Folstein Mini-Mental Status Examination (MMSE).

*Advantages and Disadvantages:* The FAQ is very sensitive in detecting individuals with dementia. A limitation of the FAQ is that

informants may not be able to provide responses on certain items, either because the subject never performed them prior to developing cognitive impairment or because the informant had insufficient information to rate the subject's current performance.

### **Activities of Daily Living Questionnaire (ADLQ) (Johnson 2004)**

The Activities of Daily Living Questionnaire (ADLQ) Scale is an informant-based instrument used to measure functional abilities in people with dementia. It takes 5–10 min to be completed (Johnson et al. 2004).

The scale is divided into six sections (self-care, household care, employment and recreation, shopping and money, travel, and communication) addressing different areas of activity, and each section has between three and six items. Each of the items is rated on a 4-point scale from 0 (no problem) to 3 (no longer capable of performing the activity). For each item, there is also a rating (9) provided for instances in which the patient may never have performed that activity in the past ("Never did this activity"), stopped the activity prior to the onset of dementia (e.g., stopped working before dementia symptoms were apparent), or for which the rater, for a variety of reasons, may not have information ("Don't know").

The total score, which has a range of 0–100, is calculated using the formula below:

*Functional impairment:*  $(\text{Sum of all ratings}/3 \times \text{total number of items rated}) \times 100$

The denominator represents the score that would have been obtained if the most severe level of impairment had been indicated for all items rated (excluding those rated "9"). The numerator represents the total of the actual ratings for all items rated (excluding those rated "9"). The resultant score represents the level of severity of impairment in ADL. The amount of functional impairment is then rated as "none to mild" (0–33%), "moderate" (34–66%), or "severe" (66–100%).

*Validity and Reliability:* This scale has high test-retest and concurrent validity and has been

shown to accurately detect decline in individuals with probable Alzheimer's disease. Total ADLQ score is highly reproducible, with concordance coefficients of 0.86 or higher (Johnson et al. 2004).

### **Bristol Activities of Daily Living Scale (BADLS) (Bucks 1996)**

The Bristol Activities of Daily Living Scale (BADLS) was designed specifically for use in patients with dementia and covers 20 daily living activities (Bucks et al. 1996). A professional or family can complete it in about 5–10 min. It is sensitive to change in dementia and short enough to use in clinical practice. It is regularly used as an outcome measure in clinical trials. This outcome is among those recommended by a consensus recommendation of outcome scales for nondrug interventional studies in dementia (Moniz-Cook et al. 2008).

*Validity and Reliability:* The BADLS has good test-retest reliability and good content validity (Bucks et al. 1996).

*Advantages and Disadvantages:* Patients can be evaluated over a full range of ADL and abilities despite communication difficulties, and it is sensitive to detect change over time. However, over half of the items (13 of 22) on the scale rate basic ADLs (e.g., selecting food, eating food, selecting drink, drinking), making the total score heavily determined by these tasks. Most individuals with dementia would not experience a decline in these areas until the later stages of illness, and this scale is unlikely to be sensitive to early decline in higher level cognitive activities.

### **Informant-Based Versus Performance-Based Functional Assessments**

Informant-based tools can be as effective as cognitive tools for dementia screening and have many advantages: they can measure change longitudinally, they can be used for subjects unable to do cognitive testing for any reason, they are relevant to everyday cognitive activities, and they can be used cross-culturally (Lorentz et al. 2002).

Informant-based dementia screens provide an estimate of change over the long time periods typically seen in evolving dementias, evaluate cognitive abilities related to everyday function, and appear minimally affected by cultural, educational, and language biases.

Performance-based ADL instruments require the person to carry out real tasks in a structured setting using accessories. Scoring is standardized and can encompass elements of performance such as sequencing, initiation, and motivation. The main disadvantages of such assessments is the length of time taken to administer, need of specialist training, and also the potential requirement of an ecological setting in the clinical environment, which is not always available.

### **Direct Assessment of Functional Status (DAFS) (Loewenstein et al. 1989)**

The DAFS is a performance-based (ADL) task that assesses seven specific functional areas: time orientation, communication, transportation, financial skills, shopping ability, grooming, and eating (Loewenstein et al. 1989). The “time orientation” subtask examines (a) the ability to tell time using a clock and (b) orientation as to person, place, and time. The “communication” subtask includes (a) ability to use a telephone and (b) send a letter, while (c) “transportation” task, (a) identification of driving signs and (b) driving rules. The financial subtask assesses participants' ability to (a) identify and (b) count currency, as well as (c) write a check and (d) balance a checkbook. The shopping subtask assesses participants' ability to learn a list of shopping items and then (a) freely and (b) with cueing select the items from a mock grocery store after a 10 min delay, (c) shop with a list, and (d) getting the correct change. Scores are obtained by computing individually completed correct responses in each domain.

*Validity and Reliability:* This instrument has high inter-rater and test-retest reliabilities. Convergent validity is evidenced by significant correlations between the scale and established measures of functional status (Loewenstein et al. 1989).

### **The Assessments of Motor and Process Skills (AMPS) (Fisher 2003)**

The AMPS is a well-validated performance-based tool. It has been used extensively with a number of populations (Fisher 2003). The person has to perform two everyday tasks chosen from a set of over 100 standardized tasks. The assessment of the two tasks simultaneously measures 16 motor (e.g., coordination, grip, transportation, etc.) and 20 mental process skills (e.g., searching, choosing, organizing, sequencing, etc.) and their effect on the ability of the person to perform familiar ADL tasks. Both tasks' scores are used in conjunction with the AMPS score. Raw scores from each motor and process skill are converted into logits, using a Rasch model approach. A software program compares a patient score against age- and sex-matched controls; scores lower than cutoffs denote impairment.

One of the disadvantages of the AMPS is its cost for the training; however, this ensures greater reliability for the trained assessor. The AMPS is also limited to OTs, which may pose a challenge depending on staff availability. Finally, the AMPS does not measure initiation.

### **The Instrumental Activities of Daily Living (IADL) Profile (Bottari 2009)**

The IADL Profile was originally developed for people post-brain traumatic injury (Bottari et al. 2009). However, it is currently being validated for aging populations and dementia patients. The assessment evaluates independence in complex everyday activities. This tool is administered in the person's home and community environment and aims to establish whether the subject's main difficulties in everyday life relates to executive function (EF) deficits. Participants are asked to simultaneously plan the full series of embedded tasks necessary to attain the ultimate goal of hosting a meal for unexpected guests. Two other tasks, obtaining the daily bus schedule for a long-distance trip between two large urban cities and making an annual budget, are also tested. Tasks are scored on the basis of

four cognitive operations related to EF: ability to formulate the goal, plan the task, execute it, and verify the attainment of the goal. For each operation, the person's level of independence is scored on a five-level ordinal scale ranging from dependent (score of 0) to independent without difficulty (score of 4). In addition to the independence score, this test also allows clinicians to understand the types of errors committed by the individual, the type and amount of cues required to perform the task, and the time to complete the task.

**Validity and Reliability:** This revealed high to very high internal consistency for all factors ranging from 0.81 to 0.98; internal consistency of the total scale was very high (0.94). Hence, a total score can be calculated, providing a reliable global indicator of IADL independence and indicating where on a continuum from totally dependent (total score, 0) to totally independent (total score, 116) the ability of an individual is located (Bottari et al. 2009).

### **Limitations and Advantages of Functional Assessments**

A key limitation of functional assessments relates to its high sensitivity to change. Changes in ADLs can be due to physical symptoms or frailty, cognitive deficits, neuropsychiatric symptoms, or a combination of these, which could confound the decline related to cognitive deficits.

However, for the same above reason, ADL scales are very useful in clinical care planning and psychosocial interventions and are also sensitive to detect improvement post pharmacological and non-pharmacological trials.

Of note, to date, most scales are unable to differentiate the exact factors underlying ADL change. This is a field with growing research interest, and it will not be long before a novel ADL can also address factors behind the measured disability.

### **Summary**

The evaluation of functional performance in older adults is essential for planning support needed in older age. Changes related to normal aging, acute

illnesses, worsening chronic illnesses, and hospitalization can contribute to a decline in the ability to perform tasks necessary to live independently in the community. The information generated from a well-conducted functional assessment can provide objective data to assist with targeting individualized rehabilitation needs or to plan for specific in-home services (such as meal preparation, nursing and personal care, homemaker services, financial and medication management), or the need to involve other people for continuous supervision.

Functional assessment can also help clinicians to understand a person's baseline capabilities, facilitating early recognition of changes that may lead to an early diagnosis of dementia. Monitoring ADL function can also provide key information on the progression of the disease. For this reason, functional disability tools are commonly used as outcome measures in pharmacological and non-pharmacological trials and should be part of any set of assessments involving the elderly and people with dementia.

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## Cross-References

- ▶ [Active Aging](#)
- ▶ [Activity Theory, Disengagement Theory, and Successful Aging](#)
- ▶ [Age-Related Changes in Abilities](#)
- ▶ [Assessment of Older People in Primary Care](#)
- ▶ [Assisted Living](#)
- ▶ [Depression and Cognition](#)
- ▶ [Disability and Ageing](#)
- ▶ [Everyday Cognition](#)

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## Assessment of Older People in Primary Care

H. C. Moorey, S. K. Bradshaw and I. Philp  
Heart of England Foundation Trust, Birmingham,  
UK

### Synonyms

Community care; Comprehensive geriatric assessment; Needs assessment

## Definition

A structured approach to identifying the needs and problems of an older person from a holistic perspective, incorporating physical, mental, social, and functional components, with intervention and follow-up in primary care.

## Overview

Assessment is fundamental to the work of specialists in the care of older people, defined as a structured approach to identifying the needs and problems of an older person from a holistic perspective, incorporating physical, mental, social, and functional components, with intervention and follow-up (Rubenstein and Rubenstein 2003). To respond to the challenge of aging populations, we need to translate the principles of specialist assessment to the primary care setting. Primary care is defined as a system of first response for addressing the health needs and concerns of the local population. Assessment systems in primary care need to be simple and holistic, able to identify people at risk, mobilize a response within primary care, and link to specialist practice. With a high prevalence of mental health problems among older people, assessment systems for primary care must include the assessment of mental health and well-being.

This entry has three aims, to describe the main methods and features of assessment of older people in primary care, drawing on examples from around the world; to describe in some detail the EASYCare assessment method, whose development over the last 25 years as an assessment tool for use in primary care for older people has been led by one of the authors; and to provide a number of recommendations for international development in this area.

## Methods

An electronic search of all HDAS journals was carried out to prepare materials for this entry, we undertook an electronic search of all HDAS

journals (<http://www.library.nhs.uk/hdas>) carried out through the OpenAthens portal on 24 November 2015. We searched for the following words in the abstract and title fields, Primary Care AND Assessment AND Older People. The time frame was set from 01 January 2015 to 24 November 2015. This produced 1,063 results, which were reviewed. We selected 30 articles were selected for detailed review based on confirming that the tool was used in the assessment of older people in a primary care setting, was not a single disease-specific screening tool, and included mental health within a holistic assessment. Studies were selected case studies for this entry to cover the main purposes of assessment where there was the strongest evidence base for their use.

The literature study identified a small number of assessment methods that fulfill the criteria. These can be divide into three main groups: those that are used to screen for risk, those that form a single assessment in primary care, and those that can form part of a stepped approach toward more comprehensive assessment. These in turn will then be discussed, drawing on a number of case studies.

### Risk Screening Assessment

Health risk appraisal (HRA) is an example of a risk screening assessment that can be used in primary care. HRA is an approach that has developed from the US-based insurance system. It involves a systematic approach, to collect information from individuals and to identify potentially modifiable risk factors (Eichler et al. 2007). Within the assessment of older people, the aim of HRA is to identify risk factors for decline in status that can then be used to modify management and improve quality of life (Eichler et al. 2007). Harari et al. (2008) used the health risk appraisal for older persons (HRA-O) as a self-completed questionnaire assessing medical conditions, function, social support, depressive conditions, memory impairment, and health measurements. A sample of people over 65 living in their own homes in London returned the questionnaire and received individualized written

feedback on their risk factors. The feedback was also incorporated into the primary care IT system so that it could also be used by GPs for reinforcement of health behavior. This tool appears to be effective at identifying risk factors, has been validated in the USA and in a number of European countries, and has a high acceptability among patients and providers in primary care. However, this study found the HRA-O had a limited impact on health behaviors, excluding a small increase in physical activity and an increased uptake of the pneumococcal vaccine. Previous studies that included face-to-face encounters with participants have had more positive outcomes, suggesting direct contact may be important in the assessment of older people in primary care.

Eichler et al. (2007) also used risk assessment to assess older people ( $\geq 70$  years of age) in primary care in Austria; however, they used the Standardized Assessment Tool for Elderly People in Primary Care (STEP) tool. This tool was developed in a collaboration between 7 different European countries and involves 33 possible health problems and risk factors for health decline. Again, this took the form of a self-completed questionnaire but also included a memory and mobility assessment by the general practitioner. If there was a positive result, the general practitioner and the patient would make decisions together about further management. Eichler et al. (2007) found the assessment influenced further management in four domains: hearing impairment, mobility and falls, depression, and urinary continence. In contrast, GPs were unlikely to act on positive cognitive results, a finding repeated elsewhere in the literature. Again, this demonstrates that risk assessment may be an effective way of assessing older people to identify risk factors and may be used to affect management in primary care. However, the impact of these management changes on long-term outcomes is not clear.

### Primary Care Assessment

Assessment of older people in primary care can also involve a more thorough assessment than that

of risk alone. Often this assessment will be an assessment of need and unmet need.

The Camberwell Needs Assessment for the Elderly (CANE) was developed in the UK, specifically for older people with mental disorders (Reynolds et al. 2000). It assesses four categories of need: environmental, physical, psychological, and social. Its validity, reliability, and acceptability have been assessed in the UK with good results. Stein et al. (2014) have also developed a German version which identified met and unmet need in older people in primary care, and results were consistent with other tools and scores. CANE has also been validated in a number of other countries. Although we found no evidence of association of the use of CANE and improved outcomes for older people, the use of CANE in both research and clinical setting and the validation in a number of countries suggests it may be a useful tool in the assessment of older people in primary care, particularly those with mental disorders such as dementia.

Another needs assessment tool that has been used in the assessment of older people in primary care is the Brief Assessment in General Practice Health Tool (BRIGHT). Wilkinson-Meyers et al. (2014) used this tool to identify met and unmet need in a sample of older people (>75) living in the community in New Zealand. They found 81% of people needed assistance with at least one instrument of daily living, and there was significant unmet need with regard to housework. However, this study was limited to personal assistance needs. Kerse et al. (2014) have published further work with the same sample where BRIGHT was used to perform a more comprehensive assessment through telephone interviews in primary care. They found that this method was effective at identifying older people in the community with increased disability. Those who undertook the BRIGHT assessment had a smaller decline in quality of life during the follow-up period. They also had an increased rate of placement in residential care, suggesting BRIGHT was able to identify need in the community that could not be met with older people remaining in their own homes, or the community support was not available to allow this. There was no difference in hospitalization and service use between the two groups.

## The EASYCare Assessment

Over the last 25 years, one of the authors (IP) has led an international project, EASYCare Health, to develop and implement an assessment system for older people in primary care. The approach has been validated (Philp et al. 2001) in 44 poor, middle income, and rich countries around the world (Olde-Rikkert et al. 2013) and reported in 80 peer-reviewed publications. The key insight from this work is that all older people and their family circumstances are unique. Therefore, older people need to be assessed for their perceptions about their health and care needs and mobilize a response based of their priorities and that of their family carers. Local systems also need to be understood, both voluntary and statutory, from which support can be mobilized. The EASYCare experience has shown that older people and their families are most concerned about maintaining independence, being able to do what is important to them, not being a burden and not suffering at the end of their lives. We have identified the top 49 top concerns of older people have been identified relating to their health and care, which fall into seven domains: communication, daily living activities, mobility, safety, accommodation and finance, mental health, and staying healthy. In recent studies, the top concerns reported have been about pain, loneliness, accommodation, financial difficulties, memory, and sleep. This heavy weighting toward concerns about mental health and environmental factors suggests that policy and practice should give greater priority to these issues to promote better health in old age.

The EASYCare approach has strong evidence for validity for use in primary care, with a variety of methods of implementation, including incorporation into frontline assessments by professionals such as primary and community nurses (Philip et al. 2014), allied health professionals, social care staff, and care assistants. Voluntary sector staffs, such as those working for NGOs, have been particularly effective in using the EASYCare assessments to underpin their work with older people. Evidence also suggests that many older people can have a satisfactory and efficient telephone-based assessment by call center staff.

Assessors from statutory, voluntary, and independent sectors do however need to be trained in person-centered assessment, including understanding issues about mental capacity. Self-assessment is possible but older people derive more benefit from a guided conversation with a trained assessor. Prior to offering an assessment service, local resources which could address identified concerns need to be mapped, and agreement must be reached about how to share summary assessment information at both an individual and population level, with due consideration to issues of confidentiality, security, and consent. In countries with well-developed primary care systems, we have found that it is useful for contact with the older person to be initiated by their primary care physician and for the summary of the assessment and response to be held within the person's individual primary care record. Following an assessment and mobilization of support, a follow-up assessment is undertaken to document what happened as a result and the person's satisfaction with the outcome. In RCTs have shown that the process mobilizes an increase in support from community and voluntary sector services, balanced by a reduction in hospital admission. Levels of independence and well-being in the older person improve. One RCT evaluated the cost per quality-adjusted life year gained, with the intervention found to be highly cost-effective (Melis et al. 2008) at less than €2000 per QALY.

An EASYCare assessment can be triggered by screening tools to identify at-risk older people and can also itself identify people who are likely to benefit from comprehensive geriatric assessment by specialist multidisciplinary teams. However, the unique feature of the approach is that its use can be contained for the most part within the primary care system and can help deliver appropriate care and support to older people in their own homes.

## Stepped Approach

Another approach identified from the literature is a stepped approach, where assessments move toward more comprehensive assessment. The U-CARE method (Bleijenbergh et al. 2013), developed in the Netherlands, is a prime example of this.

The assessment begins with a frailty screening, using U-PRIM, of older people in the community that is applied to primary care records. This is then followed by U-CARE, a nurse-led, multidisciplinary assessment and intervention.

A further frailty assessment using the Groningen Frailty Indicator (GFI) questionnaire and further supplementary tools to ensure a holistic assessment is undertaken. Frail older people in the community then undergo a comprehensive geriatric assessment at home conducted by a practice nurse. The final step is then to create a tailor-made care plan in collaboration with the GP. Results suggest that this approach is acceptable to health-care professionals and may have positive outcomes (Metzelthin et al. 2014). There was better preservation of physical functioning in the U-CARE group; however, no effect was seen on quality of life. Furthermore, there is evidence to suggest the U-CARE method is likely to be cost-effective compared to usual care (Metzelthin et al. 2014).

Another example of stepped assessment was the use by Vass et al. (2005) of an educational program to enable health visitors and GPs to provide validated short geriatric assessments to older people. Older people were first assessed by a health visitor in their own homes, as part of a nationwide program in Denmark. However, this was modified to include an assessment to select older people who were showing early signs of disability. Depending on the results of the first assessment, older people were then asked to see their GP for a short geriatric assessment, focusing on the five Ds: delirium, depression, dementia, drugs, and drinks. Vass et al. (2005) observed that those receiving the modified home visit program and GP assessment had less of a decline in their functional ability over 3 years. This result was more notable in the 80-year olds compared to the 75-year olds. Improved outcomes were also associated with more regular home visits. No differences in mortality or rates of nursing home admission were seen.

## Summary of Assessment Instrument

The key properties of the instruments we have described are summarized in the Table 1.

**Assessment of Older People in Primary Care, Table 1** Properties of the assessment instruments

	HRA-O	STEP	CANE	BRIGHT	U-CARE	EASYCare
Holistic	✓	✓	✓	✓	✓	✓
Good coverage of mental health	✓	✓	✓	✓	✓	✓
Valid for use in primary care	✓	✓	✓	✓	✓	✓
Cross-cultural validity	✓	✓	✓			✓
Supports stepped care				✓	✓	
Cost-effective					✓	✓

## Conclusion

Research of the literature for this entry demonstrated a relative paucity of recent published work about primary care-based assessment of older people, in contrast to the large amount of published work on identifying frail older people and meeting their needs through specialist services. However, the search terms were limited and we know that there is much published work and a long academic tradition focussed on developing better primary and community-based care for older people.

Nevertheless, there are some excellent, validated methods for primary care-based holistic assessment of older people's health and care needs. The methods fall into three main categories: assessment to screen for risk, single assessment for primary care management, and stepped assessment. Patterns of need appear to have strong commonalities across health systems and are well covered among the instruments we reviewed. Mental health needs feature strongly in them all.

It is no surprise that mental health is a key feature in assessment tools, which have been validated for use in primary health care. Poor mental health is a strong predictor of poor outcomes and will therefore feature in screening tools for risk. Mental health problems, including depression and anxiety, are common in older people, as are wider aspects of poor mental well-being such as loneliness, pain, and sleeping problems, and should therefore form a major component of any holistic assessment tool for primary care use. Identifying mental health problems in primary care for referral for specialist assessment using a stepped approach has always been required to support the principle of early intervention in mental

health. This has been given added impetus in older people with recognition of the benefits of early intervention for including specialist assessment for people with dementia.

Health systems should be developed to harness the use of these assessment methods. How they are implemented will depend on local factors. It is important to mobilize all available resources, including those from the third sector. The responsibility for assessment and care navigation should ideally be independent of the provision of care to avert the risk of assessors skewing the mobilization of support toward their own services. There is a strong policy and professional rhetoric for person-centered care, but it is impossible to underestimate the capacity for providers to pursue professional and organizational objectives, rather than working across organizations for the benefit of recipients of services. To have sustainable and effective care for aging populations, commissioners and policy-makers need to promote a culture of empowerment and capability, rather than one based on passive receipt of welfare and care, with genuine attention to the concerns of older people and their families for their health and care. The adoption of any of the assessment approaches we have reviewed would be encouraged, to strengthen primary care for older people and help change culture and systems to improve older people's lives.

## Cross-References

- ▶ [Assessment of Functional Abilities in Older Adults \(BADLs, IADLs\)](#)
- ▶ [Assisted Living](#)
- ▶ [Health Promotion](#)

- ▶ Home-based Primary Care
- ▶ Older Adults in the Emergency Health Care Setting
- ▶ Person-Centered Care and Dementia Care Mapping
- ▶ Psychosocial Well-Being
- ▶ Quality of Life in Older People
- ▶ Rural Health and Aging: Global Perspectives

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## Assisted Living

Abigail Kramer

Sierra Pacific Mental Illness Research, Education and Clinical Center (MIRECC), VA Palo Alto Health Care System, Palo Alto, CA, USA

## Synonyms

Assisted living facility; Long-term care; Residential living with assistance

## Definition

Assisted living facilities (ALFs) are a long-term residential option for older adults that provide a mixture of independent living and available round-the-clock medical assistance. These facilities aim to create a homelike environment for older adults to allow them to live as independently as possible when they may no longer be able to be completely self-sufficient. It provides the opportunity for elderly individuals to maintain dignity and autonomy while getting the support that they need. The services provided are based on the specific needs of the individual and can change over time as those needs may increase. This environment is attractive to older adults considering that many prefer to receive care in a homelike

setting (Brodie and Blendon 2001; Grabowski et al. 2012).

### Services Provided

Residents are provided with living amenities, daily meals, activities, and basic medical care. Living arrangements are offered as apartment style housing units, creating a community in which residents live nearby one another. Within the same facility, ALFs provide dining halls, shared facilities, and common spaces such as living rooms and patios. In addition to the provided space, many residencies offer activities and events to engage individuals and provide entertainment (Howe 2014). Encouraging residents to engage in social events is an effective way to help older adults in their transition to an ALF. These activities may also help them cope with difficult life events such as the bereavement of a spouse or loved one. Additionally, engagement in activities may reduce depressive symptoms that are commonly seen in older adults (Brody and Semel 2006).

The aspect that typically attracts older adults to move into ALFs is the on-site, 24 × 7 support and health services. Such assistance includes help with activities of daily living (ADL) such as bathing, eating, dressing, medication assistance and management, using the toilet, and walking. Specifically, residents can receive assistance with daily showers and morning routines with getting out of bed and getting dressed. Assistance can also be provided to those who need help in going from their rooms to the dining room for meals. Additionally, help is provided with chores such as cleaning, laundry, and transportation. This care is provided on an as-needed basis and can increase as health declines and need for support increases. Residents have access to a 24-h emergency call system typically near their bed, in the bathroom, and sometimes even around their neck on a necklace (Howe 2014). Overall, the philosophy of service within ALFs is to increase residents' independence and dignity while emphasizing flexible, individualized supportive services and health care (Allen 2004).

### Residents

ALFs are able to serve residents with a wide range of physical and mental health ailments. Some residents are in relatively good health, require minimal assistance, and can function with little to no limitation. These residents typically choose to live in an ALF to have assistance with taxing chores such as cleaning and meal preparation. Others choose to move to an ALF with a spouse who has declining health to have extra assistance with taking care of them. Other residents have a variety of physical disabilities due to chronic pain or being wheelchair ridden that limit them from accomplishing ADLs. These residents require assistance with mobility within their private living space and transporting to the dining hall, common areas within the ALF, or to off-site locations. Furthermore, some residents are physically able but require assistance to compensate for their cognitive decline. Such residents may require assistance with remembering to take medication and other ADLs such as bathing and dressing. Additionally, residents with health problems such as hypertension, diabetes, heart problems, and joint pain also benefit from medication management and call systems to staff members in case of emergency. Many residents have a combination of limitations and health problems requiring individualized assistance to address their specific needs (Zimmerman et al. 2001).

### Unique to Independent Living and Skilled Nursing

The services provided at an ALF are at a higher level than within an independent living facility but less intense than what is offered within a skilled nursing facility. An independent living facility offers fewer services and is considered the first step in the spectrum of care for elder adults. Independent living is sometimes referred to as a retirement community in which adults are generally in good health and require minimal supervision. Residents are responsible for taking their own medication and setting up doctors' appointments, as well as requesting extra assistance when

needed. These facilities offer smaller condominiums and apartments as housing options to reduce housekeeping tasks for residents when transitioning from their larger homes. Many older adults are drawn to independent living facilities for the sense of community and activities offered to maintain stimulation and enjoyment in life. Safety is always taken into account with well-lit walkways to reduce falling and emergency call systems to quickly alert the staff if assistance is needed. The staff typically keeps note of residents' health status in order to consider when health decline is significant enough to require increased assistance or a transition into assisted living (Howe 2014).

When health declines to the extent that a resident needs more support than is offered in an ALF, the resident is typically transitioned to a skilled nursing facility. While independent living provides less support than in an ALF, skilled nursing provides the highest level of intensive services for residents who need more individualized and advanced care. Within skilled nursing facilities, assistance is typically provided by registered nurses due to the increased care needed by residents. On the other hand, the staff members at ALFs are not required to be registered nurses and instead are commonly referred to as personal care assistants (PCAs). Staff members in ALF are mostly responsible for assistance with ADLs rather than trained to provide advanced medical care. A registered nurse typically acts as the medical director in ALFs to supervise the PCAs and the residents' medical needs. While PCAs assist residents in an ALF on an as-needed basis with ADLs, skilled nursing facilities provide services for individuals who have significant difficulty completing daily activities and require 24-h assistance (Howe 2014).

Assisted living can be an attractive and more affordable intermediate option between independent living and skilled nursing. ALFs are best designed for individuals who do not yet need a high level of intensive care but can benefit from assistance with ADLs and medication management. Many residents may transition from one level of care to another as they age, their health declines, and need for assistance becomes greater.

## Safety

Since many residents have physical and/or mental disabilities that prevent them from living independently, safety is an increased concern within AFLs. Older adults are at a higher risk of falling due to increased fragility and decreased sensory perception (Chang et al. 2004). In order to create an adequately safe environment for disabled elders, many AFLs are designed to accommodate the specific needs of the residents. For instance, facilities have wide hallways to fit wheelchairs and well-lit sturdy handrails for assistance with walking. All bathrooms and walkways throughout the building are also handicap accessible. Bedrooms are typically equipped with a call cord or switch so that patients can have immediate contact with nurses in an emergency or if they need immediate assistance. Additionally, some AFLs provide a pendant or wristband for patients to wear for easier access to communicate with staff members (Howe 2014).

## Facility Amenities

Assisted living facilities typically provide apartment style housing to residents in the form of a studio, 1-bedroom, or 2-bedroom. Units also typically include a kitchenette and a private bathroom. Residents tend to either live alone or with their spouse or partner. Some single residents may choose to live in a unit with another resident for companionship (Howe 2014). The ample space allows residents to create a homelike environment and incorporate their belongings to maintain their individuality within the facility.

In addition to the individual units, ALFs also provide many common spaces throughout the building to facilitate a community atmosphere for the residents. Such spaces include living rooms, meeting spaces/multipurpose rooms, dining halls, and patio areas for socializing and events. Many assisted living facilities also have amenities on-site that are shared by residents such as central laundry, hair and nail salons, movie theaters, convenient stores, and restaurant dining. These additional conveniences and luxuries create

a comfortable living environment for the older residents.

To further create a comfortable atmosphere within the assisted living facilities, many also provide a calendar of events and outings to engage residents and keep them active. For instance, transportation services are provided for off-site needs such as grocery shopping, pharmacy visits, shopping, and doctors' appointments. Additionally, transportation is also provided for off-site recreational activities such as museums visits, food tastings, and farmer markets. Such activities and entertainment are also planned at the facility to promote socialization among resident and to increase quality of life. Such events include guest speakers, musicians, performances, arts and crafts, and movie nights (Howe 2014). Some ALFs may also offer a "reminiscing group" in which residents are encouraged to discuss and recall pleasant memories from their pasts (Howe 2014). Not only does recalling pleasant memories increase mood but doing so can also have cognitive benefits for older adults by exercising their memory (Brody and Semel 2006). These activities promote engagement among residents to encourage them to get out of their rooms and socialize with others.

### Importance of Dining Experience

A critical component of ALFs that contributes to the quality of life of the residents is the dining hall for communal meals. Many ALFs provide all meals for residents in buffet style or restaurant style dining areas. Therefore, the facilities must provide quality food to meet the nutritional needs of elder adults. This older population commonly has deficiencies in nutritional intake due to decreased appetite and thus a reduction in food consumption. Additionally, reduced food intake also commonly occurs due to limited food options in some ALFs. Eating meals in a designated dining area within the ALF encourages residents to be more active and social within an otherwise inactive lifestyle. Without a communal dining area, residents are more likely to eat alone, increasing their isolation, thus creating feelings

of depression and further lowering food intake. Additionally, studies have shown that people tend to eat more when sharing a meal with others than when eating alone (Edwards and Hartwell 2004). Therefore, the psychological aspects of the eating environment have been suggested to play a large role in increasing residents' nutritional intake and thus increasing quality of life. Overall, the dining experience provided within AFLs is meant to create a comfortable "homelike" environment for residents to mimic distinctive patterns of family life. Creating an environment that encourages and enables residents to eat together induces feelings of togetherness, security, and happiness (Mahadevan et al. 2014).

### Choosing the Right ALF

In order to choose a high quality fit between a resident and a facility, there are many components that must be taken into account. Finding a strong match is essential to ensure the resident feels comfortable and is satisfied with their environment to feel at home. There must be a balance between the residents' profiles, their needs, and preferences with the staff and services offered at an ALF. For instance, some residents may prefer a smaller-scale ALF with a quiet and calm living environment, while others seek a "hustle and bustle" environment that provides many activities to encourage engagement. When all of these components are taken into account, it becomes quickly apparent that a "one-size-fits-all" mentality is inadequate when choosing the right ALF for each individual (Morgan 2012).

There are a variety of ways in which residents determine the quality of an ALF. First, quality is not an abstract concept but comprised of specific components that are valued by the resident. Individuals move into ALFs coming from specific backgrounds, familial lifestyles, and cultures that drive their preferences for their new home. These preferences may or may not coincide with the specific "brand" advertised by the ALF and thus make the qualities of an ALF distinctly positive or negative to individuals. Second, the perceived quality of an ALF may also change over time for

an individual depending on their specific needs. For instance, the quality of an ALF may be more dependent on the quality of life or the quality of health care services depending on the needs of a resident. In a nursing home, the answer may be clearer that the quality of health care is more essential considering the increased need for assistance from the patients; however, in an ALF, this distinction is less clear and likely a combination of both quality of life and quality of health care due to the mixed needs of residents. Therefore, ALFs experience a challenge to ensure the highest quality considering that the needs and preferences of residents' are broad and ever changing (Morgan 2012).

The third way to determine the quality of an ALF extends beyond the building and staff members but to consider the additional characteristics of the facility that make it unique. For instance, the quality of an ALF should also encompass location, culture of the community, staff management, and provided activities. The combination of these additional qualities creates an idiosyncratic community that may feel like home to some but not others. Therefore, some residents may be particularly attracted to certain ALFs that best fit their needs and preferences. Lastly, the reference point of the individual judging the ALF can drastically affect how the quality of an ALF is determined. For instance, the resident compared to the resident's adult child may evaluate the quality differently. These perspectives can also change when touring the facility versus when residing in the facility. Therefore, when accounting for the priorities of the person evaluating the quality of an ALF, the ways in which quality is determined can drastically vary (Morgan 2012).

### **Autonomy in an ALF**

Choosing to move to an ALF can be a difficult decision for both the individual and their family. Most facilities do its best to create an environment that is homey and comfortable with the core value to preserve as much autonomy as possible for residents. For some, merely moving into an ALF

enhances older adults' independence, as they no longer feel like a "burden" to their family members. They may also have the opportunity to do more activities with the aid of transportation and staff members. However, some residents have concerns of limited autonomy due to the rules and regulations of ALFs. Therefore, many facilities must strike a balance between preserving the autonomy of residents while ensuring that they are safe.

With the added care of staff members within an ALF, some privacy must be compromised to preserve the safety of residents. For instance, staff members must have access to residents' rooms to enter freely in case of an emergency. Therefore, residents' need to adjust to this limited privacy that was not present in their personal homes before moving to an ALF. They may also have limited freedoms on how to decorate or furnish their rooms in order to minimize clutter and reduce the likelihood of falling. Minimal clutter also increases the staff's ability to easily move about the room to provide services within the private quarters.

Residents also must adjust to decreased autonomy in their ability to come and go from the facility. Many ALFs request that residents sign out and inform the staff when they leave the grounds. Due to the frequency of confused elders to wander, it is important that the staff keeps track of the residents' whereabouts. Additionally, declining memory might also cause older adults to get lost easily and not be able to find their way back to the facility. While this limitation can be frustrating for older adults who are accustomed to coming and going as they please, these rules and regulations are put in place to maintain the safety of residents. Some ALFs do attempt to curb limitations for individuals depending on the level of their required supervision based on their degree of cognitive impairment. However, this aspiration becomes an ongoing challenge as cognitive abilities are always changing and at different rates. Therefore, since such a large proportion of people in ALFs do have some degree of cognitive impairment, many residents must accept these limitations as default despite varying levels in ability (Morgan 2012).

## Maintaining Well-Being

Overall, adjusting to life in an ALF can be difficult for some adults and affect their well-being during the transition. Research suggests that the best way to maintain well-being during this transition is to establish a sense of “home” at the ALF to increase feelings of belongingness and comfort (Cutchin et al. 2003). There are many ways in which this feeling can be achieved, such as through autonomy. Although some autonomy is limited as previously discussed, other types of autonomy should be purposefully persevered in order to increase the feeling that the ALF is home for residents. For example, the freedom to decorate one’s room and bring personal belongings is an essential component during the transition to an ALF that help makes the new facility feel like home. Additionally, the freedom to maintain the same level of contact with family and friends also contributes to a smooth transition. Maintaining well-being during the transition can also be achieved through developing close social relationships with other residents within the ALF. This can be done through the shared dining spaces and variety of activities offered at the facility. When residents become involved in their new environment and participate in the events, they are able to meet others and form relationships. Creating these relationships is an essential component of feeling secure and can generate feelings of belonging to a new community. Other essential components to maintain well-being during the transition to an ALF is having mutual respect with the staff members and developing a sense of security within the facility. When residents can successfully adjust to life in an ALF, they are able to feel comforted with the amenities and services offered to improve their quality of life (Cutchin et al. 2003; Hammer 1999).

## Summary

In summary, assisted living facilities (ALFs) are a desirable option for intermediate care during the aging process. Facilities offer individualized assistance for residents with a variety of ailments including physical, mental, and health limitations.

Residents are provided with private rooms and assistance with activities of daily living (ADLs). Activities and shared common rooms promote socialization and engagement in the community to increase their quality of life. Additionally, shared dining areas encourage residents to leave their private rooms to meet other residents. Although limitations are put in place to prioritize safety, ALFs attempt to create a homelike environment that maintains the autonomy and dignity of residents.

## Cross-References

- ▶ [Comorbidity](#)
- ▶ [Small-Scale Homelike Care in Nursing Homes](#)

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## Attitudes and Self-Perceptions of Aging

Paul Nash  
Centre for Innovative Ageing, Swansea  
University, Wales, UK

### Synonyms

Ageism; Discrimination; Internalized ageism; Prejudice; Stereotypes

### Definition

An attitude may be defined as an internal affective orientation explaining an individual's action (Reber 1995). They comprise four components: cognitive, affective, evaluative, and conative. The cognitive component refers to the opinions or schema held about an object. The affective component refers to the emotion or salience towards the attitude object. The evaluative component refers to the direction of the feeling, whether the object evokes a positive or negative emotion. Finally, the conative component of the attitude is the disposition for action (Maio et al. 2000). It is the combination of these components that determines the attitude held by an individual.

### Attitudes: Explicit and Implicit

There are several characteristics that define an attitude within the 4-tier framework. First, an attitude is learned. Attitudes can be learned in many ways, the most prominent being personal experience, observation of salient others, and societal influence. Each method exposes the individual to

attitudes and information about the attitude object, which they then appraise within their own belief systems (and those held within society and salient in-groups) to form and update their own opinions and attitudes.

Second, attitudes are predispositions. Attitudes are inclinations and tendencies for action; thus, an attitude and its direction contain motivational qualities. If the attitude is such that the salience towards the attitude object is high and the object is encountered, then be it negative or positive, as long as the conative response is satisfied, an individual will act upon his or her held beliefs. However, this is a predisposition and the association with behavior is not a causal one.

Third, attitudes are consistent. This does not mean that attitudes cannot be changed (as discussed later), just that they have a consistency in expression and measurement over time and across contexts. The way in which the attitudes are expressed may however change, depending on the social situation and on the pervasive attitudes of any salient others in the same social setting.

There are two subsets of the overarching "attitude": these are those of the implicit and explicit. Implicit attitudes are "introspectively unidentified (or inaccurately identified) traces of past experience that mediate favourable or unfavourable feeling, thought or action toward social objects." Conversely, explicit attitudes are defined as "consciously expressed actions, thoughts or feelings under the performer's control" (Greenwald and Banaji 1995). Research has further demonstrated that implicit attitudes are stable and enduring, allowing prediction of spontaneous behavior after exposure to unexpected stimuli. Research has also shown that explicit attitudes are less enduring and more malleable and predict only planned behavior (Perugini 2005). It is widely understood that because the two attitude types predict behavior at different times, they may in fact be manifestations of a single root attitude. Where explicit attitudes are consciously expressed by the performer, implicit attitudes reveal information which is not available to the individual through introspection however motivated or able a person. A prime example of this

is ageism. Where individuals genuinely believe they are not ageist and outwardly express accepting explicit attitudes, they may harbor negative implicit attitudes based on subtle reinforcement from their social interactions and environments.

### Formation of Attitudes

There are several theories of attitude formation, but two have become prominent. These are the summation (Fishbein and Ajzen 1974) and averaged (Anderson 1971) models. The summation approach argues that an attitude is the sum of evaluations associated with salient outcomes of observed behaviors. Thus, the attitude (either positive or negative) is the result of the total exposure to an attitude object or target. Using this approach, an attitude can be equally strong if the salience and outcome are high but observed infrequently or if the salience and outcome are low but the frequency of observation is high.

In contrast, the averaged model proposes that attitudes are subject to a process of normalization. Thus, the attitude is formed from the average evaluations of the attributes associated with an attitude object. Rather than the summation theory that simply adds together all of the experiences, this theory posits that the direction of the attitude is a reasoned average based on evaluations from each exposure. This theory, unlike the summation approach, would incorporate outlier responses or opinions and “dilute” them into the previously held knowledge about a certain attitude object.

In a review, Betsch et al. (2004) argue that both models are only applicable in certain circumstances, and an integrated model is more appropriate. This is called the value-account model, which argues that implicit attitudes are formed by summation and explicit attitudes by the averaged procedure. The model also takes into consideration the four components of attitudes, explaining the salience and motivational aspects of attitudes while centering on the cognitive evaluations made by the individual and their awareness of the process.

Allport (1954) identified some key ways in which stereotypes were formed simply through the way in which we are raised within our culture and environment. Family socialization and exposure to images in books, television, and newspapers were highlighted as key contributing sources for potential prejudicial stereotypes. Obviously in today’s world, the Internet and seemingly barrier-less technology all feed into the process of stereotype formation. Further to this, it has also been shown that stereotypes can be formed from a cognitive bias, resulting in a perception-based correlation between minority groups and infrequently occurring attributes. The reason for this being adopted as a stereotypical attribute of the minority group is due to both a categorical distinctiveness process, enhancing the similarities to the group an individual belongs while simultaneously maximizing the differences with the minority “other” (increasing the in-group/out-group difference), and the distinctiveness of the attribute occurring.

Unlike other prejudices, ageist attitudes are still openly prevalent in society. In television comedies, elderly people are depicted, defined by stereotyped negativities regarding physical decline and both physical and mental incompetency. When the age stereotypes have been acquired, they will be easily activated by the presence of an elderly person, resulting in the generalization of the stereotyped schema to elderly people. Once acquired, these attitudes are maintained and strengthened when encountering elderly people even if they do not exhibit characteristics associated with the stereotypes held.

### Population Attitudes Towards Older Adults

Although attitudes are central to the formation of prejudicial thoughts and ultimately treatment, it is arguably the stereotypes derived from attitudes that are the key factor in shaping behavior. Research highlights role incongruity as the basis for prejudicial behavior. It is proposed that prejudice itself derives from the dissonance between

beliefs about the stereotyped attributes associated with a group and the beliefs about the attributes that allow success in valued social roles.

Aging prejudice, in a similar manner to that of an attitude, can be broken into component parts: cognitive, affective, and conative. Cognitive prejudice refers to the belief that an individual holds about an older person and that a certain opinion or attitude is correct and true. Affective prejudice describes what stereotyped characteristics of older people the individual likes or dislikes. Conative prejudice is similar to the conative component of attitude, in that it refers to the propensity of the individual to act on their ageist prejudice. It is the inclination or predisposition and direction of action that are aimed to measure when assessing the attitudes held by an individual.

It is fundamental for people to categorize and create stereotypes due to the size and complexity of the daily information processed. Stereotypes are the belief that members of the same group indeed also share a certain attribute, for example, all old people are frail or all old people are wise. This assumption arises directly from the categorization process through the assimilation of in-group differences and as such the promotion of out-group homogeneity. One outcome of this categorization process is the accentuation of intergroup differences and the reduction of intragroup differences, both of which affect evaluation of the out-group and intergroup perceptions, attitudes, and behavior. Within ageism, this is essentially maximizing the differences between younger people (the group to which you belong) and older people (the out-group), ascribing negative characteristics to the group you do not belong.

Levy and Banaji (2002) conducted a review on implicit ageism, illustrating a pervasive and wide-reaching proliferation of negative ageist attitudes. This is not something confined to one social or ethnic grouping but prevalent across the gamut of society, resulting in a range of consequences for both older people and society at large.

### Impacts of Negative Aging Attitudes

Stereotypes are not applied indiscriminately but rather used to create a platform from which to seek

out further information. It is in the absence of additional information that we apply these stereotypes; however hesitantly we may do this. It has been shown that the use of stereotypes (especially gender) affects people's judgments even when additional information is presented about the individual character of the person being judged. People tend to use (age) schemata as a platform on which to base their assumptions of an older person. However, rather than seeking information generally about the person, information is sought to confirm the stereotype, rather than to cast doubt on it. There is still the ability, however, for individuals to search for information to contradict the ageist preconceptions. Stereotypes, as with other heuristic techniques, allow for increased processing capacity of other information presented simultaneously. Linked to this, it has also to be considered that stereotype use will also increase if people are cognitively or emotionally preoccupied with other concerns. In fields such as medicine where workloads are high, hours are long, and stressors are ever present, questions should be posed regarding the underlying stereotypes activated. If not, there is potential for this to lead to misdiagnosis (Duerson et al. 1992) or refusal to treat (Filipp and Schmitt 1995).

When these negative attitudes have been internalized and become implicit, the attitude holder may indeed no longer be immediately aware that they hold these attitudes. It is with the lack of conscious awareness that the negative attitude now becomes the basis for unplanned responses to the attitude target. This phenomenon can be observed with ageism in that the explicit bias is not expressed; however, behavior and language used precipitate the negative stereotypes assimilated. This has been highlighted as a more dangerous form of prejudice as even those outwardly expressing the best of intentions have difficulty trying to avoid negative responses that are generated by implicit processes.

Despite prejudice often being largely irrational, with regard to older people, some of the prejudice can be based on biological and observable declines. There are both physical and psychological losses associated with aging, a fact that

is universally accepted. The problem with aging is that societally it is seen as being simultaneously a time of wisdom and a time of physical and cognitive decline. Looked at more closely, what is being said is that people believe older adults are wiser and more knowledgeable but that they are slower and less efficient in dealing with the new and/or when they have to think on their feet. Ageism appears to have a base in physiological and psychological fact; however, little or no account is taken of the compensation method adopted by older people to minimize the effects of age-related loss. Similarly little importance is placed on the positive aspects of aging which are equally integral to an older person but counter the existing accepted heuristics and as such are often overlooked or cast aside. From these disparate viewpoints, a legitimate question arises in whether the objective views of aging (which are generally negative) are therefore likely to cue negative attitudes in those who work directly or indirectly with older adults.

Common forms of modern ageism include devaluing the contributions made by older people and viewing the pathologic processes sometimes associated with later life as normal components of the aging process. Angus and Reeve (2006) have further identified that this socially ingrained ageism actively promotes stereotypes of social isolation, physical and cognitive decline, lack of physical activity, and economic burden. Gerontophobia is a narrower band of ageism that specifically refers to a phobia of older people. Lynch (2000) identified aging anxiety as a major component of gerontophobia and more widely ageism, explaining this as the “combination of people’s concerns or fears about getting older.” These fears are based on concerns over loss of social contact, reduction in cognitive ability, changes in physical appearance, declines in overall health, and financial hardships that are themselves stereotyped characteristics of the aging process. In addition to these somewhat irrational fears, it is the knowledge that simply by living life we will become a member of this out-group, a process and transition whose path cannot be altered or avoided. The inevitability of the transition itself is stressful and causes

anxiety among those who hold these negative stereotypes.

When addressing the prevalence of all forms of ageism, it becomes clear that it now surpasses those of sexism and racism (Kite and Wagner 2002), although it is typically harder to measure due to the implicit ways it is conducted. Ageism is prominent in advertising, media, and comedy and in the way in which older people are generally viewed. It is due to this prominence that acceptance surrounding ageism has occurred. It is often seen as humorous, and based on some degree of fact, this negating any negative effects or outcomes. Due to the “humorous” nature of ageism, the negative effects on the older person (self-esteem, disablement, self-isolation) are generally ignored by the wider public. A problem arises, however, when trying to measure the “colloquially” clear prevalence. On explicit measures, people will present themselves in what they see as the most socially acceptable light. Because of this self-presentational bias, the explicit measure of ageism (unless very subtle) does not truly capture the full extent of ageism.

This negative approach is also ever present even within the healthcare settings where older adults are at their most vulnerable. Research indicates that the care of these older adults may indeed be less than that given to a younger person. Attitudes held by staff can affect the treatment received and the way in which elderly people are treated. This has been demonstrated where older people were not receiving the same diagnosis based on the same symptoms as younger people where the only differentiating feature was that of the patient’s age (James and Haley 1995). Similarly, research has highlighted that in some instances, medical professionals were refraining from treating patients with mental impairments because due to their age the conditions were considered irreversible (Filipp and Schmitt 1995). This is not something as an artifact of previous generations as medical student scores on ageism measures were no better than those reported in the general population, and no real increase in acceptance was measured from pre- to post-educational training. It can be concluded that this was a reflection on the lack of specific geriatric training. It has

been suggested that in order to improve this knowledge and sensitize students in health professions to the growing needs of the older population, they require more specific gerontological training, not simply training that focuses on the losses associated with aging. It is further posited that this training should include direct contact with older people and patients as this would help student clinicians improve their perceptions.

### Self-Perceptions of Aging

A racist will never change skin color, a misogynist will never change sex, but an ageist person will become that which they hate should they live long enough. As such, every person should be conscious of the fact that if discrimination against older people is tolerated, one day it could be directed towards them. This internalization of negative concepts and the experience of prejudicial behavior cause issues around self-esteem and well-being in older adults, as well as resulting in costs to both the individual and the wider society at large.

The practice of discrimination has been shown to cause lowered self-efficacy, decreased productivity, and cardiovascular stress (Levy et al. 2000). This is costly to individuals and, in workers, to the company they work for as these symptoms lead to decreased productivity and may lead to the perpetuation of ageist attitudes. Especially in the workplace, research has demonstrated a clear link between perceived credibility of older adults and ageist attitudes.

Despite there being apparently equal amounts of positive and negative stereotypes pertaining to older people, the pervasive attitudes present in research suggest higher negative attitudes than positive ones. These findings were not only in the young. Negative implicit ageist attitudes are held by older people themselves (Levy and Banaji 2002). The reasoning given for this is that elderly people have acquired the same implicit prejudices throughout their lives and have not had sufficient time or opportunity to develop the mechanisms to defend against this.

There are negative consequences for elderly people as a result of the ageist attitudes held as they are not only subjected to ageist prejudices from others but also internalize these implicit biases. As people progress through the life span, their age schema becomes more elaborate as more information both about others and themselves becomes incorporated. As they age, the number of traits, categories, and subcategories they have within the schema grows; however, core elements are still retained. Research supports this developmental approach, finding that despite having a more complex picture of aging, older people do not necessarily hold more positive views. Some research has suggested that older people judge their age category more favorably than younger people, but both groups have generally negative attitudes towards older age. Levy (1996) found that elderly people who exhibited higher negative implicit attitudes also performed significantly worse on memory tasks. Further, it was identified that the perceptions of older adults could also be affected by implicit self-stereotyping. It is now largely accepted that implicit age stereotypes can influence the views of older adults both towards others and upon themselves. In addition to memory tasks it is established that when older adults adopt these societal stereotypes, they see decline as inevitable and becoming a less active member of society as the only option. Similarly, when adopted, these stereotypes became a self-fulfilling prophecy, reinforcing stereotypes through the inaction and deficits resulting from their initial belief and internalization.

### Challenging Negative Perceptions

Weakly held and less salient attitudes are easier to change than strongly held attitudes, and as such, stronger attitudes are developed in areas that an individual (or in-group to which they belong) considers to be of higher salience. These strongly held attitudes can be either positive or negative but are usually polar. In areas of limited or questionable importance, attitudes tend to be weakly held, ambivalent, or neutral which means that they are more susceptible to change. Challenging these

negative attitudes also proves harder for ageism than other forms of prejudice due to the underlying nature of the attitude and the duration of time over which they are formed and reinforced.

Stereotypes can be changed through the presentation of contradictory information, but how that information is presented (concentrated examples or sporadic) and the affective nature (positive or negative) of the stereotype undergoing change are integral factors to the extent and level of success of the modification. A growing body of research has shown that contact between groups can alter stereotypes and reduce prejudice, provided that it takes place under certain conditions.

Prestwich et al. (2008) demonstrated that in terms of racist attitudes, exposure to the target group did indeed alter the attitudes held. The quantity of the contact improved an individual's implicit attitude, and the quality of the said contact affected the explicitly expressed attitudes. This has also been shown to be the case more specifically in the field of aging. With an intergenerational study, Tam et al. (2006) illustrated the same pattern of implicit and explicit attitude change based on quality and quantity of contact.

In order to improve the implicit attitudes towards older people and the resulting behavior, it is important that there is a high quantity of planned quality exposure and contact time.

Research has demonstrated that even when encountering contradictory evidence, attitudes towards older people were resistant to change and in most cases did not alter. As with most negative associations, if younger people can avoid spending time with older people and encountering evidence that may either support or challenge their beliefs about them, they will do so. Observation research has illustrated that young people are actively seeking ways to refrain from engaging in social meetings with elderly people. This avoidance only reinforces the implicitly held beliefs as it prevents the individual from having "meaningful" encounters with elderly adults that may in fact cause inconsistencies in schemata to be noticed and reevaluations of attitudes to take place.

Each of the attitudinal modification strategies can be used in an educational setting to impart knowledge and cause disequilibrium in the current schema held to force a reassessment of existing attributes and evaluations to modify the existing ageist attitude. This has been shown to be effective to differing levels across the globe. It has been shown that these attitudes (implicit and explicit) can be altered in the favor of older people. Westmoreland et al. (2009) demonstrated that through a well-structured education based on the psychological principles above, attitudes towards older people can be changed. It is in the utilization of these strategies in the training of medical professionals and people involved in the care of older people that the pervasive negative attitudes can be challenged. In challenging these stereotypes and commonly held misconceptions, the inequalities in care can also be addressed, and on a societal level, we can look to challenge the internalization of the said implicit and explicit ageist attitudes.

## Cross-References

- ▶ [Age Discrimination](#)
- ▶ [Age Stereotyping and Discrimination](#)
- ▶ [Aging and Quality of Life](#)
- ▶ [Social Cognition and Aging](#)
- ▶ [Stereotype Threat and Aging in the Workplace](#)

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## Australian Longitudinal Study of Aging (ALSA)

Tim D. Windsor and Mary A. Luszcz  
Flinders University, Adelaide, SA, Australia

### Synonyms

Cohort; Developmental dynamics; Panel studies

### Definition

One of the central methods of studying aging and development over the life span concerns examination of how individuals change over time. Research of this type requires longitudinal data, multiple repeated assessments of individuals often conducted over a number of years. This section describes key characteristics of an internationally significant longitudinal cohort study of aging, the Australian Longitudinal Study of Aging (ALSA). As detailed below, the design of the ALSA was informed by a biopsychosocial perspective, and as a result the study covers a broad range of measurement domains from functional capacity, to cognitive ability, to activity engagement. After providing an overview of the ALSA, findings related to the specific domain of social relationships and the implications of social relations for health and well-being in older adulthood are discussed.

### Background to the ALSA

The ALSA (Andrews et al. 1989; Luszcz et al. 2007, 2014) was established in Adelaide, South Australia, in the early 1990s as a means of providing sophisticated Australian data to inform research and policy related to population aging. The study has maintained a multidisciplinary biopsychosocial emphasis throughout, with a broad focus on how economic, environmental,

biomedical, behavioral, and social factors relate to aging. More specific aims of the ALSA were concerned with (i) assessing changes in health and functional status over time, (ii) identifying risk factors for chronic diseases and normative aging-related changes, (iii) assessing effects of disease processes and lifestyle on functioning and aged care service use, and (iv) examining predictors of mortality. Following an extensive pilot, the ALSA Wave 1 (baseline) assessment commenced in 1992.

## Participants and Procedures

ALSA participants consist of a population-based cohort of adults aged 70 and older at baseline, who resided in the Adelaide Statistical Division in 1992. The South Australian Electoral Roll was used as a sampling frame (voting is compulsory for Australian citizens with some rare exceptions) with the sample stratified by age group (70–74, 75–79, 80–84, 85 and older), sex, and local government area. Older adults living in the community and in residential care were eligible to participate. Prospective participants were sent letters of introduction and invitations to participate. After exclusion of ineligible participants (e.g., those deceased, not contactable, out of geographical scope), a total of 1,477 of 2,703 eligible persons (a response fraction of 54.6%) consented to take part in the study.

In addition to the 1,477 primary respondents, spouses and other household members were also invited to participate, with the age inclusion criterion for spouses relaxed to 65 years. This resulted in recruitment of an additional 597 spouses and 13 household members, providing a total of 2,087 individuals in the baseline ALSA sample. The mean age of the baseline sample was 78.3 (SD = 6.7), and the sample included similar proportions of men (51%) and women (49%). Around two-thirds of the sample (65%) was partnered, and just over half of participants left school aged 14 years or younger (55%). Characteristics of the ALSA sample in terms of sociodemographic characteristics were similar to those of older adults residing in the community,

with the ALSA sample showing some advantages in education, health, and cognition consistent with patterns of sample selectivity typically observed in cohort studies (Luszcz et al. 2014).

ALSA participants have provided data on up to 13 occasions across several modes of assessment, over a 20-year period. Much of the key ALSA content has been obtained through face-to-face structured household interviews with participants, conducted at the major waves in 1992 (Wave 1,  $n = 2,087$ ), 1994 (Wave 3,  $n = 1,679$ ), 2000 (Wave 6,  $n = 791$ ), 2003 (Wave 7,  $n = 487$ ), 2007 (Wave 9,  $n = 213$ ), 2010 (Wave 11,  $n = 168$ ), and 2013 (Wave 12,  $n = 111$ ). Unequal time intervals between the major assessments reflect changes in the levels of funding available over the study interval. Shorter interviews focusing on major life events since the previous wave were conducted at additional waves (Waves 2, 4, 5, and 8 by telephone and Waves 10 and 13 face to face). At the major waves, participants also undertook clinical assessments and completed leave-behind questionnaires.

## Measures

Details of the various measures included in the ALSA are available in Luszcz et al. (2014) and from the ALSA website [www.flinders.edu.au/sabs/fcas/alsa/](http://www.flinders.edu.au/sabs/fcas/alsa/). Face-to-face interviews with participants were used to assess a range of characteristics including sociodemographic variables, self-reported health, depressive symptoms, hospitalization, carer role, activities of daily living, lifestyle activities, social network characteristics, exercise, driving, and income.

The clinical assessments conducted at the major waves included various cognitive tests, including measures of memory, processing speed, verbal fluency, and vocabulary. Also included were anthropometric assessments (e.g., height, weight, skinfold thickness), blood pressure, grip strength, and tests of sensory functioning (audiometry and visual acuity). Ancillary clinical studies conducted at Waves 1, 3, 9, and 12 tested bone density and obtained fasting blood

samples from which basic hematology measures and lipid profiles have been extracted and 20-channel biochemical analysis conducted.

Domains assessed in the leave-behind questionnaires included nutrition, oral health, sexual activity, and psychological variables (control beliefs, morale, self-esteem, and metamemory). Finally, supplementary qualitative interviews have been conducted with subsets of participants to obtain in-depth information related to sleep, widowhood, and characteristics that could promote late-life resilience.

### Accessing the ALSA Data

The ALSA data are held at the Flinders Centre for Ageing Studies (FCAS) at the Flinders University of South Australia. The FCAS team welcomes inquiries regarding the use of the data for specific projects. Information on processes for requesting the data, current collaborations, and additional project details are available from the project website.

### Social Relationships, Health, and Well-Being: Findings from the ALSA

To date, ALSA-based research has addressed numerous topics related to late-life health and well-being, ranging from characteristics of successful aging to predictors of cognitive decline, prevalence of late-life depression, and correlates of objective and subjective measures of health (see Luszcz et al. 2014 for an overview). Because a broad review of the ALSA findings is beyond the scope of this entry, the following section focuses on ALSA findings related to the specific domain of social relationships.

Supportive social relationships are recognized as an important resource for health and well-being over the life span. Social networks are believed to promote physical and mental health through a range of processes including positive social influence (e.g., encouraging health behaviors or medication adherence) and reducing negative appraisals of potentially stress-provoking events.

Social network members can also alleviate stress through providing support and creating opportunities for the experience of positive emotions (Berkman et al. 2000; Cohen 2004; Thoits 2011). Remaining socially engaged has also been identified as a potential mechanism for delaying cognitive aging and dementia (Fratiglioni et al. 2004; Hertzog et al. 2009).

The particular relevance of social relationships to aging well is reflected in a number of ALSA studies that have examined associations of social network characteristics with health and well-being. Social network characteristics were assessed at baseline using a range of items related to both social network structure (i.e., objective network characteristics such as size and contact frequency) and network function (i.e., the extent to which network members provide support). Specific items asked about the number of children; proximity and frequency of personal and telephone contact with children, relatives, and friends; size of supportive networks; and the availability of confidants (Giles et al. 2002). A subset of the social network items concerned with contact with children and confidant availability has been retained across all waves. Researchers have also used items related to participation in socially oriented activities taken from the Adelaide Activities Profile (Clark and Bond 1995) and available across all major waves to create composite measures of social activity engagement (Isherwood et al. 2012; Kiely et al. 2013).

Several studies based on ALSA have used social network information obtained at baseline to predict healthy aging outcomes. Giles et al. (2004) used measures representing networks with children, relatives, friends, and confidants, along with a composite total network measure, to predict disability over the first six waves of ALSA (9 years). Results indicated that social networks with relatives (but not friends, children, or confidants) protected against the development of mobility disability after controlling for sociodemographic characteristics, self-rated health, chronic morbidities, depressive symptoms, global cognition, and lifestyle variables (smoking, alcohol, and exercise). The authors

speculated that the absence of protective effects from children and confidants could have arisen from a particular reliance on these networks during times of experienced or anticipated health declines negating beneficial effects of social support from these same sources. Giles and colleagues (Giles et al. 2007) used a similar approach to examine associations of social network characteristics with the use of residential aged care facilities. The most robust findings were evident in relation to availability of confidants. Specifically, participants who had more people to confide in were less likely to use nursing homes over 5 waves post-baseline relative to those without confidants, after adjustment for health, demographic, and lifestyle characteristics. In contrast, use of lower-level residential care facilities (e.g., respite care) was not reliably associated with different social network characteristics.

Additional findings from ALSA indicate that social network attributes could have implications for cognitive aging. Giles et al. (2012) modeled trajectories of memory performance over 15 years in a subset of 706 ALSA participants who provided memory data and were cognitively intact at baseline. Growth models revealed a linear decline in memory over time and a main effect of a composite social network variable, whereby participants classified into upper and middle tertiles (i.e., indicating larger and more supportive networks) showed better memory performance relative to those classified into a lower network tertile indicating smaller, less supportive networks. Rates of change in memory did not vary as a function of total network characteristics; however, an interaction of friend networks with time emerged. The interaction indicated steeper rates of decline in memory among those with smaller friend networks relative to those with larger friend networks. The findings are broadly consistent with recent perspectives suggesting that social activity could help to preserve brain functioning through cognitive stimulation (Hertzog et al. 2009); however, it is also possible that reverse causal mechanisms are at play whereby declining cognitive abilities result in withdrawal from wider social networks (Stoykova et al. 2011).

Research from ALSA has also revealed associations between social network characteristics and mortality. Giles et al. (2005) examined social networks with children, relatives, friends, and confidants as predictors of 10-year mortality in the ALSA primary sample. Cox proportional hazard models adjusted for a range of sociodemographic, health, and lifestyle variables revealed that total networks, friend networks, and confidant networks were associated with increased survival. This study added to previous mortality research using general indicators of social support by demonstrating that some network attributes (friends and confidants) may be of greater significance to longevity than others (children and relatives). In a separate analysis based on the total ALSA sample, Anstey et al. (2002) showed that membership of a social group was associated with delayed mortality among women (but not men) over 9 years after adjustment for age, self-rated health, functional capacity, and several psychological variables (perceived control, self-esteem, subjective life expectancy, and life satisfaction).

In addition to projects concerned with the role of social resources in predicting long-term health and well-being outcomes, studies using ALSA have also examined how different social network attributes are implicated in processes of late-life development. Chan et al. (2011) used baseline data to examine the extent to which received social support from formal sources (e.g., care organizations) and informal sources (e.g., friends and family) moderated the association of disability with depressive symptoms. The results indicated that the association between higher levels of disability and higher levels of depressive symptoms was weaker among participants receiving support from informal sources or support from both informal and formal sources. Importantly, formal support alone was not protective against depressive symptoms, highlighting the importance of informal social relationships for maintaining mental health in the context of aging-related declines. Using 16-year longitudinal ALSA data, a recent study by Kiely et al. (2013) examined the role of social engagement in mediating the relationship between losses

in vision and hearing and depressive symptoms. Findings showed that depressive symptoms were higher among participants with hearing loss and dual sensory loss (impaired hearing and vision) and that rates of increase in depression became steeper after onset of hearing or dual sensory loss. Importantly, associations between sensory loss and depressive symptoms became nonsignificant after adjustment for social engagement. These findings support the possibility of a specific causal process underlying increases in depressive symptoms in late life, whereby sensory losses result in decreasing social engagement which in turn results in increased experience of depressive symptoms.

Whereas Kiely et al. (2013) focused on the role of social engagement as a mediator, Isherwood et al. (2012) treated social engagement as an outcome variable, examining the extent to which becoming widowed was associated with longitudinal changes in social engagement over 16 years. Changes in levels of contact with children were also examined. Results showed a rise in social engagement over the transition to widowhood, indicating that the loss of a spouse could prompt broader compensatory network engagement. This finding was consistent with several previous studies that have examined changes in social contact following widowhood. The amount of face-to-face contact with children was similar for those who were widowed and those who were not; however, being widowed was associated with more frequent telephone contact with children.

One of the unique strengths of ALSA is the availability of data from a subset of 597 spousal couples. The spousal dyad represents a central social context for aging and development, with husbands and wives who remain together over an extended period of time developing a long shared history of joint experiences and often developing effective collaborative methods of coping with aging-related losses (Berg and Upchurch 2007; Hoppmann and Gerstorf 2009). Researchers have used data from the ALSA couples to examine spousal interrelationships in social activity, cognition, and well-being (morale) over time. Hoppmann et al. (2008) examined the extent to

which there was correspondence between husbands' and wives' levels and rates of change in social activity over 11 years by treating the spousal couple as the unit of analysis and fitting growth curves to simultaneously model change in husbands and wives. Results indicated correlated levels of social activity between husbands and wives, indicating that husbands' activity levels were more similar to those of their wives' (and vice versa) than they were to those of unrelated spouses in the sample. More activities among wives were also associated with steeper decline in activities among husbands. Additional analyses including a measure of perceptual speed also revealed a positive association of levels of it for husbands and wives again suggesting interrelated development; however, the association was weaker than the corresponding association between husbands' and wives' social activity levels.

Additional studies have examined the interrelated development of spouses by using contemporary, dynamic longitudinal methods to examine gender asymmetries in the ways in which the characteristics of one spouse appear to affect the corresponding characteristics of the other over time. Gerstorf et al. (2009) used bivariate dual change score models to examine time-lagged spousal interrelations in older couples' cognitive test performance. The results indicated that husbands' perceptual speed reliably and positively predicted wives' perceptual speed at subsequent assessments. However, the models did not provide support for the opposite unidirectional effect of wives' perceptual speed predicting husbands' subsequent perceptual speed or for a bidirectional association between husbands' and wives' speed performance. A similar pattern was evident in models used to analyze memory performance, although the unidirectional effect was not as strong and was no longer statistically reliable after adjustment for functional limitations. The authors speculate that cognitively fit husbands may afford more opportunities for their wives to maintain broad engagement in intellectually enriching activities, whereas cognitively challenged husbands may require a lifestyle with wives restricted to less cognitively stimulating

home and caring duties as one possible explanation for the observed gender differences.

Walker et al. (2011) applied a similar analytical approach using dynamic models with 11-year ALSA data, to examine spousal interrelations in morale. The findings showed an opposite pattern of gender effects to the one reported by Gerstorf et al. (2009) in relation to cognitive changes, with wives' morale scores related to subsequent changes in husbands' morale. Specifically, husbands whose wives reported higher initial morale showed shallower decline in morale over time relative to husbands whose wives reported lower initial morale. Converse patterns of husbands predicting wives' morale were not evident.

Taken together, the various findings related to social networks and aging that have arisen from the ALSA support the importance of social context in influencing critical aspects of development in older adulthood. The existing studies indicate that specific aspects of social networks are differentially related to health, well-being, mortality, and cognition. Informal social networks may be a key resource for coping with disability, and it may be losses in social engagement that account for links between declines in sensory capacities and depressive symptoms. Finally, older couples develop in interrelated ways, with gender differences apparent in the extent to which husbands and wives influence different aspects of each other's psychosocial functioning.

## Social Relations in the ALSA: Future Directions

A number of opportunities exist for further research using ALSA to examine social aspects of aging and development. Current projects are focusing on correlates of longitudinal changes in social activity engagement and resources that could moderate the association between functional disability and decline in social activity. Additional research is considering the extent to which social resources protect against associations of socioeconomic disadvantage with poor health outcomes. Scope also exists for taking novel analytical approaches to studying social

relations using the ALSA data. One promising avenue concerns the use of profile-based methods to studying social networks. Approaches of this type use statistical methods to identify subtypes of participants characterized by different combinations of social network characteristics (e.g., Fiori et al. 2006). Previous studies have typically identified diverse (i.e., extensive networks), family-focused, friend-focused, or restricted (i.e., few social ties) networks. Extending this approach to ALSA could be used to identify similar network profiles, and to examine changes in profile membership over time, or the extent to which multidimensional network characteristics are related to trajectories of change in health, cognition, and well-being. The spousal dyad data might also be used with a reorientation to focus on differences, rather than similarities between spouses on key variables. Gerstorf et al. (2013) recently demonstrated that despite husbands and wives being more similar to each other in mental health than they are to unrelated others (as is typically demonstrated when taking a between-couple focus), considerable differences between husbands and wives (and sizeable heterogeneity in these differences) are evident when taking a within-couple perspective. Considering whether husbands and wives who are more or less similar to each other on key variables adapt more or less effectively to aging-related changes could represent a fruitful avenue for future examination of social relations and aging well using the ALSA.

## Cross-References

- ▶ [Aging and Mental Health in a Longitudinal Study of Elderly Costa Ricans](#)
- ▶ [Berlin Aging Studies \(BASE and BASE-II\)](#)
- ▶ [Canadian Longitudinal Study on Aging, A Platform for Psychogeriatric Research](#)
- ▶ [China Health and Retirement Longitudinal Study \(CHARLS\)](#)
- ▶ [Chinese Longitudinal Healthy Longevity Study](#)
- ▶ [Dynamic Analyses to Optimise Ageing \(DYNOPTA\)](#)
- ▶ [English Longitudinal Study of Aging \(ELSA\)](#)

- ▶ [Health and Retirement Study, A Longitudinal Data Resource for Psychologists](#)
- ▶ [Health, Work, and Retirement Longitudinal Study](#)
- ▶ [History of Longitudinal Studies of Psychological Aging](#)
- ▶ [IKARIA Study, Greece](#)
- ▶ [Irish Longitudinal Study on Ageing \(TILDA\)](#)
- ▶ [Korean Longitudinal Study of Ageing \(KLoSA\): Overview of Research Design and Contents](#)
- ▶ [Life and Living in Advanced Age, A Cohort Study in New Zealand, Te Puawaitanga o Ngā Tapuwae Kia Ora Tonu \(LiLACS NZ\)](#)
- ▶ [Older People and Their Psychological Well-Being in Japan, Evidence from the Japanese Study of Aging and Retirement \(JSTAR\)](#)
- ▶ [Longitudinal Aging Study Amsterdam](#)
- ▶ [SONIC Study, A Longitudinal Cohort Study of the Older People as Part of a Centenarian Study](#)

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## Australian Longitudinal Study of Women's Health (ALSWH)

Michelle Steffens and MyNhi Nguyen  
School of Psychology, The University of Queensland, Brisbane, QLD, Australia

### Synonyms

Women's Health Australia

### Definition

The Australian Longitudinal Study of Women's Health (ALSWH; also known as Women's Health Australia, WHA) is a prospective longitudinal population-based survey of more than 40,000 Australian women across three generations. The project collects quantitative and qualitative data to investigate the epidemiology of Australian women's physical and mental health across the life-span; that is, how biopsychosocial and behavioral factors enhance or compromise women's health, and how these effects might vary at different life stages. A key feature of the ALSWH is its extensive record linkage with Australian Medicare, Census, and other databases, which allow

researchers to incorporate novel variables, validate participant reports, and evaluate women's access to, and use of, various healthcare services.

### Background to the ALSWH

In 1989, the Australian Department of Community Services and Health (ADCSH) released its landmark *National Women's Health Policy* (Australian Department of Community Services and Health 1989), reviewing the body of knowledge on Australian women's health and outlining recommendations for the course of future research. Following a lengthy period of consultation with women's advocacy organizations and researchers, the ADCSH (now Australian Department of Health) agreed to fund a long-term longitudinal study of Australian women's health and well-being, and in 1995, the Australian Longitudinal Study on Women's Health (ALSWH) was founded (Dobson et al. 2015; Lee et al. 2005; Brown et al. 1996).

The ALSWH is a multidisciplinary joint project of the Universities of Queensland and Newcastle. The project has two overarching goals: first, to investigate the influences of biological, psychological, social, environmental, and lifestyle variables on women's physical and mental health (referred to here together as "health"), with a view to guiding future Australian health policy and practice; second, to assess the influence of any recent changes in Australian health policy and practice on women's health (Women's Health Australia 2016b).

To address these aims, ALSWH surveys were developed around five key themes: (1) how women spend their time – in terms of employment, unpaid caregiving, motherhood, socializing, and leisure – and what impact this has on health; (2) how self-rated health, specific diagnoses, weight, exercise, and diet affect health outcomes; (3) the prevalence and characteristics of violence and abuse against women across the life-span; (4) how to best help women maintain health during and beyond significant life events (e.g., childbirth, menopause, and divorce) and throughout their older years; and (5) the availability,

usage, and appropriateness of healthcare options, implications for governmental costs, and women's experiences of accessing the healthcare system (Brown et al. 1996). Twenty years on, emerging technologies can now provide highly specific location data, enabling researchers to add a sixth theme: Examining the impact of geographical and climate factors – such as drought and pollution – on women's health (Dobson et al. 2015).

By mid-2014, the ALSWH project had produced almost 500 peer-reviewed journal articles involving at least 780 researchers. ALSWH findings formed the cornerstone of evidence used to develop the Australian Government's 2010 *National Women's Health Policy* and several other governmental and organizational health-related policies (Dobson et al. 2015).

ALSWH data have also been used in a number of national and international studies and systematic reviews, most notably the *Dynamic Analyses to Optimise Ageing (DYNOPTA)* project. DYNOPTA pools participants from the ALSWH and other major Australian longitudinal work to study the health determinants and outcomes of over almost 80,000 Australian men and women (Dobson et al. 2015).

## Participants and Procedures

At its 1995 inception, the ALSWH established three main cohorts, defined by age: young women, born in the period 1973–1978 (aged 18–23 years in 1996); the mid-aged, born 1946–1951 (aged 45–50 years); and older women, born 1921–1926 (aged 70–75 years). Recruitment and subsequent surveys were conducted via mail, with an online survey option now available.

A critical feature of the ALSWH is its population-sampling approach, intended to broadly represent all Australian women, as all previous Australian longitudinal studies centered on specific subpopulations (Brown et al. 1996). To establish the 1995 cohorts, the ALSWH researchers took a stratified random sample of the Medicare database, which

contains the most complete and up-to-date record of Australian citizens and permanent residents. Women in rural and remote communities were intentionally oversampled to ensure that these subsamples were large enough for statistically valid comparisons with urban women (Brown et al. 1999). Comparison to 1996 Census data confirmed that all three cohorts approximated the underlying populations (Brown et al. 1996).

In longitudinal research, attrition (participant withdrawal, death, or nonresponse) is an inevitable challenge. If there is even slight bias in the manner in which participants are lost, the sample characteristics diverge from those of the population it represents. When differences are large, insights from the study might no longer apply to the population of interest. As ALSWH participants who missed one survey have often completed subsequent surveys, it is not possible to determine precise attrition rates, but approximations can be made (Dobson et al. 2015). From Surveys 1 (1996) to 6 (2011), there was a 43% drop in the number of surveys returned by the younger cohort, a 27% drop for mid-aged women, and a 67% drop for the older cohort. Record linkage with the National Death Index database showed that around 40% of the older cohort died over this period. Survey data and researcher contact reveal that a primary reason for withdrawal by older participants is their increasing frailty. Thus, to maximize the data acquired from older women while limiting their participation burden, researchers now send a shortened survey every 6 months.

## Measures

Numerous measures are employed across the formal ALSWH surveys (S1: 1996; S2: 1999; S3: 2002; S4: 2005; S5: 2008; S6: 2011) and approved substudies (in which participants are invited to partake in related surveys in between the formal ALSWH surveys). All surveys are available on the ALSWH website (Women's Health Australia 2016a). The surveys include a

range of established psychometric scales and novel items to assess numerous variables (Lee et al. 2005) on demographics, physical and mental health, quality of life, day-to-day functioning, lifestyle, environmental factors, experiences with the healthcare system, and topics of relevance to specific cohorts (e.g., contraception, menopause, and age-related health problems). Most items are quantitative, but several open-text items have been included, allowing deeper qualitative analysis of complex topics. This entry describes the main types of quantitative measures used with the older cohort. Except where otherwise noted, information is sourced from two reports by ALSWH investigators, which summarize the project's main methods and findings (up to publication dates) for the older cohort (Byles et al. 2010) and the mental health of all cohorts (Holden et al. 2013).

Demographic items address age, area of residence, country of birth, language spoken at home, marital status, and education. Behavioral and lifestyle items assess body mass index, height, physical activity and restrictions, cigarette and alcohol consumption, transport options, and ability to perform activities of daily living. Health-related items ask women to report their overall physical and mental health, medical and psychological health diagnoses, common symptoms of later life (e.g., vision or hearing loss, back pain, and height loss), significant medical events (e.g., falls and surgeries), medication use, number of GP and specialist doctor appointments, number of hospitalizations, and whether they live in the community or in a residential aged care facility. Items exploring social engagement and support focus on the number, type, and supportiveness of social contacts (e.g., spouse, family, and friends); satisfaction with their social relationships; whether a loved one was experiencing health problems or had recently died; and financial constraints on social activities (e.g., whether they have difficulty managing on their income).

A number of established self-report psychometric measures are included to assess aspects of older women's health and experiences. Details of these are beyond the scope of this entry but can be sourced from the ALSWH website (Women's Health Australia 2016a).

The ALSWH also includes several objectively assessed variables, providing validation and expansion of participant reports. This is achieved primarily via electronic record linking, in which each participant's ALSWH dataset is matched with records kept by Medicare, Australian Department of Veterans' Affairs, and Pharmaceutical Benefits Scheme programs. Linkage allows researchers to corroborate self-reported health diagnoses and medications, track government healthcare costs, and identify patterns of access to healthcare services across the socioeconomic and geographical landscapes (Dobson et al. 2015; Lee et al. 2005). Importantly, linkage has recently been established with databases held by aged-care services and facilities. This will permit future ALSWH work to incorporate data from formal assessments of older women's physical and cognitive capabilities, such as those completed during application to support services and admission to residential aged-care facilities (Dobson et al. 2015).

The ALSWH team has recently expanded their record linkage capabilities in a new direction, now incorporating geocoded data to pinpoint each participant's location of residence. This allows researchers to assess how climate and weather events – such as drought, natural disasters, and air pollution – might affect women's physical and mental health (Women's Health Australia 2016a).

## Accessing the ALSWH Data

Researchers wishing to work with ALSWH data, propose a substudy, or access its linked external databases must apply to the ALSWH Publications, Analyses, and Substudies Committee. Information on eligibility and the application process are available on the ALSWH website (Women's Health Australia 2016b).

## ALSWH Findings on Older Australian Women

The core ALSWH team has, thus far, released three relevant reports of key findings: Byles and

colleagues' review of older women's physical and social health (Byles et al. 2010), Holden and colleagues' review of mental health across all cohorts (Holden et al. 2013), and Byles and colleagues' review of medication and healthcare costs (Byles et al. 2008). This entry summarizes these findings and refers the reader to the full reports for citations.

### Physical Health in Older Australian Women

Aging brings inevitable declines in physical health, ability to perform activities of daily living, and health-related quality of life (*health QoL*). The ALSWH has explored numerous demographic, biological, medical, and social predictors of these outcomes.

#### Physical and Lifestyle Predictors of Health Outcomes

A similar pattern of risk factors was observed when investigating health outcomes beyond quality of life: height loss, body mass index (BMI), falls, smoking, and alcohol use were all identified as predicting broadly aversive health outcomes. Both underweight and overweight/obese women had higher risk of hospitalization than those with healthy BMI, especially if they smoked; however, slightly overweight women (25–27 kg/m<sup>2</sup>) had the lowest mortality risk, with current smokers at greatest risk across all BMIs. Overweight and obese women were at lower risk of osteoporosis, but higher risk of hypertension, heart disease, diabetes, and heart disease, with the latter effect again amplified in smokers.

Smoking was inversely related to longevity, with a clear dose–response relationship. At Survey 1, women reported their smoking status and their responses later cross-referenced with 2006 national mortality data. Results were striking: 81% of those who had never smoked and 75% of ex-smokers had survived, but smokers' mortality rate rose steeply with the more cigarettes consumed per day. Just 43% of women who smoked at least 25 cigarettes per day survived to at least 2006.

Results were less clear-cut for alcohol use. At Survey 1, 35% of women were nondrinkers and 29% drank less than weekly; for many, these were

long-term behavioral patterns. Alcohol consumption was inversely related to mortality: non- and rare-drinkers were up to twice as likely to die over a 6-year period as moderate drinkers and also tended to report poorer mental health and social functioning, even after accounting for smoking, health diagnoses, BMI, and demographics. No survival benefits were observed for women who drank more than the moderate rate. ALSWH investigators note that there is insufficient evidence to suggest that non- or rare-drinkers should increase their intake to reap health benefits.

Falls are a common concern for older women, and for good reason. In a subsample of the older cohort, around 20% had fallen in the past 6 months and over half feared falling in the next year. On average, women's homes had 9 of 25 listed fall hazards, though hazard incidence differed little between women who and had not fallen. Across the full older cohort, women with moderate to very high levels of physical activity were less likely to fall than those with no or very low levels, and much of this benefit persisted for at least 6 years. Women with very high levels of physical activity reduced their risk of sustaining a fracture by half. It is interesting to note, however, that greater physical activity was not significantly related to another indicator of bone health: height loss. Women lost an average of 0.19 cm height per year, with more severe losses associated with reduced self-rated health. Women were at greatest risk for height loss when underweight, born in a European country, diagnosed with osteoporosis, and taking both sleep and anxiety medications.

#### Medical Diagnoses as Risk Factors for Poor Health Outcomes

Among the strongest predictors of older women's health outcomes were the number and types of chronic health conditions and experience. Cancer and Alzheimer's disease were most predictive of disablement and death, while cancer, heart disease, and stroke were predictive of high health system usage. More than any other disease, Alzheimer's was associated with diminished social functioning and general health. The prevalence of chronic illness increased over time, and the more conditions a woman experienced, the

greater her likelihood of experiencing poor health QoL, physical disablement, and death.

#### Predictors of Health-Related Quality of Life

On average, health-related quality of life (*health QoL*) declined at each survey (Surveys 1–5). This trend encompassed four patterns: (a) 50% of women held relatively stable scores of high health QoL; (b) 27% had high health QoL at Survey 1 that declined over subsequent surveys; (c) 20% began with low health QoL that further deteriorated over time; and (d) 3% reported low health QoL at Survey 1 but showed improvement at each survey and reported high health QoL by Survey 5.

Compared with women with consistently high health QoL, those with poor or declining scores tended to be poorly educated, widowed, a smoker, overweight or obese, and physically inactive. These women were more likely to have a range of chronic health conditions (e.g., heart disease, stroke), general physical symptoms (e.g., back pain, vision problems), and a history of falls. They were also more likely to have had specific surgeries, take several medications, and frequently access GP and specialist care.

#### Patterns of Healthcare System Usage

Australians on a low income – such as age-pensioners, war widows, and low-income self-funded retirees – qualify to receive a Medicare subsidy that covers either the full cost of a GP visit (bulk-billing GPs) or the great majority of the cost (non-bulk-billing GPs). Likewise, they receive a government subsidy on most prescribed medications, via the national Pharmaceutical Benefits Scheme (PBS). With record linkage established for around half of older ALSWH women, it is possible to get independent snapshots their healthcare system usage and out-of-pocket costs. To date, there has been limited review of older women's usage of healthcare services.

An early ALSWH substudy of New South Wales women (Young et al. 2000) found that 98.8% of older women (6,464 of 6,542) had seen a GP in the 1995–1996 calendar period. Older women claimed the Medicare subsidy for a total of 110,482 GP consultations over this time: an average of 8 appointments per woman per year,

compared with around 5 per year for younger and mid-aged women. The most commonly used PBS medications among older women were those used to treat conditions of the cardiovascular system (75%), nervous system (61%), alimentary (gastrointestinal) tract (57%), musculoskeletal system (43%), and respiratory system (20%). Women taking at least one of these medications were more likely than their peers to visit their GP and specialist doctors often, as were overweight/obese women and diabetics (Byles et al. 2008).

For many older women, poor availability and affordability of doctor visits limit their access to medical care. From 1995 (Young et al. 2000) to 2005 (Walkom et al. 2013), a significant minority of older women reported that needing to visit a non-bulk-billing GP caused financial strain, with some unable to seek medical care at times. Women in rural and remote areas experienced the greatest financial burden: with specialist doctors, major hospitals, and sometimes GPs unavailable outside of main cities, these women face travel and accommodation costs on top of consultation fees. For some of these women, becoming unable to drive themselves to distant appointments has made seeking medical care impossible.

Many older women have also identified medication costs as a significant financial burden (Walkom et al. 2013), and this was particularly true of those requiring multiple medications. In an evaluation of women's 2003–2005 PBS subsidy claims (Byles et al. 2008), older women made more PBS claims and took a greater number of medications than did younger and mid-aged women. Thus, despite receiving a higher PBS subsidy per medication than many young and mid-aged women, older women incurred the greatest cumulative out-of-pocket medication expenses. This took a serious financial toll, with many feeling a substantial impact on their ability to live on their income, and some even forced at times to choose between buying food or essential medication.

Dental work, too, is unaffordable for many older women. Dentistry receives little governmental funding compared with medical services, leaving considerable patient costs, as well as

limited access for those in rural and remote areas. Across Surveys 2–4 (Sibbritt et al. 2010), around 36% of older women visited a dentist; however, it was not necessarily the same women accessing care at each time point. Of women who had visited a dentist, just 21% reported a consultation on all three surveys, 15% on two surveys, and 19% on just one survey. In Survey 4, 5% of women reported not consulting a dentist despite needing to. Reasons typically cited were a shortage of local dentists, lack of transport, high costs, and/or a long waiting period for an appointment. Compared with those reporting no dentist visits, women who accessed dental care at least once tended to live in urban regions, be married or in a de facto relationship, be non-smokers, have better physical functioning, live easily on their income, and have attained higher education.

In recent years, Australia has experienced substantial growth in the *complementary and alternative medicine (CAM)* industry, which includes non-evidence-based fields such as naturopathy, homeopathy, acupuncture, and chiropractics. The Medicare/PBS systems cover neither consultations with CAM practitioners nor the purchase of CAM products, such as herbal preparations and “detox” pills. Roughly 40% of women reported visiting a CAM practitioner at least once over Surveys 1–4, with most reporting usage on just one survey and none reporting CAM use at all four surveys. Despite the overall rise in CAM popularity, older women’s usage declined at each survey, dropping from around 15% at Survey 1 to just 10% at Survey 4. Those most likely to visit a CAM practitioner lived in rural/remote regions, had poorer physical health, and more frequently visited their GP, specialist doctors, and hospital. Importantly, this suggests that older women were not using CAM practitioners as an *alternative* to modern medicine but as a transient *complement* to their usual medical practitioners and treatments (Adams et al. 2009).

### Mental Health of Older Australian Women

*Mental health* is not merely the absence of a psychiatric diagnosis. Rather, the World Health Organization (World Health Organization 2014) refers to mental health as “a state of well-being in

which an individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and is able to make a contribution to his or her community. [It is] fundamental to our collective and individual ability as humans to think, emote, interact with each other, earn a living and enjoy life.” *Mental illness*, then, is most completely viewed as encompassing both psychiatric diagnoses and subclinical psychological distress that interferes with a realistic view of the self or the ability to cope with day-to-day life, employment or study, or community participation.

### The Prevalence of Psychological Distress

Although psychological distress was less common in older women than in younger and mid-aged women, a significant portion of older women reported high distress in at least one survey. At Survey 1, roughly 6% of older women reported significant psychological distress and this gradually increased over time, hitting 8% at Survey 6. It is important to note, however, that this was a dynamic effect, with around half of older women distressed at Survey 1 becoming mentally well by Survey 2 and a portion of previously well women reporting distress in Survey 2. This trend was mirrored across Surveys 3–6, with the greatest contribution to prevalence at each survey coming from women who had not previously reported distress. A subset of older women did, however, experience chronic or recurrent psychological distress. Women were at a ninefold greater risk of reporting significant distress at any given survey when they had reported distress at the previous survey and a fourfold greater risk when they had reported distress at the survey before that.

In the younger and mid-aged cohorts, the prevalence of psychological distress fell consistently across the measured 5-year period, but in a concerning trend, distress began climbing again in the older cohort, from 4% at age 75 years to around 7% at age 87. Likewise, the prevalence of diagnosed clinical depression or anxiety increased as older women aged: from age 75 to 87 years, depression rose from 4% to 7% and anxiety disorders from 3% to 5%. It appears, then, that the rate of mental illness in older women is increasing

but so is its detection and treatment. Yet these mental illnesses were not entirely remediated by treatment, with depressed women of all ages continuing to experience greater psychological distress than those without the diagnosis (36–48% vs. 5–16%, averaged across all cohorts).

Much ALSWH work has focused on identifying and understanding the individual and social factors that influence, and are influenced by, mental health in women.

#### Individual Factors: Demographic, Lifestyle, and Medical Predictors of Distress

Several demographic, lifestyle, and medical factors have been associated with psychological distress in older women. It remains unclear to what degree (a) these individual factors might impact mental health, (b) mental health might influence these individual factors, or (c) the individual factors and mental health are reciprocally related.

Most notable in demographics, women were more likely to report distress if they had lower education levels, experienced difficulty managing on available income, had been born in a non-English-speaking country, or spoke a non-English language at home. In terms of lifestyle/health factors, older women were more likely to report distress if they were underweight, a current or ex-smoker, or a nondrinker. Interestingly, overweight and obese older women were less likely than those of healthy or low weight to report psychological distress. There was no significant association between distress and any relationship status for older women, which the ALSWH team suggests might be due to widowhood becoming common in women's social networks by this stage.

A number of chronic medical conditions were also related to mental health. Older women who reported high stress at Survey 1 were more likely than their peers to report coronary heart disease or stroke for the first time at Survey 2, while women with poor mental health at Survey 1 were at increased risk of reporting diabetes for the first time at Survey 2 (Strodl and Kenardy 2006). Similarly, older women with arthritis were more likely than peers to be experiencing depression and/or anxiety (Byles et al. 2010).

#### Social Factors: The Importance of Social Support for Mental Health

The ALSWH project has also explored how numerous social factors are linked with mental health outcomes. Important social factors fall roughly into six categories: (1) building and receiving social support, (2) accessing the community, (3) contributing to the community, (4) caregiving, (5) navigating widowhood, and (6) experiencing elder abuse.

**Building and Receiving Social Support** Older persons are at high risk for shrinking social support, particularly via the death of friends and family members, retirement from the workplace, and declines in their physical mobility. This can result in a “vicious cycle” in which reduced social support worsens mental health, and poor mental health impedes women in engaging with their community and making new friends.

Unsurprisingly, women with a broader social network at Survey 1 tended to be those with good physical and mental health, those born in Australia or another English-speaking country, and those undergoing a social hardship, such as serious health decline in a loved one or being a widow. Over Surveys 2–4, women's networks typically decreased slightly. Smaller networks were more associated with having been born in another country, having impaired vision or physical functioning, and having moved house (often away from a long-time home to a retirement village or closer to family). Women with small social networks tended to report poorer mental health than those with more larger networks, which the ALSWH authors tentatively suggest might reflect a poorer ability of distressed and depressed individuals to connect with, maintain, and benefit from their social network.

Women reporting greater satisfaction with the quality of their social contacts were more likely to not be impaired in mobility, hearing, sight, or continence; not have experienced a recent major illness; have been born in Australia or another English-speaking country; not have recently moved house or suffered a drop in income; and either have a partner or be a widow, rather than be separated, divorced, or never married. More

socially satisfied women also reported better overall mental health, though, again, the direction of causality (if any) is undetermined.

**Accessing the Community** Physical and cognitive signs of aging can reduce older persons' access to their community, particularly when they are no longer able to drive. Often, substantial barriers in accessing public transport, such as high cost, limited availability, inconvenience, or poor disability access, compound the reduced community access of persons who have ceased driving.

At Survey 3, roughly half of all older women living in urban areas reported driving themselves as their primary mode of transport, compared with around 70% of rural/remote women. Public transport was rarely used in rural and remote areas, likely due to poor availability. Of women driving at Survey 3, 86% were still driving at Survey 4, while 10% relied on someone else to drive them; only a minority reported using public transport.

Ceased drivers tended to have limited mobility, vision, or hearing; have impairments due to chronic medical conditions such as stroke or arthritis; or take at least five medications. Compared with continuing drivers, ceased drivers were more likely to later report poorer self-rated health, greater physical disability, and decreased access to leisure and social activities outside of their home. One in five older women reported being unable to venture beyond their own neighborhood, which can have a particularly heavy impact on their ability to access critical facilities such as shops and healthcare service providers.

**Contributing to the Community** Volunteering with a community organization is one common way to stay physically, mentally, and socially active. Over Surveys 1–4, between 8% and 25% of women reported undertaking volunteer work in at least one survey, whereas 35% reported never volunteering. Across Surveys 2–4, volunteers were more likely than their non-volunteer peers to be well-educated, speak English, live in rural areas, live alone, driving their own car as primary transport, and having greater social support. They appeared better positioned to access the healthcare

system as needed, tending to have private health insurance, visiting healthcare professionals more often, and reporting better physical and mental health-related quality of life.

Compared with women who had never volunteered (*non-volunteers*), those reporting volunteer work at all four time points (*continuing volunteers*) and those volunteering at Surveys 3 and 4 (*new volunteers*) were more likely to report superior physical and mental health at all surveys. Those who reported volunteer work in at least one survey (*intermittent volunteers*) also displayed better physical/mental health at Survey 2, but showed decline in all measures over time, and by Survey 4 had become indistinguishable from non-volunteers. Across Surveys 2–4, continuing volunteers had the greatest social support, non-volunteers the poorest, and intermittent and new volunteers moderate support.

**Becoming a Caregiver** Across Surveys 2–5, around 40% of older women reported for at least one time point that they were acting as informal caregivers through their husband's later years or for other family members. However, the great majority (95%) of these women did not act as caregivers permanently, instead transitioning into or out of the role over the 12-year period sampled. Compared with older women who had never provided care, caregivers reported lower perceived quality of life, and poorer physical and mental health. Those with more intense duties and those who lived with their care-recipient were particularly vulnerable to these challenges. At all levels of caregiving intensity, both short- and long-term carers reported adequate social support.

**Navigating Widowhood** With Australian women typically living longer than men, widowhood is a common experience for older women. At Survey 1, 35% of older women were widowed, with an additional 2,494 women widowed by Survey 3.

Compared with that of their married peers, the mental health of widows typically showed a slow decline in the 4 years preceding spousal death, possibly indicating anticipatory grief or the growing burden of caregiving. The greatest decline was

observed at the point of spousal death and over the subsequent 12 months before beginning to recover. By women's fourth year post-loss, their mental health had returned to the level prior to the initial years of decline. Qualitative analysis has shown that, despite the grief of spousal death, older women's quality of life often rapidly improves as the physical and emotional strain of caring for a seriously ill husband is relieved.

Many widows reported that maintaining or increasing social contact and participation in activities smoothed adjustment to widowhood. Most belonged to a local organization such as a church or RSL club, and more than one-half engaged in enjoyed hobbies (e.g., gardening, handiwork, and eating out) most or every day of the week. Widowhood was, in fact, associated with greater social connectedness, despite the loss of the woman's primary source of practical and emotional support. Analyses suggest that in the bereavement period and beyond, friends, grown children, and other family members step up to fill the gap in support.

**The Experience of Elder Abuse** The term *elder abuse* encompasses physical, verbal, psychological, sexual, and financial abuse directed toward older people, typically perpetrated by family member(s). Survey 1 revealed an alarming prevalence of abusive behaviors against older women. Roughly 8% of older women were categorized as *vulnerable to elder abuse*; these women reported fearing their family member(s) or experiencing at least one episode of verbal or emotional abuse. Over 6% of women reported at least one incident of *coercion*, while 18% rated highly on *dependence*, receiving inadequate privacy, feeling distrustful of family, or being reliant upon family members for critical aspects of life. Around 15% were classed as *dejected*, feeling often sad, lonely, unwanted, or uncomfortable around at least one family member.

Compared with women who felt safe, abused women were more likely to be current or ex-smokers, be single or widowed, have lower education and social support, and have greater difficulty managing on their income. They also tended to report poorer mental health and a greater

number of chronic medical conditions such as diabetes and stroke, though it remains unclear whether there is any causal effect.

#### Mental Healthcare Usage by Older Australian Women

In 2006, the Australian government introduced the *Better Access Scheme (BAS)*, allowing GPs to refer patients for up to 10 subsidized sessions per year with a mental health professional. The scheme is greatly underused by older women: 4 years on from its introduction, just 3% of older women had used the BAS in treating their diagnosed anxiety or depression. Compared with diagnosed women who did not use the BAS, the BAS users were less likely to have private health insurance or a pensioner concession card. At each of Surveys 1–5, BAS users reported better mental health than non-BAS anxious or depressed women, though both groups reported consistently poorer mental health than those diagnosed with neither anxiety nor depression.

#### Future Directions for ALSWH

To date, ALSWH investigations with older women have centered on those living in the community. With record linkage now expanded to databases held by these aged-care facilities, future work might compare the health and quality of life of women in residential aged care those living in the community. Extending demographic measures to explore the community living arrangements of women (e.g., living independently vs. living with grown children) may yield further insights into factors related to health and well-being, particularly regarding elder abuse.

A second direction of interest is to include in upcoming surveys an updated measure of social support, as those used to date have not assessed the impact of what has become a major source of social support for individuals of all ages: the world of Internet forums, Facebook, and social media. In particular, it would be interesting to compare the level of support received from networks online versus “in real life,” and whether online support might be more accessible and life enhancing for older women with limited mobility.

Finally, it would be useful to compare ALSWH data with that currently being acquired in a separate longitudinal study of Aboriginal and Torres Strait Islander (ATSI) Australians' health. While a small number of ALSWH participants were of ATSI background, they cannot represent the immense diversity of ATSI peoples. ATSI have a substantially shorter life-span than non-ATSI Australians, as well as poorer physical and mental health, and numerous demographic differences. Comparing ATSI and ALSWH study findings might shed more light on factors contributing to poorer ATSI health outcomes and, assisting with improvement of healthcare services and public health programs for ATSI Australians.

## Conclusion

Australian women are living longer than ever before, yet there has been a paucity in long-term prospective research to examine the biopsychosocial factors underpinning physical and mental health. The ALSWH has shed some light on this problem. Both physical and mental health was shown to decline throughout old age, with attendant declines in physical capabilities and quality of life, and rises in public health costs. Medicare services are heavily burdened yet are underused by older women living in rural or remote areas, and those requiring assistance for mental health concerns. Greater efforts must be made to ensure that older women – particularly those in rural and remote communities – can access quality bulk-billing GPs, specialist doctors, hospitals, and dentists. Elder abuse is also a critical issue for older women and must be better addressed in terms of prevention, reporting, and elder protection.

Current and future burden on the Australian healthcare system might be somewhat relieved – and older women's health and quality of life enhanced – with extended public programs to assist elders to lose weight, quit smoking, increase physical activity, remain connected with their community, and cultivate supportive social networks. Future research with the ALSWH older cohort will be useful in continuing to assess the

impact of such measures, as well as further exploring factors contributing to older women's health and quality of life.

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## Autism Spectrum Disorder

Ye In (Jane) Hwang<sup>1,2</sup>, Kitty-Rose Foley<sup>1,2</sup> and Julian Trollor<sup>1,2</sup>

<sup>1</sup>Department of Developmental Disability Neuropsychiatry, School of Psychiatry, University of New South Wales, Sydney, NSW, Australia

<sup>2</sup>Cooperative Research Centre for Living with Autism (Autism CRC), Long Pocket, Brisbane, QLD, Australia

### Synonyms

Adulthood; Ageing; ASD; Asperger's syndrome; Autism; Autism spectrum disorder; Autistic disorder; Intellectual disability; Neurodevelopmental disability; Pervasive developmental disorders

### Definition

Autism spectrum disorder is a neurodevelopmental disorder that is both high in prevalence and most commonly lifelong in nature. Despite this, there is a dearth of available information regarding the disorder in later life. Existing evidence indicates poor outcomes in adult life in a range of areas of health and wellbeing, though more information is needed to create a more comprehensive understanding of the circumstances and needs of autistic adults as they age.

### Introduction

The lifelong nature of autism spectrum disorders (ASD) attests to the need for a thorough understanding of the condition throughout the lifespan. This entry will summarize the extant knowledge regarding ASD in later life. It will begin with a brief discussion of the conceptual and diagnostic background of ASD and evidence of its persistence into adulthood. Overviews of several key areas of health and wellbeing in later life for this population follow. These areas include physical health, mental health and cognition, participation and lifestyle and supports. In particular, these sections highlight the knowledge gaps regarding ASD in later life and make suggestions for future work in the area. Finally, challenges and future directions for work on this topic are presented.

### Background

Autism spectrum disorders (ASD) are a heterogeneous group of neurodevelopmental disorders characterized by persistent deficits in social communication and interaction, as well as restricted, repetitive, or stereotyped behaviors or interests (American Psychiatric Association 2013). The Diagnostic and Statistical Manual of Mental Disorders (DSM-V) specifies that these symptoms must be present during the child's early developmental period and should not be better explained by global developmental or intellectual delay (American Psychiatric Association 2013).

Symptoms must also cause clinically significant impairments in key functional domains such as social or occupational functioning.

ASD has undergone several significant conceptual revisions over time, and these are reflected in the evolution of terminology and diagnostic criteria. The first diagnosis of ASD, termed “early infantile autism,” was made by the Austrian-American psychiatrist and physician Leo Kanner in 1943 (Kanner 1943). In Kanner’s view, autistic children were socially cut off from the world and experienced particular trouble dealing with change. In some cases, the diagnosis was confused with schizophrenia. In addition to this, poor parenting practices and poor parent–child relationships were considered as key precipitators of ASD. This resulted in parents, especially mothers, being blamed for their child’s ASD. By the 1960s, advancements in scientific research methods shifted the focus away from environmental influences to neurological and genetic explanations. By the following decade, the rise of the cognitive movement saw language and communication difficulties become the defining feature of autism. During this time, Wing and Gould (1979) framed autism as a triad of social behavioral impairments that originate in specific areas of the child’s brain. “Infantile autism” was first officially recognized in the DSM-III in 1980 within the class of pervasive developmental disorders, alongside Asperger’s disorder, Rett syndrome, childhood disintegrative disorder, and pervasive developmental disorder not otherwise specified (PDD-NOS) (3rd ed., DSM-III, American Psychiatric Association 1980). Its key criteria included pervasive lack of social responsiveness, deficits, and peculiarities in language and bizarre responses to certain environmental cues, but it was distinguished from schizophrenia based on schizophrenia-specific symptoms such as hallucinations. After a major revision in the DSM-III-R, infantile autism was renamed “autistic disorder,” acknowledging the developmental nature of the condition and its persistence beyond early childhood (Volkmar and McPartland 2014). A polythetic approach was implemented in this revision, allowing for greater diagnostic flexibility. In the most recent revision of diagnostic

criteria (DSM V), autistic disorder, Asperger’s disorder, and PDD-NOS were merged under the umbrella term of “Autism Spectrum Disorder” (American Psychiatric Association 2013).

The reported prevalence of ASD has varied widely among studies, though a general increase in prevalence has been observed over time. Estimates from the mid to late twentieth century lay between 4 and 12 per 10,000 persons, whereas more recent estimates report the prevalence of ASD to be between 30 and 90 per 10,000 persons (Baird et al. 2006). This increase may reflect the broadening of diagnostic criteria, increased availability of diagnostic services and funded supports, increased public and clinical awareness, differences in study methodology or a true increase in prevalence of ASD. The best available data on prevalence of ASD in adults is from a 2011 study from the United Kingdom, which found a prevalence of 9.8 per 1000 persons (Brugha et al. 2011), a figure similar to that observed in children. This finding suggests substantial retention of the diagnosis into later life.

The widening of diagnostic criteria and the observed increase in prevalence suggests the possibility that a large number of autistic adults live without a formal diagnosis of ASD. The complexity of first diagnosing a developmental disorder in adulthood also raises the possibility that some autistic adults may be misdiagnosed with other mental disorders (Stuart Hamilton and Morgan 2011). The “hidden nature” of this population also presents challenges for research, especially when determining inclusion criteria for adults without an official diagnosis. Lack of clarity of diagnosis in adults also creates clinical challenges, as assessment and management of additional mental or physical health conditions may not be appropriately tailored to the person’s needs.

The most appropriate terminology for referring to those with a diagnosis of ASD has been subject to much debate, with different groups expressing their preference for different terms. Person-first language (e.g., adult with autism) has been found to be preferred by health professionals and parents of individuals (Kenny et al. 2016). On the other hand, adults with a diagnosis of autism themselves have been found to prefer

identity-first language (e.g., autistic adult), a common reason for this preference being the idea that autism is a positive and inseparable part of their identity (Kenny et al. 2016). We acknowledge and respect the range of opinions present in this debate and have been mindful of this in using the terms “with ASD,” “autism,” and “autistic adult” interchangeably throughout this entry.

## ASD in Later Life

Research which follows children with ASD into younger adulthood and beyond finds evidence of both improvement and stability in the core social and behavioral phenotype of ASD. In a review of 25 prospective, retrospective, and cross-sectional studies, Seltzer and colleagues (Seltzer et al. 2004) concluded that despite the small volume of work and some methodological limitations, modest improvements in ASD symptoms are apparent from childhood through to adulthood. These improvements are significantly less for those who also have intellectual disability. Importantly, these improvements are seldom large enough to place the individual within the normal range of functioning, indicating that in most cases, ASD is a lifelong condition. The progressive increase in the prevalence of ASD, coupled with global population ageing including increased longevity for those with developmental disorders, highlights the need to ensure the development of age-specific supports for older adults with ASD. Although there has been a notable increase in research focusing on autistic adults, more information is needed regarding the health and wellbeing circumstances and lifespan trajectories of this population.

## Physical Health

Physical health is an area of critical importance for both the general population and for autistic adults as they age. The ageing population of autistic adults and their need for appropriate health services presents a significant challenge to health care systems, health professionals, and to society.

Autistic children have high rates of co-occurring medical conditions, and this co-occurrence has also been observed in adulthood (Croen et al. 2015). In particular, markers of differential health status are evident for autistic adults relative to the general population, both in terms of the presence of common medical conditions and medical conditions associated with genetic disorders (Croen et al. 2015).

Perhaps the most obvious indicator of differential health status for autistic adults is the observed mortality rate. Compared to the general population, autistic adults experience 2–5.6 times higher mortality rates (Mouridsen et al. 2008). This rate appears slightly higher in females, individuals with more severe intellectual disability, and those who also have epilepsy. There is also some indication that the causes of death for this population in childhood and adolescence differ to those in adulthood, with the most common causes of death in adults reported to be epileptic events (e.g., seizures), respiratory events (e.g., respiratory arrest), and cardiovascular events (e.g., arrhythmia) (Bilder et al. 2013). Unnatural events, such as accidents and suicide, are also notable causes of death in autistic adults (Hirvikoski et al. 2015). Specific unnatural causes of death may have an association with intellectual ability, such that people with ASD and intellectual disability are more at risk of accidental death whereas suicides are associated with people with ASD and normal intelligence (Mouridsen et al. 2008; Hirvikoski et al., 2015). Taken together, mortality data suggests that the heightened mortality risk in ASD is associated with the presence of additional medical conditions, specific genetic syndromes, and intellectual disability, rather than the ASD itself (Bilder et al. 2013). In light of such evidence, the authors have argued for the need for more in-depth examinations of the potential mediating role of comorbid conditions in the increased mortality risk for autistic adults using larger, population-based samples (Schendel et al. 2016).

Studies investigating medical conditions in autistic adults report high rates of bowel disorders, sleep disturbance, seizures, diabetes, neurologic disorders, and auto-immune diseases (Croen et al. 2015; Jones et al. 2015). Reports of obesity

rates have been less consistent. The medical morbidity patterns share some similarities to those found in autistic children. However, age-related disorders such as hypertension and diabetes mellitus type I (Jones et al. 2015) are also observed. More cross-sectional studies of the physical health of autistic adults are needed to elucidate the extent of physical health issues facing this population and how these compare to control populations. Further, longitudinal studies are needed in order to examine the trajectories of health as people with ASD age and the factors that determine health outcomes. A particular focus on how preexisting conditions interact with the ageing process to produce secondary conditions or disabilities is also required.

## Mental and Psychological Health

The mental health of autistic adults presents another area which requires further study. High rates of psychopathology are well documented in autistic children (Simonoff et al. 2008). The evidence base for the association in adulthood is smaller and it is unclear whether the comorbidity patterns in children are mirrored in older populations. There is also limited knowledge concerning age-related changes in prevalence of mental disorders in autistic adults and the prevalence of age-specific mental health conditions. One study tracing 135 autistic children who had previously been referred to a British outpatient clinic before the age of 16 found about 16% of the sample developed a definite new psychiatric condition within the follow-up period (ranging from 23 to 58 years). In this work, the authors emphasize the large variation in individual outcomes and in the disabling effects of the psychiatric condition (Hutton et al. 2008). Such findings point to the complexity of the relationship between ASD symptoms and the subsequent development of psychiatric disorders.

The prevalence of psychiatric disorders in autistic adults has been examined in a limited number of studies (Croen et al. 2015; Hofvander et al. 2009; Totsika et al. 2010). These suggest that autistic adults are at higher risk than the general

population of developing a mental health condition. Robust estimates regarding the rate of psychiatric disorders from population-based studies of adults with ASD are lacking, though clinic-based studies of children suggest that between 50% and 70% suffer psychiatric disorders. A recent examination of a sample of insured autistic adults in the United States reported that 54% of their 1507 participants had a clinical diagnosis of a psychiatric disorder according to records from outpatient and inpatient clinical databases for the period of 2008–2012 (Croen et al. 2015). Available evidence from a clinical study indicates anxiety and mood disorders to be the most common psychiatric disorders in autistic adults with lifetime rates reported at 50% and 53%, respectively (Hofvander et al. 2009). Also considerable are the reported lifetime rates of attention-deficit/hyperactivity disorder (43%) and obsessive compulsive disorder (24%) (Croen et al. 2015; Hofvander et al. 2009). As with the general population, there is some evidence from cross-sectional investigations to suggest that prevalence of mental disorders (other than the dementias) may decline as autistic adults get older (Totsika et al. 2010). However, the extent of this decline is unclear and an over-representation of mental disorders compared to age-matched non-autistic populations is likely to persist.

The presence of multiple comorbidities as well as the substantial overlap between the symptom profile of ASD and other mental health disorders can make it difficult to identify the precise nature of psychiatric conditions in autistic adults (Ghaziuddin and Zafar 2008). Similarly, psychiatric disorders may manifest in atypical ways in those adults with low IQ and/or intellectual disability, including self-injurious behavior and irritability (Ghaziuddin and Zafar 2008). Therefore, misdiagnosis and diagnostic overshadowing, where clinicians fail to diagnose comorbid psychopathology in individuals as a result of attributing their symptoms to their ASD, are key issues for this population.

Studies have found the majority of autistic adults to be taking one or more psychotropic medications, with some longitudinal evidence suggesting a significant increase in the

proportion of medicated autistic adults over time (Esbensen et al. 2009). There has been longstanding concern regarding inappropriate prescribing of psychotropic drugs in people with intellectual disability, including those with ASD in association with intellectual disability. Studies suggest that rates of psychotropic drug prescription exceed recorded rates of psychiatric diagnoses with a recent population-based cohort study in the United Kingdom reporting that 26% of their sample who had been prescribed antipsychotic drugs to have no record of severe mental illness or challenging behavior (Sheehan et al. 2015). The issue of inappropriate drug prescription is one with implications both at the individual and system levels. It is a particularly pertinent issue for those individuals with intellectual disability who are also older and autistic, for whom new prescriptions of antipsychotics are shown to be significantly more common (Sheehan et al. 2015).

The role of psychological factors in the health and wellbeing of autistic adults is another area that is poorly understood. Psychological factors including coping, resilience, self-esteem, and emotion regulation have been increasingly recognized in gerontology as key adaptive mechanisms for all adults as they age (Bowling and Iliffe 2011). However, there is little extant information examining such psychological factors specifically in autistic adults.

Overall, as with physical health, the mental and psychological health of autistic adults is a field that would benefit from further detailed studies. Robust descriptive and longitudinal examinations of the presentation, correlates, and trajectory of different conditions in autistic adults across the full spectrum would be valuable. In particular, specific studies of age-specific and ageing-related mental health conditions and related interventions are needed. Additional investigations are also needed into the extent and reasons for different drug-prescription practices. Finally, more concentrated efforts are needed to investigate the function and predictive value of adaptive psychological mechanisms in health and wellbeing outcomes for this adult population.

## Cognition and Perception

The cognitive functioning of adults in late life is a matter of substantial research interest in the general population. In the case of autistic adults, there is very little information available regarding their cognitive strengths and weaknesses relative to the general population. Studies examining cognitive deficits in autistic individuals have particularly focused on executive functioning. Executive functioning has a key role in ageing, since the deterioration of executive functioning is largely accepted to be the underlying factor in declines in cognitive ability as adults get older. Executive functioning also has a particular relationship with ASD, with cross-sectional investigations consistently finding evidence of deficits of executive functioning in autistic individuals across the lifespan and both for those with and without intellectual disability (Hill 2004). Related to this, a popular idea in the literature has been that deficits in executive functioning may underlie a range of social and behavioral characteristics evident in ASD (Hill 2004). As with other areas of functioning, the vast majority of the available literature in this area is restricted to childhood and early adolescence.

There is limited evidence available regarding the developmental trajectory of executive functioning in autistic individuals. Cross-sectional studies have provided some insight into the development of executive functioning across the lifespan. One study examining performance on executive functioning tasks of autistic boys with no intellectual disability found them to display deficits in inhibition, flexibility, and planning compared to their non-autistic peers, but also that the older group (mean age = 13.2) outperformed the younger group (mean age = 9.2) on these tasks (Geurts and Vissers 2012). Similarly, a 3-year longitudinal study suggested improvement in the planning domain of executive functioning in autistic children (Pellicano 2010). These findings are consistent with longitudinal reports showing the lessening of ASD symptoms over time (Shattuck et al. 2007). However, executive functioning deficits are still found in adults. One study of older

(mean age, 64 years) autistic adults without intellectual disability found impairments in sustained attention, working memory, and fluency (Geurts and Vissers 2012). Taken together, these cross-sectional and longitudinal studies suggest that deficits in executive functioning are apparent across the lifespan. However, the precise developmental trajectory of executive function across the lifespan and the interaction with age, intellectual ability, lifestyle, and health related variables require detailed and very long-term study.

Considering the prevalence of dementia in older adults throughout Western countries, we may assume that a substantial number of autistic adults also develop dementia. However, there is very little research examining the prevalence, presentation, and trajectory of dementia in this population. There are two conflicting possibilities regarding the representation of dementia in autistic populations. The first is that there may be an underrepresentation of dementia in autistic adults. Some researchers believe “hyperplasticity” (Oberman and Pascual-Leone 2014) of the ASD brain may be protective against age-related cognitive decline and dementia. Another possibility is that developmental effects interact with environmental and medical risk factors to result in an overrepresentation of dementia in autistic adults. Recent reports of thinning in the tempo-parietal cortex in young autistic adults raise questions about whether such effects may give rise to premature ageing, cognitive decline, and dementia (Mukaetova-Ladinska et al. 2012). The exact nature of the relationship between dementia and ASD awaits discovery. Nevertheless, dementia has a significant impact on the individual, family, and society, including in people with ASD.

A key feature which is now listed in the DSM-V criteria for ASD is hyper- or hypo-reactivity to sensory input or unusual interests in sensory aspects of the environment (American Psychiatric Association 2013). Unusual sensory processing has been found to occur in 30–100% of autistic individuals, with one study reporting 95% of autistic adults self-reporting extreme levels of sensory processing on at least one quadrant of the Adult/Adolescents Sensory Profile (Dawson and Watling 2000; Crane et al. 2009). Research has

reported that sensory experiences can be both problematic and enjoyable for autistic adults and span visual, auditory, tactile, olfactory, and vestibular stimuli (Robertson and Simmons 2015). A defining feature as to whether the sensory experience is positive or negative depends on whether the autistic adult has control, or perceived control, over the sensory stimuli. Different sensory stimuli and environments can have extremely debilitating effects on autistic adults and can evoke nausea, physical pain, cause the adult to become immobile, and negatively affect the adult’s ability to concentrate or attend to a task. This has significant implications for an adult’s participation in employment and leisure activities, functioning appropriately in social situations, and attending health care appointment/services and other age-specific activities. Further exploration of the prevalence and changes in sensory processing in autistic adults as they age is required, as well as further investigations of specific triggers and potential coping strategies.

## Participation and Lifestyle

For autistic adults who are ageing, little is known about participation (e.g., employment, ongoing education, leisure, volunteering, etc.) and lifestyle factors (e.g., exercise, diet, smoking, alcohol, drug use, etc.) and how they affect health and quality of life. Achieving and maintaining social participation and other lifestyle activities present unique challenges for autistic adults due to their social, communication, and behavioral challenges. Exploration of social factors in autistic adults indicates that this population tends to do poorly on objective indicators of social functioning (Howlin et al. 2013) and many report feelings of loneliness and isolation (Tobin et al. 2014). In terms of broader lifestyle factors, autistic adults are reported to attain low levels of employment, education, and independence, which have led to most extant outcome studies concluding that autistic individuals attain poor overall outcomes in adulthood (Henninger and Taylor 2013). There has been discussion regarding the role of IQ in determining such outcomes, though studies

conducted with a range of samples have indicated that autistic adults experience poor social integration regardless of their IQ (Henninger and Taylor 2013).

In regards to life style factors, autistic adults have been reported as using alcohol and drugs less than the general population (Croen et al. 2015). Participation of adults in physical activities is relatively unknown, though studies in children with ASD indicate that they appear to be less active than their non-autistic counterparts (Pan 2008). In addition, studies indicate that health problems resulting from sedentary or minimal-activity lifestyles such as obesity and cardiovascular disease are more common in adults with intellectual and developmental disabilities such as ASD (Yamaki 2005). This has significant implications during ageing as maintenance of physical activity is largely accepted to have a protective effect on overall health and cognitive function. Investigation of participation and lifestyle factors which autistic adults are engaged with as they age is required. This investigation needs to firstly gain an understanding of ageing effects on such activities, and then to identify the best ways to improve participation which may then influence overall health and quality of life of ageing autistic adults.

Some research has focused on quality of life (QoL) as an overall indicator of wellbeing for this population. These studies have relied on a select range of measures that assess QoL as a multidimensional construct including a range of dimensions: physical and mental functioning, relationships and social inclusion, personal development, family and wider environments, recreation and leisure, safety and security, and subjective wellbeing (Burgess and Gutstein 2007). A meta-analysis of 10 QoL studies across the lifespan demonstrated QoL to be lower in autistic populations compared to their non-autistic counterparts, and no associations between the individual's QoL and their age, IQ, or autism symptom severity (van Heijst and Geurts 2014). Notably, only one of these studies examined QoL in an adult sample over the age of 50. QoL has been argued to be a suitable and advantageous construct for examining outcomes

and developing treatments for autistic individuals by allowing a holistic profile of their health and wellbeing to be constructed (Burgess and Gutstein 2007). Further investigation of QoL for ageing autistic adults and identification of factors which positively or adversely influence QoL is needed, given the lack of a solid evidence base.

## Informal and Formal Supports

Supports and services are central aspects of the lives of autistic individuals throughout their lifespan, regardless of their level of functioning and symptom severity. These supports include informal supports such as supportive social relationships and more formal supports for participation in society and everyday activities. The positive relationship between social support and quality of life (QoL) is well established for the general population. A substantial number of studies have investigated social support and its effects for autistic adolescents and younger adults, but there is a paucity of evidence for adults beyond the post-secondary school transition period. Informal social support has been identified as an important predictor of QoL in a systematic review of fourteen studies investigating the relationships between social participation, social support, and QoL in autistic adults (Tobin et al. 2014). Evidence suggests that perceived, rather than actual, informal support is a strong predictor of QoL but also that unmet formal support needs contribute to poorer QoL in autistic adults (Renty and Roeyers 2006). The importance of person-centered approaches to support intervention was also identified in this review as important in increasing complex skill sets (Tobin et al. 2014). It would be particularly useful to investigate how the relationship between social support and QoL may be different for adults with different levels of functioning and how this relationship may change with age. This would inform the development of targeted interventions and support solutions across the lifespan.

Reviews of the availability, quality, and accessibility of services for autistic adults within each region or country are needed to provide important

insight to the service needs and circumstances of autistic adults. Existing reviews and reports from the United States, the United Kingdom, and Australia report a general lack of supports available for autistic adults (Freedman 2014; Shattuck et al. 2012; Roth 2013). This is unsurprising given the overall lack of available information regarding the needs and circumstances of autistic adults. In order to ensure the effectiveness of services, the evidence base on which existing services have been developed should be surveyed. Accessibility of services is another key issue to be addressed, especially for those for whom ASD symptoms may affect access, those living in rural areas, those who are time and resource-poor, and those from culturally and linguistically diverse backgrounds. Furthermore, some qualitative evidence from the United Kingdom suggests that autistic adults, particularly those considered “higher functioning” due to their higher IQ and/or less severe symptoms, are prone to “falling through the gaps” of services and supports (Griffith et al. 2012). Being a spectrum disorder, service and support needs will range widely between individuals and this must be considered when developing and reviewing services for this population. In addition, reviews of existing health and disability services in terms of their coverage of autistic adults would be useful.

## Challenges and Future Directions

There are unique challenges in studying ASD in later life. The first is the heterogeneity of the spectrum itself. Being a spectrum disorder, individuals with ASD vary widely in their level of intellectual and communicative functioning, severity of symptomatology, and presence of additional conditions. This makes it difficult to generalize findings beyond each study sample and its unique characteristics. It may be useful to investigate suitable ways of grouping autistic individuals based on certain factors such as IQ or gender to make more generalizable and useful interpretations of research findings.

A second issue is the hidden nature of adult autistic populations. It is likely that a potentially

large number of autistic adults are ageing either unaware of their condition, without a formal diagnosis or with a misdiagnosis of a different condition. The “hidden nature” of this population presents some difficulties for research, which include identifying recruitment pathways and determining inclusion criteria for adults who do not have an official diagnosis. Such issues must be carefully considered when conducting research, especially during stages of recruitment and in the interpretation of findings.

Overall, several key recommendations may be made for future research regarding ASD in later life. A common thread throughout this discussion has been the lack of robust research evidence for the years beyond the post-school transition phase in virtually all areas of health and wellbeing. Research focusing on this period of life is urgently needed, considering the substantial prevalence of ASD, global trends in population ageing, and that the first cohorts of diagnosed adults are now entering middle age and older adulthood.

Considerable research efforts are required to improve the understanding of the circumstances, needs, and challenges of autistic adults in later life. Such efforts should include both cross-sectional and longitudinal examinations of health and wellbeing. Importantly, our understanding of autism in later life should be informed not only by quantitative interrogations but also by qualitative research that examines the lived experience and subjective perspectives of autistic adults and other relevant parties such as their families and health care providers. Such mixed-methods interrogations allow for the creation of a more complete picture of autism in later life.

Findings from the detailed investigations of ASD in adulthood should be interpreted in the context of the wealth of information available regarding ASD in childhood, in order to develop a whole lifespan understanding of ASD. Also, the well-documented presentation of ageing-specific health conditions in the general population can be a useful source for developing specific research questions and for assessing the relative state of autistic adults compared to the general population. It should also be noted that our present understanding of ASD in later life and consequently

also the discussion throughout this entry relies heavily on studies from the United States and the United Kingdom. Keeping in mind the influence of wider contextual factors on the health and wellbeing of populations in general, efforts are needed to develop a deeper understanding of the specific circumstances facing autistic adults across different geographical and cultural contexts including lower- and middle-income countries.

Without a thorough understanding of the unique circumstances and challenges of ASD in later life, it is difficult to develop adequate and effective services for this population. Such issues have been illustrated in studies that find a clear lack of knowledge and training on the part of health professionals in providing care for autistic adults (Warfield et al. 2015). Related to this, there is the need for future researchers to consider the translational components that may arise from their findings and to maximize the utility of their research in this sense.

In addition to more applied research, there is also the opportunity and need for the development of theories specific to ageing and ageing on the autism spectrum. For example, “successful ageing” (Rowe and Kahn 1987) is an emerging theory in the social gerontology literature being developed to understand desirable ageing standards for older adults. However, the present theoretical and empirical literature on the concept is largely exclusive of disabled individuals. Given the high rates of disability in old age, it would be useful from both personal and societal level to develop theories of ageing that consider those ageing with a lifelong disability such as ASD.

## Summary

A vast majority of the research on ASD has focused on childhood and adolescence. Recent investigations that suggest ASD to be lifelong, as well as increasing prevalence rates of the disorder and wider social trends of population ageing, call for more focused investigations into ASD in later life. The small existing body of available research suggests poor physical and mental health

outcomes exist for this population in adulthood. While other areas such as cognitive functioning, participation, lifestyle, and supports have not been entirely unexamined, the quality and quantity of this evidence is limited. This topic area would benefit from more robust investigations that examine not only the presentation and correlates of ASD in later life but examine the lifespan trajectory of such indicators as individuals get older.

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## Cross-References

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- ▶ [Aging and Psychological Well-Being](#)
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## Automaticity and Skill in Late Adulthood

Dayna R. Touron

University of North Carolina at Greensboro,  
Greensboro, NC, USA

## Synonyms

Expert; Habitual; Involuntary; Practiced

## Definition

**Automaticity** refers to cognitive processing that requires few mental resources and describes both processes that are innately or spontaneously effortless as well as those that engage fewer resources following practice or training. **Skill** refers to cognitive processing that has reached a high level of competence and mastery as a result of experience and investment.

## Automaticity and Skill in Late Adulthood

This entry will review theoretical perspectives, historical findings, and recent developments in the study of automaticity and skill in older adulthood. This topic is of particular interest for the present volume because automaticity and skill represent a critical dissociation in the study of cognition and cognitive aging. Whereas older adults often show reduced competency in novel and unfamiliar tasks, performance is typically spared for the performance of well-practiced tasks, or tasks that are inherently automatic. This distinction accounts in part for one of the most notable paradoxes in the study of cognitive aging – that healthy older adults generally function quite successfully in their everyday lives, despite the marked declines that are seen in laboratory assessments of cognitive ability. Indeed, the empirical study of cognition depends in large part on tasks that are novel, controlled, and reductionist, whereas older adults' daily lives involve complex encapsulated domains and opportunities for compensation. This dissociation in the outcomes of cognitive aging highlights the distinction between effortful and automatic processing that occurs in persons of all ages, with unfamiliar tasks often requiring substantial cognitive resources and well-practiced tasks proceeding in a more fluent manner.

## Automaticity

Automaticity is often defined in contrast to cognition that involves effort or the involvement of

attentional resources. From a descriptive standpoint, task performance might be considered automatic when it is fast, effortless, obligatory, autonomous, and occurs without conscious awareness (Logan 1988). Automaticity is an inherent property of some tasks but develops with practice for other tasks, as distinguished by seminal theories of automatic processing advanced by Hasher and Zacks (1979) and Schnieder and Shiffrin (1977).

## Perspectives on Automaticity

Cognitive processes may be conceptualized as falling on a continuum, from those that are relatively effortful and require substantial processing resources, such as performing complex mental arithmetic, to those that are relatively automatic and require fewer or minimal processing resources, such as navigating the familiar route from one's work to home (e.g., Cohen et al. 1990). Some tasks appear to be innately automatic, often requiring few resources from very early in development and universally across life experiences (Hasher and Zacks 1979). From the perspective of cognitive aging, the standard finding is that such tasks rarely show age-related declines, as is the case for attentional orienting (Hartley et al. 1990; Jennings et al. 2007), implicit memory (Hasher and Zacks 1984; Amer and Hasher 2014; but also see Howard and Howard 2013), familiarity-based recognition (Jacoby 1992; Yonelinas 2002), and the processing of emotional cues (e.g., Johnson and Whiting 2013). Other tasks are not inherently automatic and instead involve a shift from effortful to automatic processing but are also largely unaffected by aging because the learning underlying the automaticity was acquired in early life, as with the lexical proficiency that underlies performance in the Stroop task (e.g., Verhaeghen and De Meersman 1998).

In terms of the mechanisms that underlie automaticity development, several possibilities have been advanced, including strength-based (Cohen et al. 1990), memory-based (Logan 1988; Rickard 1997), and process-based (Fitts 1964; Ackerman 1988; Anderson 1987; EPIC Meyer and Kieras 1999) perspectives. These different perspectives shed light on diverse but overlapping classes of automatic processing and development

(Fisk et al. 1996). For the most part, these models have been developed and refined by examining performance on laboratory tasks of automaticity development.

Strength-based models of automaticity conceptualize learning as occurring as a result of attention training, describing a transition from controlled search for information to automatic detection by contrasting associated responses to target stimuli versus distractors in visual search domains following considerable exposure (Schneider and Shiffrin 1977).

In contrast, memory-based theories of automaticity propose that skill development is driven by a shift from responding based on an algorithmic strategy to responding based on retrieval from memory. In Logan's instance theory account (1988), exposures during practice lead to the accumulation of instances in memory. Strategy is determined by a race between the algorithmic and memory alternatives with an increasing distribution of completion times for each. After sufficient exposures, instance retrieval is expected to occur more rapidly than the algorithm can be executed.

Process-based theories also involve increasing reliance on memory systems but also increasingly incorporate reliance on sensory-motor (e.g., Ackerman 1988) and procedural (e.g., Anderson 1987) skills. These models are able to account for a wide swath of both elemental and complex human cognition (e.g., see the modeling of simple digit data entry and the complex radar "fighter pilot" task; Fornberg et al. 2012).

### Age Differences in Automaticity

Research examining age differences in automaticity from the perspective of attentional strength has primarily demonstrated age differences by examining performance in visual and memory search paradigms, with older adults showing reduced activation of associated responses to target stimuli even following extensive training (Fisk et al. 1996). However, some aspects of automaticity in visual search performance do show stability with aging. For example, older adults do not show impairments in the top-down guidance of visual search (Madden et al. 2004, 2005).

When considering memory-based automaticity, older adults transition more slowly compared to younger adults, in part due to slower learning (Jenkins and Hoyer 2000). Indeed, for some tasks, older adults' learning is not simply slower but fails to reach automatic levels even following extensive training (e.g., Maquestiaux et al. 2010, 2013). In contrast, memory-based automaticity has been found to develop rapidly for older adults in the well-practiced domain of reading (Rawson and Touron 2009, 2015).

Beyond the cognitive changes that can slow learning in older adulthood, age differences in automaticity development have also impacted an aversion by older adults to utilize memory strategies after learning has occurred (Touron 2015). Memory avoidance by older adults appears to be driven by a number of different factors, including low confidence in memory ability (Touron and Hertzog, 2004a,b; Frank et al. 2013; Hertzog and Touron 2011) and a failure to understand the costs and benefits of memory use relative to the algorithmic strategy (Hertzog et al. 2007; Touron and Hertzog 2014). Older adults' strategy use during learning is also influenced by age-related decreases in task-switching preferences (Hines et al. 2012) that are likely linked to reduced task-switching ability (Kray and Lindenberger 2000; Reimers and Maylor 2005), particularly in situations where the optimal task strategy is not apparent (Kray et al. 2002). Older adults are able to use external cues as an aid to strategy decisions but also might overutilize these cues beyond their practical applicability (Spieler et al. 2006; Lindenberger and Mayr 2014). Older adults' avoidance of the less demanding memory strategy can be seen as volitional, given that instructions and modest incentives increase memory use to levels consistent with older adults' memory abilities and similar to memory use by younger adults (Touron et al. 2007; Touron and Hertzog 2009). These findings are consistent with the perspective that older adults tend to be more conservative in decisional elements of cognitive tasks (Ratcliff et al. 2000, 2006) and indicate that memory-based models of automaticity should allow for strategy choice processes (Rickard 1997).

Research taking a process-based approach to automaticity demonstrates that older adults can develop automaticity in some but not all components of cognitive tasks. For example, when searching a set of information held in memory, older adults are able to develop automaticity in memory-based components but not attentional components of the task (Fisk et al. 1995). Expanded process models are also able to account for older adults' slower transitions to automatic task approaches by incorporating age-related declines in the cognitive abilities that underlie the task, as well as age differences in strategic choices (e.g., Meyer et al. 2001). When considering the changing roles of knowledge, perceptual-motor ability, and memory capacities over the course of training on a task, older adults have been shown to have qualitatively similar patterns to those of young adults (Hertzog et al. 1996; Rogers et al. 2000).

Although older adults are slower to acquire automaticity in new skills, they frequently utilize already acquired knowledge and automatized skills in everyday life and in this manner may compensate for declines in cognitive abilities. Indeed, interventions that capitalize on automatic processes can improve older adults' everyday functioning. For example, medical self-care adherence can be improved by requiring participants to form implementation intentions of the critical health behavior, so that these detailed plans can later be automatically available when the behavior is required (Liu and Park 2004). In a similar manner, age-related increases in established knowledge in relevant domains can benefit automaticity development for complex task skills, such as financial planning, in the laboratory (Ackerman and Beier 2006; Beier and Ackerman 2005), particularly in the early stages of learning.

## Skill

In comparison to many of the automatic processes and tasks discussed above, domains of cognitive skill are often quite complex. Given this, the study

of skill often breaks studied tasks down in order to examine their component operations and abilities. As with the study of automaticity, age differences in skill development and skilled performance vary depending on the particular focus of study.

Research on the establishment of skill, components of skill, and outcomes of skill have taken various approaches, from the study of skill development using novel tasks in a laboratory environment (ranging from simple reaction time tasks to complex video game tasks) to the examination of more complex skills in real-life domains (such as technology use), to the study of skills with extended training and exceptional populations within expert domains (such as chess or bridge). For a few tasks, older adults' performance appears to be similar to younger adults in terms of both the development and execution of skills (as for simple perceptual motor tasks, Salthouse and Somberg 1982). For other tasks, older adults are slower to acquire skills but then perform at levels comparable to younger adults (as in the mental arithmetic training by Charness and Campbell (1988)). For a third class of tasks, older adults differ in both the development and asymptotic performance of skilled activities, even when the task approach is qualitatively similar (as in a video game interface that aggregates several simple tasks described by Salthouse and Somberg (1982) and the vigilance learning studied by Parasuraman and Giambra (1991)).

## Elements of Skilled Performance

Skill domains rely on the coordination of and support from relevant component cognitive operations. Typically, skilled performance integrates fluid and crystallized intellectual abilities (e.g., Ackerman 1992). Declines in fluid abilities, such as processing speed, can present obstacles to skill development and performance, whereas crystallized abilities such as vocabulary knowledge are typically retained or augmented with aging and can therefore support new skills (Salthouse 2004; Schaie 1996). Memory involvement is often key to expert performance (Ericsson and Chase 1982), as in the chunking of complex representations to more streamlined semantic concepts (Chase and

Simon 1973). This chunking is particularly critical given age-related declines in working memory capacity (Bopp and Verhaeghen 2005) and the substantial requirements for coordinating information in complex skill performance. Skills also rely heavily on speeded information processing, and declines in processing speed contribute substantially to age-related differences in many different areas of cognitive performance (Salthouse 1996).

Several large-scale studies of cognitive training and interventions have examined whether older adults' skilled performance may be optimized with extensive exposure to related task components. Due in part to the recent widespread availability and popularity of computerized cognitive training programs, such as Brain Age and Lumosity, there is considerable interest in evaluating the efficacy of cognitive training, as well as the breadth of any benefits that arise from training. Available research typically shows fairly narrow ability-specific benefits from training for older adults (e.g., Stine-Morrow et al. 2014; Willis and Nesselroade 1990), with improved performance on the trained tasks but not for intelligence or cognition more broadly. These findings are consistent with the broader literature on cognitive training (e.g., Redick et al. 2013). This pattern has been obtained across a variety of basic cognitive abilities, such as memory, reasoning, and processing speed (e.g., mnemonic training by Verhaeghen et al. (1992) and Willis et al. (2006)). However, some promising evidence for transfer has been obtained, such as benefits for general health and well-being (i.e., Wolinsky et al. 2006, 2009, 2015). With a broader invention approach, research by Park and colleagues has demonstrated that an engaged cognitive and perhaps social lifestyle can also benefit older adults' performance in memory and fluid intelligence (Park et al. 2014; Stine-Morrow et al. 2008; also see Hultsch et al. 1999).

### Other Influences on Skilled Performance

Noncognitive characteristics also play a role in skilled performance, including those related to personal interests, motivation, and personality. Older adulthood sees a shift towards less openness

to experience, which might discourage investment in developing new skills (Kanfer and Ackerman 2004). Older adults also commonly have a lesser interest in pursuing new knowledge and skills due to an increased motivation towards interpersonal and emotional goals (Carstensen 1995). Metacognitive beliefs are likely to also play a role, including general and task-specific self-efficacy and performance monitoring that might encourage continued performance or shifts in task approach or strategy (see Hertzog and Hultsch (2000) for a review). Positive beliefs regarding memory control and ability, and monitoring that highlights the performance success, can lead to more optimal strategies and outcomes for performance.

Compensatory and strategic factors often influence older adults' performance within skilled domains, both in everyday skills and expert performance. Healthy older adults typically retain high levels of functioning in everyday tasks, in part due to a tendency to perform familiar tasks in highly routinized domains. These pockets of ability represent encapsulated regions that do not typically show the age-related cognitive decrements present in more novel and unpracticed task domains. This encapsulation can be an incidental outcome of pursuing personal interests and vocations or can also be more purposeful; the selective optimization with compensation model (Baltes and Baltes 1990) describes the tendency of older adults to select activities more narrowly and alter task approaches in order to optimize their performance in skilled domains. For example, in later life an expert auto mechanic might choose to selectively repair those car models or systems that they have the most prior experience, in order to rely on established knowledge and minimize the cognitive resources needed for the diagnosis and solving of unfamiliar problems. From the perspective of metacognitive training benefits, research has demonstrated that cognitive training can be enhanced with concurrent interventions aimed at boosting cognitive self-efficacy (West et al. 2008). Specific interventions that enhance metacognitive monitoring and strategy updating also allow older adults to improve cognitive performance (Bottiroli et al. 2013).

### Everyday Skills

Other research has examined older adults' development and retention of skills in everyday domains such as driving, technology adoption, and the work context. For many older adults, the preservation of driving skill is particularly critical, given the implications for continued maintenance of an active and autonomous lifestyle. Although cognitive, sensory, and physical declines can impair driving ability, older adults tend to revise driving patterns in order to compensate for these changes. Older adults often have considerable experience and familiarity with driving, but normative declines in sensory, physical, and attentional abilities can make driving more hazardous for older adults (e.g., Emerson et al. 2012). For example, older drivers often avoid periods of busy traffic, night driving, and routes that require left-hand turns. Due to these patterns, rates of accidents are not higher for the older adult population, although injury from traffic incidents is more frequent (NHTSA 2014).

Although adoption and reliance on technology is lower among older adults, use of electronic devices can also be beneficial to older adults' functioning and independence. Computers and smartphones enable older adults to engage in cognitively and socially stimulating activities, and electronic medical devices can enable the tracking of health conditions, communications, and outcomes. Older adults are slower to adopt new technologies, although historical trends show increases in use and competence. In particular, those older adults who have minority status, lower education, and lesser financial resources are less likely to use new technologies, with additional predictive factors such as cognitive abilities, concerns, comfort, and personal confidence (Czaja et al. 2006).

Everyday skill has also been examined within the context of changes in work for older adults. Most people can work productively until fairly late life, although this varies by domain and can be affected by institutional pressures. For individuals who continue to work within a particular occupation throughout adulthood, the work context can become an encapsulated domain that shows preserved abilities despite general

cognitive declines (for a review, see Bowen et al. 2011). From the perspective of both self- and supervisor ratings, older workers are generally shown to fare quite well in terms of performance as well as indices such as attendance and other personal contributions. In addition, the work environment can provide older adults with mental challenge and social support that can facilitate more positive aging outcomes, particularly when the job requires the processing of novel information and completion of varied and stimulating tasks (Andel et al. 2007). Research examining exceptional achievements and productivity in the work domain has demonstrated that quality work can occur throughout the lifespan, although there is substantial variability depending on the particular occupation (Simonton 1991).

### Expertise

The findings for work domains exemplify the broader literature on expertise and aging. Older adults who are experts in a particular skill often typify patterns of encapsulation. Substantial literatures on expert performance by master typists, chess players, crossword puzzle solvers (e.g., Hambrick et al. 1999), and bridge players demonstrate that age differences are often eliminated with substantial expertise in a domain. Despite these findings, age differences are typically obtained when the component abilities are examined outside of the familiar domain of expertise. For example, those with expertise that relies upon mental imagery (professional graphic designers) are no better when implementing a new mental imagery task, the method of loci mnemonic (Lindenberger et al. 1992). Similarly, chess experts retain the ability to recall complex spatial configurations in late life, but only when these configurations represent meaningful gameplay for chess pieces, and can therefore rely on established memories. Research focusing on the role of deliberate practice notes that considerable investment is required to reach expert levels of performance (e.g., the 10,000 hour rule, Ericsson, 2006). Other researchers point out that additional factors must also influence the establishment of expertise, including intelligence and cognitive

capacities, inherent talent in the domain, and dispositional influences (Hambrick et al. 2014).

## Conclusions and Future Directions

This entry has reviewed evidence for both age-related declines and preservation in automaticity and skill. In general, older adults are most able to maintain functional levels of performance when tasks rely on abilities that are inherently automatic, have been automatized early in life, or involve familiar and well-practiced routines. In addition to the underlying cognitive capacities, tasks often also involve strategic choices, as with the reliance on acquired information for memory-based automaticity, or the willingness to persist in the learning of new technologies. Based on these findings, we might support skill acquisition and functioning in older adulthood by structuring tasks in such a way that reliance on established knowledge is facilitated and encouraged.

## Cross-References

- ▶ [Cognition](#)
- ▶ [Everyday Cognition](#)
- ▶ [Expertise and Ageing](#)
- ▶ [Plasticity of Aging](#)
- ▶ [Psychology of Wisdom](#)

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## Behavior Modification

Jennifer Inauen<sup>1</sup> and Urte Scholz<sup>2</sup>

<sup>1</sup>Department of Psychology, Columbia University, New York, NY, USA

<sup>2</sup>Department of Psychology, University of Zurich, Zurich, Switzerland

### Synonyms

Behavior change; Behavioral change

### Definition

Behavior modification means the change of a current behavior by adopting a new behavior or by increasing or decreasing the current behavior.

Understanding, predicting, and evoking behavior modification is a key topic in all areas of psychology. It is a crucial means to reaching personal, organizational, and societal goals across the lifespan, including the major goal to stay healthy and well. With chronic disease on the rise, partly due to an increasing aging population, promoting and stabilizing health and well-being is more topical than ever (cf. Scholz et al. 2015). Behavior modification is a major factor to prevent and manage chronic diseases, such as diabetes and cardiovascular diseases (e.g., Ornish et al. 1998), be it, for example, to normalize blood pressure levels by exercising or eating more healthily or by

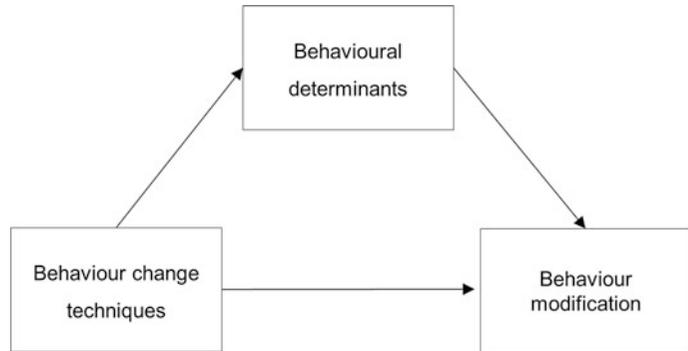
better adherence to medication regimes; behavior modification and long-term maintenance are crucial at any time during the lifespan, even though the goal of behavior modification may differ depending on age. Whereas increasing health and well-being or preventing disease may be more achievable goals for younger persons, stabilization is often the more realistic goal in older age. Irrespective of this, however, behavior modification is usually a prerequisite. The following sections introduce the key principles of behavior modification. An overview is given of the behavioral determinants, the techniques by which behavior modification can be engendered, and how these can be selected for interventions. The entry ends with concluding remarks and directions for future research.

### A Social Cognitive Approach to Behavior Modification

Before the cognitive revolution in the second part of the twentieth century, behavior modification was mostly understood as the learning process termed operant conditioning (learning by reinforcement or punishment), which is associated most notably with the works of behaviorist B.F. Skinner. The processes by which behavior modification occurs were considered a “black box,” as they were deemed unobservable and could therefore not be empirically studied. The cognitive revolution changed this understanding

## Behavior Modification,

**Fig. 1** Schematic display of the principles of behavior modification (Adapted from Michie et al. (2008))



and led to the social cognitive approach to behavior modification.

In contrast to the simplistic stimulus–response view of behaviorists, social cognitive theories of behavior modification assume “that social behaviour is best understood as a function of people’s perceptions of reality, rather than as a function of an objective description of the stimulus environment” (Conner and Norman 2005, p. 5). To illustrate this, imagine elderly persons who have difficulties to walk. The objective description would predict that these difficulties will impair them from getting enough physical activity. The social cognitive approach, in turn, would assume that whether or not these persons find a way to overcome this barrier and engage in physical activity despite their walking impairments (e.g., by doing yoga exercises at home) depends on the persons’ perception of this barrier, for example, on their motivation to exercise and on their belief that they can exercise, even when this is difficult (a behavioral determinant known as self-efficacy, Bandura 1999). Various theories have developed from this social cognitive approach. These theories have identified several behavioral determinants, with the theory of planned behavior (Ajzen 1991) and the health action process approach (Schwarzer 2008) as a classic and a more recent example, respectively.

A further principle of the approach is that the behavioral determinants (or causal processes) are modifiable and that they can be specifically tackled with behavior change techniques (BCTs, Michie et al. 2008). Behavior change techniques are “. . .an observable, replicable, and irreducible component of an intervention designed to alter or

redirect causal processes that regulate behaviour” (Michie et al. 2013, p. 82). There are a great number of BCTs with which researchers and practitioners aim at modifying behavioral determinants and behavior. Recent efforts have been directed at standardizing definitions of BCTs in order to accumulate evidence on their efficacy (Michie et al. 2008, 2013) and to link BCTs to specific behavioral determinants (Abraham 2012). Figure 1 summarizes the elements of theory-based behavior modification.

## Determinants of Behavior Modification

There are essentially two types of social cognitive theories that have been proposed to understand and predict behavior modification: continuum theories and stage theories. Continuum theories assume that persons can be characterized on a continuum from action readiness to actual behavior modification (Abraham 2012). Stage theories, on the other hand, assume that the process of behavior change comprises a discrete number of stages an individual has to pass through to modify a behavior from adoption to long-term behavioral maintenance. A representative of each type of behavior theory is presented next.

A classic continuum model is the theory of planned behavior (Ajzen 1991). At the theory’s core are behavioral intentions. They reflect “. . . people’s decisions to perform particular actions” (Sheeran 2002, p. 2). The theory of planned behavior predicts that when people form an intention to perform a behavior, they are more likely to carry out this behavior. Behavioral intentions, in

turn, are predicted by attitudes toward the behavior (i.e., persons' valuations of the behavior and its consequences and the expected likelihood that these will occur), the subjective norm (i.e., beliefs about others' expectations regarding the behavior and a person's willingness to comply with these), and perceived behavioral control (i.e., beliefs about facilitating and hindering factors and their subjective power to impede behavior performance). The latter is also assumed to have direct effects on behavior (Ajzen 1991). In summary, the theory of planned behavior predicts that persons are most likely to perform or modify a behavior when they are highly motivated (i.e., have strong intentions as determined by their attitudes, subjective norms, and perceived behavioral control) and have high perceived behavioral control. The TPB has been widely researched and proven useful to explain and predict several health behaviors (Conner and Sparks 2005). However, a major criticism is the finding that while intentions are usually well explained by its predictors, behavior is not. This phenomenon is commonly referred to as the intention-behavior gap and indicates that, contrary to many behavior theories' assumptions, people who have stronger intentions than others are only moderately more likely to perform a specific behavior than others (Sheeran 2002). This has led to fruitful research on self-regulatory (or volitional) factors that may explain how intentions translate into actions (Schwarzer 2008) and how to overcome the gap (Sheeran 2002). Timely health behavior models have incorporated these factors to mediate intention-behavior relations. The health action process approach (HAPA, Schwarzer 2008), for example, includes volitional mediators such as action planning, coping planning, and action control (Sniehotta et al. 2005). According to Schwarzer, the HAPA is a hybrid model, meaning that it can be applied as both a continuum model and a stage theory.

Stage theories have traditionally put more emphasis on factors that can translate intentions into actions than continuum theories. As mentioned above, stage theories assume that the behavior change process can be divided into a fixed sequence of qualitatively distinct stages (or phases). At the core of these theories are

transitional variables (e.g., the decision to take action) that "move" persons from one stage into the next (e.g., from the pre-action to the action stage, cf. Schwarzer 2008). Each stage transition is predicted by a specific set of stage determinants that are causally related in some theories (e.g., the HAPA, Schwarzer 2008). Stage theories are commonly considered more comprehensive than continuum theories, but also more complex. One of the earlier and possibly the most prominent stage theory is the transtheoretical model of behavior change (Prochaska and DiClemente 1983). In its most frequently used version, the transtheoretical model proposes five stages of change: precontemplation, contemplation, preparation, action, and maintenance. Stage progression is specified by decisional balance (pros and cons of behavior), self-efficacy (confidence and temptation), and ten processes of change: five cognitive (e.g., consciousness raising) and five behavioral (e.g., stimulus control). While the idea of separating the behavior change process into distinct phases may seem appealing, empirical tests of the transtheoretical model and other stage theories have generally yielded mixed evidence for the distinction of stages (e.g., Sutton 2005). Nevertheless, they remain particularly popular among practitioners, perhaps because of their clear-cut directions for intervention development that is a consequence of the stage assumption: if persons in different stages of behavior change are qualitatively distinct, they would require different BCTs to promote their transitions between the stages. This point will be further touched upon in a subsequent section. But, first, an overview of BCTs is given.

## Behavior Change Techniques (BCTs)

There are a vast number of techniques that have been proposed and applied to modify behavior, with the abovementioned operant conditioning being one of the first of what is now termed a BCT. A major challenge in behavior modification research is the fact that the same BCTs are often termed differently by behavior change professionals from different fields. Or the same term is

used, but different techniques are meant by it. This consequently limits the potential of intervention research to produce evidence on the effectiveness of specific BCTs. In an effort to address this issue, several research groups have recently focused on creating taxonomies of BCTs with standardized definitions. This work is crucial to building a cumulative science of behavior modification. The most widely accepted, systematic, and comprehensive taxonomy that has emerged from these efforts is the BCT taxonomy v1 by Michie and colleagues (2013). In its first version, the taxonomy comprises 93 distinct BCTs that were collected through extensive reviews of the scientific and applied behavior modification literature from various fields, such as clinical psychology, social psychology, and health psychology. The BCTs are grouped into 16 clusters. These include clusters of social-psychological BCTs, e.g., goals and planning, which comprise BCTs such as problem solving and action planning, or the BCT cluster feedback and monitoring. Other clusters contain BCTs to foster social support, making contextual changes of antecedents (e.g., BCTs restructuring the physical environment and adding objects to the environment) or providing reward and threats.

The taxonomy should potentially be applicable to behavior modification in any field of interest, from clinical to health psychology and pro-environmental behavior modification to changing workplace behavior. There are, however, also behavior-specific taxonomies that may be helpful in providing a subset of these BCTs, as not all of the abovementioned techniques are relevant to all behaviors. This can be especially useful when such taxonomies also include information on the effectiveness of the BCTs for modifying a particular behavior.

The BCT taxonomy v1 was a vital first step toward standardization of BCT research and practice. Still, it can be expected that this taxonomy will further develop in the coming years, as it will be refined by researchers in psychology and other fields as well as practitioners. Another topic that also needs to be addressed is the mapping of BCTs onto specific behavioral determinants, i.e., what BCTs can modify which behavioral determinant.

This will help selecting specific BCTs to target behavioral determinants that are particularly important to change a specific behavior.

## Selecting BCTs

Social cognitive theories and empirical evidence provide guidance which determinants to focus on to achieve behavior modification. BCT taxonomies and empirical research provide an overview of techniques available to modify behaviors. But behavior change researchers and practitioners also need knowledge about the link of BCTs and behavioral determinants, so BCTs can be specifically selected to tackle the intended determinants. Also, when evaluating behavior change interventions, the mechanisms of the intervention can be ascertained by assessing the behavioral determinants assumed to be modified by the administered BCTs and performing mediation analysis. This not only offers a tool to test social cognitive behavioral theories but can also deliver important information as to why an intervention was successful (what were its active ingredients?) or not (did the intervention fail to enhance the behavioral determinants?). For example, in an intervention study on physical exercise in cardiac rehabilitation patients, two intervention groups were compared to a standard-treatment control group (Scholz et al. 2007). The first intervention group received an action planning intervention, that is, participants were asked to plan when, where, and how to implement their physical exercise. The second intervention group received a combined action plus coping planning intervention. The coping planning part comprised asking participants to think about barriers to their physical exercise and to subsequently form detailed plans, when, where, and how they will overcome these barriers. Two months later, the combined planning group was the most successful in increasing their physical exercise levels. This effect was independent of the age of participants. However, a closer look at the behavioral determinants revealed age-differential effects: older individuals reported the highest levels of coping planning already at the baseline assessment compared to young and

middle-aged participants. The latter two age groups increased their coping planning after the intervention whereas the older participants reported relative stability of coping planning across the two months. Self-reported action planning in contrast was not changed by the intervention, nor were there age-differential effects over time (Scholz et al. 2007). Thus, not only analyzing the direct effects of BCTs on behavior modification but also examining the effects on the behavioral determinants provides important information on what the active ingredient of an intervention is and whether or not this applies, for example, to people of all ages.

Unfortunately, with few exceptions (Mosler 2012), behavior theories provide little guidance on which BCTs can modify which behavioral determinants, and empirical research on the BCT-behavioral determinant-behavior link is still rare. There are, however, some expert groups that have proposed links (Michie et al. 2008; Abraham 2012) or are currently working on this. Abraham (2012), for example, provided a menu of 40 BCTs linked to behavioral determinants. In any case, much empirical research is needed to test these proposed links.

When planning an intervention, another question is which behavioral determinant to target. On the one hand, this depends on the goal of the endeavor, e.g., testing a particular theory or the more applied goal of evoking greatest possible behavior modification. It also depends on the theory that the intervention is based on. Continuum theories and stage theories have different implications for selecting behavioral determinants for interventions. As discussed above, continuum theories assume that their behavioral determinants increase the likelihood of people's behavior performance. This implies that behavior can be modified by changing any of the behavioral determinants of the theory and that this holds for all individuals, wherefore this approach is sometimes termed "one size fits all." If it is a causal theory, the most distal behavioral determinants should be targeted, as it is assumed that they will work their way through to behavior change by modifying the more proximal behavioral determinants of the theory (Sutton 2008). Alternatively,

one could "jump into the causal chain" (Sutton 2008, p. 73) and aim at directly altering proximal determinants. In addition, some approaches, such as intervention mapping (Bartholomew et al. 2011) or the RANAS (Risk, Attitude, Norms, Ability, Self-Regulation) approach (Mosler 2012), suggest procedures to target behavioral determinants that are of particular importance to the target population and context (Mosler 2012; Bartholomew et al. 2011). In the intervention mapping approach, this step is referred to as needs assessment (Bartholomew et al. 2011). It entails a detailed literature review and survey in the target population to carefully adapt the intervention to the context.

A criticism of the one-size-fits-all approach is that individual particularities are not taken into account. Tailored interventions seek to overcome this. They are defined as "...any combination of strategies and information intended to reach one specific person, based on characteristics that are unique to that person, related to the outcome of interest, and derived from an individual assessment" (Kreuter et al. 2000, p. 277). One form of tailoring is stage tailoring. As discussed above, stage theories assume qualitatively distinct behavior change stages. Consequently, different interventions result for persons who are in different stages of change. Following a stage theory approach, the stage of change of each person needs to be assessed beforehand, and everyone receives the intervention that is tailored to their current stage. By stage theories' rationale, interventions matching individuals' present stage of change should allow transition to the next stage, whereas mismatched interventions should have nil or possibly adverse effects. The prerequisite to perform stage-tailored intervention is a staging algorithm that can reliably assess individuals' stage of change prior to the intervention. The transtheoretical model, for example, assumes time-based criteria to determine individuals' stage of change. This has been frequently criticized, because the time criteria seem arbitrary. More recent theories, such as the HAPA, therefore developed psychological staging algorithms that characterize persons regarding their current intentions and behavior.

An advantage of stage-tailored interventions should be that they take into account the characteristics of the target persons and may therefore be potentially more effective than not-tailored interventions. However, evidence on this is mixed, which may be due to the lack of reliable staging algorithms, and the lack of clear definitions of and evidence for the predictors of each stage transition. In particular, it has been criticized that stage-tailored interventions usually only use few behavioral determinants for assessing stages (Abraham 2008). The menu-based approach, in contrast, considers many social cognitive factors, possibly from a compilation of behavioral theories (Abraham 2008). Each individual's characteristics are considered, wherefore this approach may lead to a menu of as many BCTs as behavioral determinants that were considered. A disadvantage of this approach is the increased effort and complexity for developing and implementing the great number of interventions required to meet the needs of all participants.

## Conclusions and Outlook

In summary, behavior modification is related to behavioral determinants that can be modified by BCTs. In the health behavior modification field, which is of particular importance to the aging population, theory and research on the behavioral determinant–behavior modification link is much advanced. Despite an ongoing discussion whether behavior modification is best understood as a continual process or as divided into discrete stages, the behavioral determinants of importance are now, in principal, understood. A behavior change theory that elegantly incorporates both the continuum and the stages of change approach, and may therefore have gained popularity fast, is the HAPA model (Schwarzer 2008). It specifies causal pathways to behavior change, similar to the theory of planned behavior, but it extends the latter by volitional factors (action planning and coping planning, phase-specific self-efficacy, and action control) in an effort to overcome the intention–behavior gap. Yet, to plan and implement interventions, the HAPA can also be divided

into at least three stages: pre-intention/motivation, pre-action/volition, and action.

In contrast to the behavioral determinant–behavior change link, BCTs and their mechanisms to modify behavior require much further research. Important groundwork has been done by producing standardized definitions of the BCTs (Michie et al. 2013) and by hypothesizing their links to behavioral determinants (Abraham 2012). Now, these definitions require large-scale adoption by researchers and practitioners, and empirical investigations need to test the mechanisms by which their BCTs modify behavior.

Regarding environmental factors, the social cognitive approach makes the argument that their influence on behavior is mediated through individuals' perceptions thereof. However, other fields of research, e.g., environmental psychology, suggest that behavior is best understood as an interaction of person by environment. Following this viewpoint, it could be helpful to consider environmental factors that may hinder or facilitate behavior modification.

Finally, a further line of future behavior change research concerns the mode of delivery of interventions. Whether an intervention is delivered personally (e.g., by a health professional), by mass media (e.g., leaflets or television), and by the Internet or smartphone should make a difference in its efficacy. But little is known on this subject yet. Also, the ideal mode of the delivery could differ for different populations, e.g., for different age groups.

## Cross-References

- ▶ [Behavioral Analysis](#)
- ▶ [Cognitive Behavioural Therapy](#)
- ▶ [Cognitive Control and Self-Regulation](#)
- ▶ [Decision Making](#)
- ▶ [Environmental Influences on Aging and Behavior, Theories of](#)
- ▶ [Health Promotion](#)
- ▶ [Prospective Memory, New Perspectives for Geropsychological Research](#)
- ▶ [Psychological Theories on Health and Aging](#)

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## Behavioral Analysis

Jane E. Fisher<sup>1</sup>, Susan P. Thompson<sup>2</sup>,  
Cyndy G. Soto<sup>2</sup>, Andrew J. Ahrendt<sup>2</sup> and  
Adrienne K. Chong<sup>2</sup>

<sup>1</sup>Department of Psychology/298, University of Nevada, Reno, NV, USA

<sup>2</sup>University of Nevada, Reno, NV, USA

## Synonyms

Applied behavior analysis; Behavior modification; Behavior therapy; Behavioral health; Classical conditioning; Learning theory; Operant conditioning

## Theoretical Foundations of Behavior Analysis

Behavior analysis involves the systematic application of learning theory to explain why behavior is occurring. Within this model *behavior* encompasses everything a person does including observable behavior as well as what the person thinks and feels (Ramnero and Torneke 2008). Learning theory posits that an individual's behavioral repertoire is a product of their genetic and learning histories (Skinner 1938/1991). The significant heterogeneity of psychological functioning within the population of older adults is both predicted and explained by the model's assumption that each human being is unique by virtue of their idiosyncratic genetic and learning histories. The utility of behavior analysis for explaining behavior in late life and prescribing interventions to promote behavioral health is significant as the majority of evidence-based behavioral health interventions share roots in learning theory.

Within learning theory *genetic history* encompasses factors that influence the individual's physiology and is reflected in the individual's current physiological status (e.g., health status, sensory functioning, physical conditioning) as well as in responses that are natural, biologically driven, and not learned (e.g., salivating at the smell of food, blinking at a bright light). Behavior that is the product of an individual's *learning history* encompasses responses that are influenced by environmental experience.

*Learning* is conceptualized as occurring within two processes: *operant conditioning* and *respondent conditioning*. Behavior analysis assumes that to the extent that behavior, including both developmentally "normal" and dysfunctional behaviors, is learned it can be unlearned (Krasner and Ullman 1965). The assumption of behavioral plasticity is the *raison d'etre* for the systematic application of learning principles to produce behavior change at any point in the life span (Bijou 1961/1995; Baltes and Barton 1977).

**Operant conditioning and functional relations.** The unit of analysis within operant conditioning is *behavior in context*. Context includes both historical and current physiological, cultural,

and social conditions. In order to understand *why* a particular behavior is occurring, a behavior analyst attempts to identify patterns in the conditions and events that surround the behavior, i.e., whether events or stimuli (called *antecedents*) reliably precede and follow (called *consequences*) the occurrence of the behavior. The continuous interaction of antecedent, behavior, and consequence over time is called the *operant contingency* (Skinner 1938/1991). A *contingent* relationship between antecedents and consequences is said to occur if systematic observation of behavior reveals that an antecedent reliably increases the probability that a behavior will be emitted and the occurrence of the behavior increases the probability that a consequence will be delivered. Antecedents are environmental events or stimuli that are reliably present in the setting in which a behavior occurs. Antecedents can be verbal or nonverbal. Verbal antecedents may be either the verbal behavior of another person or the individual's own verbal behavior, for instance, "I know how to do this" or "This isn't safe." When an antecedent gains the property of signaling the availability of reinforcement for certain behaviors, the behaviors are said to be under *stimulus control* in that the presence of the antecedent stimulus increases the probability of the behaviors occurring.

Within the operant model, consequences are defined based on their effect on behavior, i.e., whether the consequence results in an increase or decrease in the probability that the behavior will be emitted in the presence of similar antecedents. If it is determined that the probability of a behavior occurring over time has increased, i.e., its frequency increased, the consequence is labeled a "reinforcer"; if it is observed that the probability of the behavior decreased over time, then the consequence is considered a "punisher." The adjectives "positive" and "negative" distinguish different types of reinforcers: if a behavior results in *access* to a stimulus (e.g., smiling is reliably followed by a hug from a friend), the reinforcer is considered "positive." If behavior is followed by a reduction in the quantity of a consequence (e.g., the intensity of painful emotion declines immediately following suicidal ideation;

physical pain is reduced following the ingestion of an analgesic), the consequence is considered a “negative” reinforcer. Reinforcement *contingencies* are identified based on their *effect on the quantity of behavior*, i.e., whether behavior frequency increases, is stable, or decreases over time.

The identification of the reinforcement contingencies controlling a behavior is a central goal of behavior analysis and directly informs the identification of interventions that would be effective for increasing or decreasing the behavior. Points of intervention to *break the contingency* may include: (1) altering the antecedent stimuli to prevent or increase the probability of the occurrence of behavior (e.g., removing electronic devices and reading material from a bedroom to promote sleep, placing medicine containers by the coffee pot to increase the probability medication will be taken in the morning as prescribed, camouflaging a door to prevent a person with dementia from trying to exit) or (2) discontinuing the reinforcement of a behavior (known as *extinction*) (e.g., discontinuing negative reinforcement of escape from emotionally painful private events through in vivo exposure, instructing family members to stop attending to maladaptive “sick” role behaviors), delivering a reinforcer contingent on behavior that is incompatible with a dysfunctional behavior, or both (Ramnero and Torneke 2008; Skinner 1938/1991). Examples of differential reinforcement of behavior include praising a client’s problem solving when emotionally distressed rather than his engaging in escape of avoidance behavior or praising a caregiver of a person with dementia for engaging in empathic verbal responses rather than corrective feedback with their family member.

Within the behavior-analytic model, it is assumed that a behavior may serve more than one function or purpose. For example, complaining about poor health or pain may result in an individual escaping from household tasks (i.e., the behavior is negatively reinforced in that it results in the removal of aversive stimuli) and also being consistently followed by hugs and comforting statements by family members (i.e., the behavior is positively reinforced in that it is consistently followed by social attention). It is

important to determine if a behavior serves more than one function in order to design an intervention that will effectively address all functions of the problem behavior.

The function of a behavior is determined through a variety of assessment methods:

- (a) *Experimental functional analysis* during which hypothesized controlling variables, specifically the antecedents and consequences, are directly manipulated while the behavior analyst carefully monitors whether there are changes in frequency of the behavior (Skinner 1938/1991; Bijou 1961/1995). Experimental functional analysis is the most direct and accurate method of identifying the function of a behavior.
- (b) *Descriptive analysis* or assessment involves less direct, but often more practical methods for generating but not directly testing hypotheses about the function of a behavior. Descriptive assessment can involve a variety of methods, such as direct observation, self-report methods involving interviews, or paper and pencil questionnaires. Descriptive analysis can also include a variety of sources of information from clients or collateral sources, for instance, a client monitoring and recording the environmental and private events that precede and follow the problem behavior, having the client or an informant (e.g., a caregiver) complete a paper and pencil questionnaire designed to assess the contextual variables reliably associated with the behavior, or having an informant directly observe and record the problem behavior and events or stimuli that precede and follow the behavior (Haynes and O’Brien 2000).

## Classical Conditioning

Classical or respondent conditioning involves learning by association. Classical conditioning has been applied to explain the development of many physiological and emotional responses including conditioned fear, sexual arousal, trauma-related anxiety, and responses associated

with substance abuse. For example, an individual who has experienced a traumatic event may later experience anxiety when they have contact with environmental stimuli, such as the smells, images, or sounds similar to those present during the initial traumatic event.

Classical conditioning provides the theoretical foundation for several evidence-based therapies such as exposure therapy for anxiety. Classical conditioning was first described by the Russian physiologist Ivan Pavlov (1849–1936). In studying the salivary and gastric secretions of dogs, Pavlov would place a bowl of meat powder in front of a dog and measure the amount of secretions naturally produced. During his studies Pavlov observed that over time the dogs would start salivating when he entered the room, regardless of whether meat powder was presented. Pavlov's serendipitous, yet astute, observation of this phenomenon led to a series of experiments in which he systematically manipulated the presentation of a neutral stimulus, the sound of a bell or tuning fork, prior to presenting meat powder in order to better understand this learning by association. Pavlov observed that by repeatedly pairing the sound, a neutral stimulus, with the presentation of the meat powder, an unconditioned stimulus because it naturally elicited a response, the dogs would start to salivate at the sound of the neutral stimulus, demonstrating that the neutral stimulus had obtained functional properties similar to the food. The bell had become a *conditioned stimulus* (CS) in that it elicited a learned reaction or *conditioned response* similar to the natural reaction or *unconditioned response* of salivating to the food (an *unconditioned stimulus*).

*Behavior analysis of functioning in late life.* Behavior-analytic strategies have been applied to promote the health and quality of life of older adults in a variety of ways. Treatment goals have ranged from increasing health-related behaviors such as exercise, sleep, nutrition, and medication adherence to decreasing behaviors that restrict or prevent access to positive and valued outcomes, (for instance, social withdrawal and isolation, substance abuse, and suicidal behaviors). Examples of behavior-analytic conceptualizations of

health-interfering and health-promoting behaviors are described below.

*Depression.* The behavior-analytic model of depression considers the interaction of the person's repertoire within its historical and current environmental context. The model posits that the risk of depression increases when individuals experience low rates of positive reinforcement, high rates of aversive events (punishment), or both in their lives (Ferster 1973). Further, the model assumes that an individual's repertoire, which may include high-frequency negative self-statements, low frequency of eye contact or smiling during interactions, or evidence of a low frequency of instrumental problem-solving skills, may further limit their access to positive reinforcement in day-to-day life or increase the probability of experiencing aversive consequences (Ferster 1973; Lewinsohn and Graf 1973). In addition, behaviors commonly exhibited by persons who meet diagnostic criteria for depression, such as excessive sleeping, social withdrawal and isolation, and alcohol consumption, may be negatively reinforced by escape from or avoidance of potentially aversive consequences such as feeling anxious, ashamed, lonely, or rejected (Martell et al. 2001). The low rates of behavior commonly observed when an individual behaves in a manner typically described as "depressed," in turn, further limit opportunities for the person to contact pleasant experiences that would elevate his mood. More stable behaviors in the person's repertoire, such as social skill deficits involving low rates of eye contact or smiling and high rates of vocalizing negative and pessimistic statements during social interactions, may increase the likelihood of contact with aversive consequences, which could include negative affect and withdrawal by others. In addition, these social skill deficits could further limit opportunities for contacting pleasant experiences and hence increase the likelihood of continued depressed mood. Behavioral approaches to the treatment of depression typically target both the depressogenic repertoire and contextual factors.

In regard to age-associated considerations, sensory changes, medical conditions that result in chronic pain or fatigue, and medication side

effects may reduce or altogether preclude pleasure during activities that had been historically preferred. Further, a large proportion of elderly persons judged to be depressed are prescribed antidepressant medication although over 50% of older adults who meet criteria for major depressive disorder do not respond to first-line treatment with antidepressant medication (Joel et al. 2014). In many cases, pharmacological intervention for depression may be contraindicated as polypharmacy increases the risk of adverse medication effects (American Geriatrics Society 2015). In contrast, evidence-based non-pharmacological treatments for depression including behavioral activation (BA) (Martell et al. 2001) and cognitive behavior therapy (CBT) have been found to be highly effective for the treatment of depression in older adults (Gallagher-Thompson et al. 1990; Ayers et al. 2007) and have no side effects.

BA is designed to improve mood by targeting the individual's inactivity, avoidance, and withdrawal behaviors. Specifically, the BA treatment process involves three main steps: *activity monitoring* (monitoring the actions that preclude and follow depressive behaviors), *activity scheduling* (replacing prior maladaptive behaviors with positive, productive behaviors that increase contact with pleasant consequences), and *modifying activities based on client feedback* (continually adjusting the treatment plan until the desired outcome is reached) (Martell et al. 2001). During treatment it is important to consider how an individual's skill repertoire, sensory functioning, and health may influence their experience of activities, for example, individuals with sensory deficits may prefer activities that involve fewer sensory challenges. It is also important to consider an individual's socialization history when identifying potentially gratifying experiences. For example, an individual with a history of enjoying solitary activity may find physical activities more rewarding than those involving social interaction. Further, while it is commonly suggested that depressed clients increase social contact by attending community or other organized events, socializing with strangers may be less preferred by older adults who have a history of experiencing

the emotion regulation benefits of intimate interactions with close friends and family (Carstensen 1992).

## Suicide

Globally, the elderly are at higher risk of suicide than any other age group, with elderly men accounting for the largest proportion of suicides. Older adults tend to use lethal means and are less likely to report suicidal ideation prior to attempting suicide (World Health Organization 2014). Further, the current cohort of older adults is more likely to report somatic symptoms rather than emotional distress when experiencing depressed mood or anxiety (Hinton et al. 2006). A behavior-analytic conceptualization of suicidality considers suicidal thoughts and actions to be learned behaviors that function to allow the individual to avoid or escape overwhelmingly distressing and aversive feelings (Chiles and Strosahl 2005; Linehan 1993). Experiencing physical or emotional pain is a normative event at some point in the course of a long life but the ways in which individuals cope with physical pain and distressing emotions vary significantly. For individuals with a limited repertoire for coping with painful private events and weak social attachments, suicidal thoughts and actions may provide an immediate escape from or avoidance of physical pain and distressing feelings of loss, loneliness, or emptiness.

A behavior-analytic conceptualization of suicidality focuses on the context of suicidal behaviors, both private thoughts and emotions and overt actions, including the circumstances that tend to precede the occurrence of the behaviors and the consequences that reliably follow the suicidal behavior. To illustrate, suicidal ideation would be conceptualized as being negatively reinforced if it produces the consequence of temporarily alleviating painful emotion *and* the frequency of suicidal ideation following painful emotions has increased or is maintained over time. Alternatively, suicidal behavior would be conceptualized as being positively reinforced if it is consistently followed by a consequence

such as access to social attention and comfort from friends and family and the frequency of the behavior increases over time.

Dialectical behavior therapy (DBT), developed by Marsha Linehan (1993) as a treatment for chronically suicidal individuals, focuses on replacing harmful behavior patterns (including thought patterns) with skillful alternatives. A behavior-analytic interpretation of the therapeutic process within DBT considers the contingency between suicidality, private events (e.g., distressing thoughts of abandonment), and environmental events (e.g., attention from or rejection by others). This contingency is broken by building a repertoire of behaviors (e.g., emotion regulation skills, distress tolerance skills, interpersonal skills) that are incompatible with suicidality. Although the primary population Linehan studied when developing DBT was young and female, the behavioral principles underlying the treatment are applicable throughout the life span. DBT has been found to be effective with older adults (Lynch et al. 2006).

## Neurocognitive Disorders

Neurocognitive disorders such as Alzheimer's disease and vascular dementia are among the most debilitating conditions affecting older adults. Behavior analysis has been applied to both support the maintenance of adaptive behaviors (e.g., activities of daily living, speech, etc.) and prevent, decrease, or reverse *excess* disability and promote the behavioral health of elderly persons with neurocognitive disorders (Buchanan et al. 2011; Fisher et al. 2007). Within this population, excess disability is said to occur when a person is more disabled than expected based on the underlying neurodegeneration (Fisher et al. 2007). Within the behavior-analytic model, excess disability in persons with neurocognitive disorders is evident in the premature decline of functional behaviors that will eventually be lost due to neurodegeneration. Designing environments that support functional behaviors is a fundamental goal of behavior-analytic approaches to enhancing the health and quality of life of persons

with neurocognitive disorders (Buchanan et al. 2011; Fisher et al. 2007; Hussian 1981).

The behavior-analytic or "contextual" model of neurocognitive disorders assumes that a person who is experiencing progressive cognitive decline will develop strategies to compensate for the impairment (Hussian 1981) and that the context in which they are experiencing the neurological changes can have a profound effect on their and their family members' behavioral health and quality of life (Schulz and Sherwood 2008). In this regard, the contextual model treats the interactions between affected persons and their family as essential to well-being.

An important implication of the age-associated risk of neurocognitive disorders is that they affect the functioning of individuals with decades-long genetic and learning histories and hence highly complex verbal, emotional, and interpersonal repertoires. Given the current lack of treatments for these disorders, behavior-analytic approaches to the support of persons with neurocognitive disorders tend to focus on three primary goals: (1) preserving functional repertoires, (2) preventing excess disability, and (3) preventing behaviors that lead to negative outcomes for persons and their families (commonly referred to as "noncognitive neuropsychiatric symptoms," "behavioral disturbances," or "challenging behaviors"). The behavior of family and professional caregivers is considered to be a critical feature of the context in which persons with neurocognitive experience changes and therefore the responding of caregivers is commonly targeted within behavior-analytic support services. *Support of caregivers* tends to focus on (1) increasing caregivers' knowledge of neurocognitive disorders and the effects of neurological changes on behavior in order to promote perspective taking rather than pathologizing behavior, make the behavior of care recipients predictable, and reduce the likelihood that caregivers will respond to the care recipient with negative consequences, such as negative affect and corrective feedback that may inadvertently or intentionally punish behaviors within the already vulnerable repertoire of the care recipient; (2) promoting the ability of caregivers to cope with the emotional and instrumental challenges

that commonly emerge when caring for someone with a neurocognitive disorder; and (3) assisting families in preserving the meaningful and rewarding qualities of their relationship with their family member (Fisher et al. 2007; Nichols et al. 2011).

Persons with dementia experience an array of neurological changes that impact their ability to perform activities of daily life such as personal care and more complex tasks such as managing finances and medications and driving. The behavior changes that accompany neurocognitive disorders are often experienced as confusing, “out of character,” or “intentional” and aversive by family members. In addition, declines in verbal abilities increasingly lead to communication problems within relationships that involve behaviors that have been under powerful stimulus control, for example, responses that have reliably followed an antecedent stimulus – such as a family member’s request or effort to initiate a conversation by inquiring about how the family member is doing – and were reliably reinforced for decades. The confluence of communication deficits and perceived intentional and unpredictable behavior changes (i.e., reflecting the breakdown in the stimulus control of behavior) that occur during the course of neurodegenerative diseases typically lead to high rates of conflict between affected persons and their family members (Fisher et al. 2007). From a behavior-analytic perspective, intra-familial conflicts may be due, in part, to the discontinuation of reinforcement contingencies (i.e., “extinction”) which is typically experienced as emotionally painful by family members.

Within the behavior-analytic or contextual model, the behavior changes that accompany neuropathology represent a natural response to increasingly overwhelming environmental demands (Hussian 1981). Declines in verbal abilities, including the ability to verbally label and respond to private events (e.g., pain, discomfort, fear, boredom, etc.), are a leading risk factor for excess disability in persons with neurocognitive disorders. This is due to the fact that the lack of ability to label, report, and respond to private events such as pain or discomfort increases the

likelihood of the emergence of behavior changes that are misattributed to neurodegeneration. The default attribution of behavior change to neuropathology is a leading threat to the behavior health and quality of life of persons with neurocognitive disorders. Knowledge of the distinction between normal or expected behavior change or decline versus unusual behavior changes and careful examination of the context in which behavior changes occurred are critical for understanding the behavioral health of an individual who has a neurocognitive disorder and detecting adverse medical or environmental events. Because neurodegenerative disorders inevitably produce significant declines in behavioral repertoires, there is a risk that all observed behavior changes will be attributed to neurodegeneration, including behaviors that are a response to acute, treatable conditions such as pain, infection, or medication side effects. Through education and guided practice, family and professional caregivers can learn to understand and better predict the behavior of persons with neurocognitive disorders and hence respond in a more empathic and supportive manner (Nichols et al. 2011).

Given the current lack of a cure or effective treatment for neurocognitive disorders, geriatric healthcare advocacy groups have identified the development of support services that promote the quality of life of affected persons and their families as a priority (Odenheimer et al. 2014). The variable nature of the symptom presentation and trajectory of these disorders can limit the utility of traditional medical population-based approaches to disease management. In contrast, the idiographic nature of behavior analysis can readily accommodate the heterogeneous symptom presentation and the influence of idiosyncratic personal histories and contextual factors on the functioning of persons with neurocognitive disorders. An increasing body of literature demonstrates that behavior-analytic strategies are effective for both preventing and reducing excess disability and what are commonly described as noncognitive psychiatric symptoms, including resistance to care, wandering, and disruptive vocalizations exhibited by persons with dementia (Fisher et al. 2007; Hussian 1981).

## Behavior Analysis of Health-Related Behaviors

Chronic illness and disability disproportionately affect older adults relative to other age groups. Numerous studies have documented the effectiveness of behavior-analytic strategies for promoting behavioral health and adaptive functioning in order to prevent or delay the onset of morbidity in healthy adults and prevent excess disability in persons with chronic illnesses. Domains targeted have included lifestyle factors that are known risk factors for chronic illnesses including exercise, diet, and smoking (LeBlanc et al. 2011; Roane et al. 2015). The following discussion focuses on how the principles of behavior analysis have been applied to foster health-promoting behaviors.

Behavior analysis of health-related behaviors considers the complex interaction of an individual's repertoire and contextual variables (antecedent and consequent stimuli) that promote or interfere with the occurrence of desired behavior(s). Analysis of the temporal relationship between a behavior (e.g., eating calorie-dense food or sedentary watching of television) and its consequence(s) (e.g., immediate access to pleasurable sensation or escape from physical discomfort vs. delay of benefits) is particularly important for understanding the probability of the occurrence of health-promoting versus health-interfering behaviors. The more powerful effect of immediate reinforcement relative to delayed consequences can be a significant barrier to behavior change. Further, many health-interfering behaviors are maintained by *primary* reinforcers (i.e., stimuli that do not require conditioning to function as a reinforcer such as food or the reduction of pain or discomfort) while health-promoting behaviors are often maintained by delayed consequences and/or *secondary* (i.e., conditioned) reinforcers such as praise, a number appearing on a scale, or fitting into smaller-size clothing. The inherent delay in the consequences of many health-promoting behaviors can limit the effectiveness of setting long-term and abstract verbal goals such as "losing weight" or "getting in shape." Behavior-analytic strategies of health

promotion tend to address the differential effects of immediate versus delayed reinforcement by incorporating goal setting that focuses on increasing specific, concrete behaviors that are achievable in a short amount of time (Roane et al. 2015; King 2001). Consideration of age-associated barriers that may interfere with goal attainment is also important. Potential barriers may include chronic pain conditions, access to transportation and resources such as affordable nutritious food and fitness facilities and equipment, and reduced mobility or endurance.

Self-monitoring of specific behaviors is incorporated within many behavior-analytic health promotion programs as it allows the individual to assess the occurrence of desired behaviors, competing health-interfering behaviors, and progress toward goals in real time. Self-monitoring also enables individuals to identify barriers that require manipulation by providing detailed information about antecedents in instances when the individual deviated from their goals or lapsed. Social support in the form of praise for health behavior adherence has also been found to be effective in promoting health-promoting behaviors in older adults as it can function as an immediate, secondary reinforcement of behaviors that compete with maladaptive behaviors that have been historically maintained by powerful primary reinforcers including food or escape from discomfort by stopping exercise (Roane et al. 2015; King 2001; Penedo and Dahn 2005; Killgore et al. 2013).

Stimulus control or antecedent-based strategies involve arranging the individual's environment in order to increase the probability that a health-promoting behavior will occur while reduce the probability of the occurrence of health-interfering behaviors. Strategies include removing antecedents for undesired behavior while increasing the salience of antecedents associated with the health-promoting behavior. For example, in promoting physical activity, an antecedent-based intervention might involve placing exercise shoes by the front door, laying out exercise clothes on the bed, or installing a stand-up desk in an office. The promotion of nutritious eating might involve removing unhealthy foods from the home and

following a structured meal plan with restricted choices. In the case of smoking cessation, an antecedent-based strategy might be avoiding settings or behaviors associated with smoking, for example, bars or having cigarettes in the home, and involves replacing smoking behavior with an alternative, incompatible adaptive behavior, such as chewing gum or holding a cigarette-shaped object (LeBlanc et al. 2011; Roane et al. 2015).

Behavior-analytic relapse prevention training involves normalizing deviation from goals when attempting behavior change, for instance, missing a scheduled walk or consuming calorie-dense food, and orienting the client to the identification of antecedents or triggers for lapses as well as behavioral skill training like problem solving or relaxation exercises to promote adaptive responding if relapses occur (LeBlanc et al. 2011; Roane et al. 2015; King 2001; Penedo and Dahn 2005; Killgore et al. 2013). For example, an individual who is striving to adhere to a nutritious diet might be instructed to consume high-volume but low-calorie foods prior to social gatherings in order to prevent hunger and reduce the reinforcement value of high-calorie foods.

Sedentary lifestyle, poor diet, medication non-adherence, and smoking are well-established risk factors for an array of preventable, chronic illnesses prevalent within the elderly population including cardiovascular disease, stroke, osteoporosis, many cancers, and type 2 diabetes. Relatedly, there is also vast evidence that even small changes in lifestyle factors such as increasing physical activity can decrease the morbidity and mortality due to cardiovascular disease (King 2001; Penedo and Dahn 2005; Killgore et al. 2013; Chapman et al. 2013). In addition, recent research indicates physical activity can buffer age-related cognitive decline. That is, older adults who are physically active are less likely to demonstrate cognitive decline relative to their more sedentary counterparts (Chapman et al. 2013). Thus, the promotion of adaptive functioning in older adults via behavior-analytic strategies has the potential to contribute to both improved quality of life and the prevention of chronic disease and disability.

## Cross-References

- ▶ [Alzheimer's Disease, Advances in Clinical Diagnosis and Treatment](#)
- ▶ [Anxiety and Cognition](#)
- ▶ [Anxiety Disorders in Later Life](#)
- ▶ [Behavioral and Psychological Symptoms of Dementia](#)
- ▶ [Dementia and Neurocognitive Disorders](#)
- ▶ [Depression and Cognition](#)
- ▶ [Depression in Later Life](#)
- ▶ [Lifestyle Factors on Depression, Effects of](#)
- ▶ [Suicide in Late Life](#)
- ▶ [Vascular and Mixed Dementia](#)

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## Behavioral and Psychological Symptoms of Dementia

Brian Draper<sup>1,2</sup> and Anne Wand<sup>1,3</sup>

<sup>1</sup>School of Psychiatry, University of NSW, Sydney, NSW, Australia

<sup>2</sup>Academic Department of Old Age Psychiatry, Prince of Wales Hospital, Randwick, NSW, Australia

<sup>3</sup>South East Sydney Local Health District, Sydney, NSW, Australia

### Definition

The term “Behavioral and Psychological Symptoms of Dementia” (BPSD) was coined in 1999, being defined as “symptoms of disturbed perception, thought content, mood or behaviour that frequently occur in patients with dementia” (Draper et al. 2012a). BPSD is not a unitary concept but rather an umbrella term that encompasses a number of symptom groups or syndromes; currently, there is limited agreement about syndrome composition, although “agitation,” “moods,” and “psychosis” feature prominently. It is likely that BPSD syndromes have a different prevalence,

etiological factors (biological, psychosocial, environmental), prognosis, and hence management implications.

## Introduction

In the historical descriptions of dementia by Esquirol in 1838 and by Alzheimer in 1907, behavioral and psychological symptoms were recognized as features of the dementia syndrome (Draper et al. 2012a). For example, Alzheimer's description of his patient Auguste Deter included symptoms of paranoia, delusions, vocal disruption, and hallucinations in addition to cognitive impairment. Despite this, for many years the focus of clinical dementia research was on the cognitive features, and it was only in the 1980s that an increase in research into the noncognitive symptoms occurred (Draper et al. 2012a).

One of the difficulties in establishing BPSD syndromes has been the term "agitation," which has been used in a variety of ways by clinicians and researchers. An Agitation Definition Working Group recently used a survey and consensus process to form an agitation definition for dementia and cognitive impairment that has four components: the behavior is consistent with emotional distress; there is excessive motor activity, verbal or physical aggression; the behaviors cause excess disability; and the behaviors are not solely attributable to another disorder (Cummings et al. 2015).

Another difficulty in establishing BPSD syndromes has been the lack of consensus about measurement. Numerous rating scales have been developed to measure BPSD, and there is no single gold standard, with one recent overview article listing 35 scales (Ford 2014). Some of the more commonly used scales are the Neuropsychiatric Inventory (NPI), the Cohen-Mansfield Agitation Inventory (CMAI), and the Behavioral Pathology in Alzheimer's disease rating scale (BEHAVE-AD). Each relies on the observations of a person who has been in close contact with the person with dementia over the previous 2–4 weeks (depending on the scale used). The NPI and BEHAVE-AD have a neuropsychiatric focus

with symptoms being rated in clusters such as delusions, hallucinations, mood disturbance, and sleep disturbance, while the CMAI is more descriptive of individual behaviors such as biting, scratching, screaming, and pacing. Hence, the choice of rating scale might depend on the purpose. There is also a scale that focuses specifically on depression, the Cornell Scale for Depression in Dementia (CSDD).

BPSD occur in almost all people with dementia, with the community-based Cache County Study reporting a 97% 5-year prevalence of any type of BPSD as measured by the NPI. Many types of BPSD tend to persist, with 18-month follow-ups in the Cache County Study reporting that delusions persisted in 66% of individuals, depression in 58%, and aberrant motor behavior in 56%. However, it is noteworthy that population-based studies of BPSD have shown variability of types of BPSD in different countries; for example, apathy is less prevalent in China and Nigeria than in Japan, the United States, Spain, and the UK (Wang et al. 2012). BPSD are particularly common in nursing homes with the point prevalence ranging from 69% to 92% in studies from Australia, Norway, the Netherlands, and the United States (Draper et al. 2012a).

There has been a paucity of research that has explored the relative prevalence of BPSD in different types of dementia (Ford 2014). However, high rates of hallucinations and disinhibition have been reported in Lewy body dementia, consistent with visual hallucinations being one of the core diagnostic criteria for the disorder. Similarly, early behavioral disinhibition is a diagnostic criterion for frontotemporal dementia, which is distinguished from other types of dementia in most studies by the presence of disinhibition, apathy, and aberrant motor behavior. Comparisons of vascular dementia and Alzheimer's disease have had inconsistent findings, with some studies reporting few differences and others showing higher rates of apathy, depression, and emotional lability in vascular dementia and higher rates of psychosis (most commonly delusions) in Alzheimer's disease. Depression is more strongly associated with Parkinson's dementia than Alzheimer's disease.

## Etiology of BPSD

Research into the etiology of BPSD is in its infancy and has mainly focused on Alzheimer's disease. There is a growing body of research, but much of it is unreplicated. Current models suggest an interaction of a broad range of factors including neurobiological substrates (such as genetic polymorphisms, neurotransmitter changes, neuropathology, medical comorbidity), premorbid personality, psychological reactions, and social aspects including caregiver and environmental issues (Draper et al. 2012b).

There are three main explanatory models of how caregiver interactions might contribute to BPSD. The "stress threshold" model is based on the observation that people with dementia have a lower threshold to coping with stress, with behavioral disturbances occurring when this threshold is exceeded. The "learning theory model" emphasizes the importance of inadvertent reinforcement of inappropriate behaviors; for example, caregivers might only respond to a noisy person when they are calling out and not when they are quiet. The "unmet needs model" recognizes that people with more severe dementia cannot always communicate their needs, such as social interaction, pain relief, hunger, or physical activity; hence, caregivers have the challenge of working out what unmet needs the behavior might represent. The models are not mutually exclusive; it is likely that elements of each might operate simultaneously with the individual circumstances of the person with dementia perhaps indicating which factors might be more relevant in their situation (Draper et al. 2012b).

It is likely that the relative contribution of each of these etiological factors varies according to the specific behavior and type of dementia. Here, we cover some of the more prominent types of BPSD and outline the key etiological factors that have been identified for each.

### Psychosis (Delusions and Hallucinations)

In general, psychosis is mainly associated with neurobiological substrates. This includes medical comorbidity, such as infection, hypoxia, or drug toxicity, which may result in delirium with

associated acute psychosis, particularly visual hallucinations and paranoid ideation, which develops over a few days. There are often features of agitation present. From a clinical perspective, this is a critically important diagnosis to make due to the high morbidity and mortality associated with delirium.

Psychosis otherwise has a more gradual onset and is more common in females, declining cognition and increasing severity of neuropathology in Alzheimer's disease. There is preferential involvement of the frontal lobe and/or limbic regions, although visual hallucinations tend to involve the occipital lobes (Draper et al. 2012b). On functional imaging, psychosis is associated with hypoperfusion in frontal and temporal lobes. Some delusions may be explained by memory deficits (e.g., misplacing items and interpreting this as theft) and misidentification of people and place. Although inappropriate caregiver strategies are also reported to be associated with delusions, it is unclear whether these are etiological or reactive to the psychosis.

There is an increased familial risk of psychosis in Alzheimer's disease as suggested in a study involving the combination of samples from the United States and the UK that found a significant association between proband psychosis status and the occurrence of psychosis in Alzheimer's disease in siblings with linkage peaks occurring on chromosomes 7 and 15. A meta-analysis of serotonergic system genes concluded that the HTR2A T102C polymorphism is a significant risk factor for psychosis in Alzheimer's disease. These receptors may also modulate antipsychotic response. Polymorphisms in dopamine receptors have also been associated with psychosis in most studies, particularly D3 genes, where two studies found homozygous (i.e., having identical pairs of genes) carriers of the 1 allele to be at increased risk (Draper et al. 2012b).

In Lewy body dementia, in contrast to Alzheimer's disease, visual hallucinations, but not delusions, are associated with less tangle burden but more cortical Lewy body pathology and may be related to cholinergic deficits in the temporal cortex. Further, visual hallucinations are associated with hypometabolism in visual

association areas rather than the primary visual cortex. However, delusions in Lewy body dementia have a similar substrate to psychosis in Alzheimer's disease.

### Aggression and Agitation

Aggression and agitation are often associated with other frontal symptoms such as disinhibition and may be a reflection of executive dysfunction. Aggression is more common in males and vocally disruptive agitated behavior more common in females. The etiology may be complex, multifactorial, and include medical comorbidities, history of head injury, alcohol and substance misuse, neurobiological substrates of dementia, and social, psychological, or environmental factors. Premorbid personality may also interact with these factors. Verbal and physical aggression may be secondary to pain, physical discomforts (e.g., constipation, thirst, overheating), depression, and other health issues. These behaviors are often best interpreted as a form of communication of distress. Consequently, patients with agitation and aggression have diverse reactions to caregiver intrusion into their personal space, with some improving and others worsening depending on the type of interaction, indicating a need for training of caregivers and tailored interventions.

Neurobiological substrates of aggression and agitation in Alzheimer's disease are multiple and complex. Genetic factors include polymorphic variations in serotonergic and dopaminergic genes. Dopaminergic, cholinergic, serotonergic, and noradrenergic neurotransmitter changes have been reported in the brain. For example, in Alzheimer's disease, aggression is linked with choline acyltransferase (ChAT) activity in the frontal and temporal cortices, with reduced ratios of ChAT activity to dopamine D1 receptor binding and dopamine concentration in the temporal cortex. Consistent with this is the finding that on functional neuroimaging, aggression is associated with hypoperfusion of the temporal cortex. Further, dopamine-blocking agents improve aggressive behavior in dementia. Aggression in Alzheimer's disease is also associated with an increased postsynaptic sensitivity to

noradrenaline with a lower concentration of noradrenaline producing an amplified effect. Locus coeruleus neuronal loss, upregulated expression levels of tyrosine hydroxylase mRNA, and an increase in noradrenaline synthetic capacity in residual cells may account for the increased postsynaptic sensitivity to noradrenaline. The dopaminergic system has also been implicated in aggression and agitation in frontotemporal dementia, a type of dementia that has frontal and temporal lobe neurodegeneration, with increased activity and altered serotonergic modulation of dopamine neurotransmission (Ford 2014; Draper et al. 2012b).

### Depression

Depression tends to occur earlier in the course of dementia, and for many, it can be the presenting problem. In some individuals, this represents a psychological reaction to self-awareness of early cognitive decline, while in others it appears to be associated with neurobiological changes associated with the evolving dementia, with frontal symptoms such as apathy being associated with more severe depression. Depression is more common in young-onset dementia with some evidence of an increased risk of suicide in the 3 months post diagnosis. A history of depression is also a risk factor for dementia, and so in many there is likely to be a predisposition to further depressive episodes and, as in cognitively intact people, those with dementia may become depressed in the context of stressful life events such as the death of a partner, admission into institutional care, pain, and other physical discomforts. Frustration from impaired communication skills, particularly in those with aphasia disproportionate to impairment in other cognitive domains, can also precipitate depression.

Neurobiological substrates to depression include abnormalities in the serotonergic neurotransmitter system including polymorphisms of serotonergic genes, reduced noradrenaline levels, and polymorphisms in dopaminergic genes. Neuroimaging studies show hypoperfusion (i.e., decreased cerebral blood flow) in frontal, temporal, and parietal lobes to be associated with depression in Alzheimer's disease (Ford 2014; Draper et al. 2012b).

## Apathy

In the absence of depression, apathy is generally a reflection of neurobiological changes. Apathy is associated with frontal-subcortical dysfunction irrespective of the type of dementia. In Alzheimer's disease, neuroimaging studies show hypoperfusion in frontosubcortical structures, especially the anterior cingulate, while in frontotemporal dementia there is disruption of cortical-basal ganglia circuits. Neurotransmitter changes in Alzheimer's disease include cholinergic deficiency and a blunted dopaminergic brain reward system (Ford 2014; Draper et al. 2012b).

## Clinical Features of BPSD

The hallmarks of dementia are deterioration in aspects of cognition and social and physical functioning. The term BPSD is not a diagnosis in itself but refers broadly to various clinical presentations seen in people with dementia. BPSD is an important development in a person with dementia as it is associated with longer hospital admissions and more complications, more disability, greater likelihood of placement in a residential aged care home, more rapid rate of decline, greater financial costs, reduced quality of life, greater mortality, and significant stress for carers and staff in residential facilities (Draper et al. 2012a). From a clinical perspective, BPSD can be subdivided into behavioral and psychological symptoms.

### Behavioral Symptoms

#### Aggression and Agitation (Verbal or Physical)

Agitation is common in people with dementia, and the prevalence increases with the progression of cognitive impairment. Agitated behaviors may be divided into four subtypes, aggressive, nonaggressive, verbal, or physical. Aggressive behaviors include swearing, screaming, scratching, pushing, grabbing, hitting, kicking, and biting. Nonaggressive behaviors include calling out/repeated requests for attention, being verbally demanding, complaining, excessive/unrealistic anxiety, repetitive questions, phrases, concerns, or sounds, pacing and wandering,

rummaging, restlessness or purposeless activity, repetitive movements or mannerisms, hiding things, and inappropriate dressing or disrobing. People with poor social relationships are more likely to be aggressive. Unsurprisingly, aggression and agitation are associated with admission to residential care.

#### Disorders of Sexual Expression

Sexual disinhibition may be verbal or physical and directed at self or others. These behaviors may be particularly confronting for caregivers and pose logistical problems in residential care. Sexually inappropriate behaviors may range from requests for unnecessary assistance in changing/bathing and genital care to suggestive gestures, disrobing, exposing, or masturbating in public, sexually explicit language, remarks or recounts of sexual experiences, and unwanted physical contact (e.g., kissing, inappropriate touching/fondling/grabbing, sexual advances, and attempts to have intercourse without consent).

These behaviors may relate to lack of an intimate partner, lack of privacy, misinterpretation of cues (e.g., caregivers touching them when assisting with personal care), an unfamiliar or understimulating environment, predementia sexual behavior, medication (e.g., dopaminergic drugs), mood disorders, or psychotic symptoms (Royal Australian and New Zealand College of Psychiatrists 2013).

#### Sleep Dysfunction

Disturbed circadian rhythm may complicate the progression of dementia and cause considerable carer stress. In dementia with Lewy bodies (a type of dementia characterized by fluctuation in mental state and intermittent confusion, parkinsonism, visual hallucinations, and falls), REM sleep behavioral disorder (which involves the person acting out their vivid dreams while asleep) may occur early and even precede the formal diagnosis of dementia. Sundowning is a term for the onset or worsening of BPSD symptoms in the afternoon or evening. It may also relate to disturbed circadian rhythms. Sleep dysfunction may also relate to comorbid medical conditions (e.g., sleep apnea, congestive cardiac failure, pain, depression),

environmental conditions (e.g., room temperature, lighting, changes in the environment), and medication (e.g., diuretics).

#### Wandering

Wandering is a symptom particularly burdensome for carers, which may lead to placement in residential care. It may include exit seeking and repeated attempts to leave home and aimless walking. Under stimulation, boredom, anxiety, and cognitive deficits in navigation may be contributory.

### Psychological Symptoms

#### Psychosis

**Delusions** Persecutory or paranoid delusions are the most widespread type in dementia. Common delusional beliefs include theft, that a spouse/caregiver has been replaced by an impostor (Capgras syndrome), that the person's residence is not their home, infidelity, and abandonment (Grossberg et al. 2012). Delusions may also be distressing for caregivers and increase the risk of violence toward them, particularly with delusions of infidelity and of impostors. Delusions in dementia are a risk factor for physical aggression.

**Hallucinations** Visual hallucinations are the most common type in dementia, followed by auditory hallucinations, with other sensory modalities rare. A common hallucination is of phantom boarders, where the person sees people in the home who are not actually there. Visual misperceptions also occur, when there is a visual stimulus but it is misinterpreted. This may relate to visual agnosias (impaired recognition of items presented visually) or problems with contrast sensitivity.

**Misidentification** External stimuli may be misinterpreted leading to misperceptions, which may be held with delusional intensity. The common types of misidentifications are of self (not recognizing one's own image), phantom boarders (people being in the person's home), of other people (e.g., a spouse or family member), and of events on television being interpreted as occurring

in real time around them. Misidentification includes the defined syndromes Capgras, Fregoli (i.e., believing that a person is someone else in disguise), and intermetamorphosis (i.e., believing that familiar people in their lives have switched identities).

**Anxiety** Anxiety may occur on its own or in conjunction with another type of BPSD. Themes may relate to health, the future, finances, and activities or events not previously considered stressful. A common anxious cognition in dementia is fear of being left alone, which may reach phobic proportions. Godot syndrome may also occur, where the person repeatedly asks questions about an upcoming event.

**Depression** The spectrum of depressive symptoms is common in dementia, with depressed mood being most common (40–50%), followed by subsyndromal depression and major depression (10–20%) (Grossberg et al. 2012). It can be difficult to diagnose depression due to the overlap with somatic symptoms of dementia (such as weight loss, agitation, apathy, disturbed sleep) and the increasing communication and language difficulties as dementia progresses. A depressive illness should be considered if there is a rapid deterioration in cognition, a family or personal history of depression, pervasive low mood and anhedonia, unexplained acute behavioral change, or if the family is concerned about depression.

**Apathy** Apathy is a lack of interest, interactivity, emotion, concern, motivation, and initiation of activities. It is a common symptom, which may occur in up to 50% of patients with mild to moderate dementia. Symptoms of apathy and major depression may overlap, including reduced interest, lack of energy, psychomotor slowing, and poor motivation. Apathy may be distinguished from a depressive illness when amotivation occurs without the somatic and mood symptoms of depression (sadness and psychological distress). The following case demonstrates how a carer may interpret apathy in a loved one with dementia and the commonality with features of depression.

*Case 1* Sidney is a 91-year-old man living at home with his wife. He was diagnosed with mixed vascular/Alzheimer's dementia 6 years ago. His wife refers him for assessment of depression. She complains that for the last year he just sits in his chair and stares at the wall. He no longer waters the plants and even seems to have lost interest in cricket as he does not even turn on the television when sitting in front of it. She is frustrated by how "lazy" he is and that he no longer even helps with the gardening. He does not strike up conversation with her but responds if she talks to him. When their great-grandchildren visit, he smiles and watches them play.

This case is illustrative of apathy with profound lack of motivation, self-initiated activities, and indifference but the retention of warmth and reactivity when caregivers take the initiative to provide enjoyable activities and interactions.

## Principles of Management

BPSD may arise for numerous reasons, thus there is no single approach to management. The environmental, biological, psychological, and interpersonal factors should be considered when assessing someone. BPSD may be considered a form of communication, whereby unmet needs are expressed through behavior (Royal Australian and New Zealand College of Psychiatrists 2013). Aspects of the individual's personality, culture, and personal experiences may also influence their presentation. The first step is to have a clear description of the behavior and to evaluate whether intervention is needed. It may help to have caregivers/residential care staff keep a behavior diary prior to formal assessment. The ABC (antecedent, behavior, consequences) approach may be used to comprehensively describe behavioral problems. Using this method, the clinician records the antecedent events leading to the behavior (the context and any precipitant), the particular behavior, and the consequences of the behavior (for the patient, staff, others).

Delirium must first be excluded in a person with dementia who has an acute change in mental

state or behavior. Dementia is a strong risk factor for delirium. The hallmarks of delirium are sudden onset of or new confusion, fluctuation in cognition and level of consciousness, and inattention. The etiology may be multifactorial and include medications, pain, and physical illness. Anesthetics, drug intoxication or withdrawal, and drug interactions, adverse effects, and polypharmacy may be relevant. Drugs of particular concern include psychotropics and those with cholinergic properties. Pain is a prevalent symptom in people with dementia but often unrecognized and undertreated. Common causes of pain include wounds, fractures, urinary retention, poor dentition, constipation, and surgery. Any acute medical illness may precipitate a delirium, so broad potential causes should be considered and treated accordingly. It may take days to several weeks for delirium to resolve, even after the underlying cause is treated.

## Nonpharmacological

Nonpharmacological interventions are first-line treatment for BPSD. A person-centered approach emphasizes the importance of understanding the individual- what their interests, past experiences, and preferences are- and how this may inform the management of their BPSD (Royal Australian and New Zealand College of Psychiatrists 2013). For example, past negative experiences of institutionalization may be unwittingly reenacted in residential care, or knowledge of a person's hobbies may be used to divert them from the behavior or to address unmet needs for stimulation and social contact.

### Environment

Environmental factors may contribute to BPSD. A change to the environment, including the interpersonal mix of residents or staff at a facility, may precipitate BPSD. It is important to evaluate whether there are extremes of temperature, lighting, stimulation, noise, or clutter. There is good evidence for unobtrusive safety features improving resident well-being and depression (Fleming et al. 2009). Exit seeking may be reduced by minimizing the number of locked doors or obscuring door handles, so as not to attract attention, and

**Behavioral and Psychological Symptoms of Dementia, Table 1** Effective non-pharmacological treatments for BPSD

Treatment	Outcome
Essential oils: lavender and lemon balm	Limited evidence for reducing agitation when used as a sprayed mist and in facial/arm massage, respectively. Lemon balm also improves social engagement and constructive activity
Recordings of family voices (15 min)	Reduced agitated behaviours when audiotape of a family member talking was played through headphones. However, low level of evidence
Music: matched to person's taste Soothing sounds of water (ocean, stream)	Reduced agitated behaviours more than generic classical music. When used during baths reduced rates of physical and verbal aggression Reduced verbally disruptive behaviour
One-to-one interaction with a clinician (active engagement in conversation, sensory kit, gentle exercise, or manual activities matched to their skills and interests)	Reduced verbally disruptive behaviours
Daily physical activity (30-min)	Improved mood more effectively than a gentle walking group or conversation group
Sleep hygiene program (encouraging daytime activity, set-personalised bedtime routine, minimising interruptions at night, minimal light and noise at night)	Major reduction in time spent sleeping during the day and minor reduction in the time spent awake at night
Snoezelen room (multisensory stimulation)	Moderate evidence for reducing depression, aggressive behaviour and apathy and improves wellbeing during morning care, but benefits only apparent for a short time after the session
Animal-assisted therapy (pets)	Promotes social behaviour, improves nutrition, and reduces agitation and/or aggression
Therapeutic activities (a heterogeneous group including stimulation, cooking, Montessori methods, behavioural elements, creative activities)	Some benefit for apathy, especially if individually tailored (Brodaty and Burns 2012)

when doors do not have glass panels. An environment that provides a variety of spaces may reduce depression and anxiety, improve social interaction, and help the person find their way around. Single rooms are also beneficial in residential care. Optimization of levels of stimulation is effective, by both reducing unhelpful stimulation (e.g., noise or busy doors) and increasing lighting (e.g., good visual access to toilets). A homelike environment reduces aggression, but it is not possible to disentangle the effects of small unit size, staff skills, and care philosophy or familiar physical environment (Fleming et al. 2009). Similarly, there is moderate evidence for providing opportunities to engage in ordinary activities of daily living (ADLs), but the effects are hard to distinguish from staff factors and the contribution of the environment (Fleming et al. 2009). The provision

of outside space is only beneficial if combined with staff interaction. A number of other nonpharmacological treatments may confer benefit in BPSD (O'Connor et al. 2012, see Table 1).

Sensory impairment is associated with BPSD and may be reversible. A thorough visual or auditory examination should be part of the assessment of hallucinations and the environment optimized to improve visual contrast and lighting. Inability to speak the local language may act as a sensory impairment by impeding communication. Interpreters should be used to optimize the likelihood of effective communication.

#### Psychological Approaches

Psychoeducation for caregivers about how to manage BPSD is an effective strategy, with benefits lasting months (Livingston et al. 2005).

There is also evidence for behavioral management strategies, which target behaviors of the individual or caregiver. Individual sessions are more effective than groups (Livingston et al. 2005).

There are a few types of psychotherapy, which have been evaluated in people with dementia. Any intervention should be based upon a person-centered framework, which incorporates the unique experiences and preferences of the individual. Overall, evidence is poor, and the methodological quality of studies is weak (Livingston et al. 2005). Cognitive stimulation therapy uses information processing rather than knowledge of facts to stimulate and engage people with mild to moderate dementia in an optimal learning environment. It may reduce depression and improve quality of life, during treatment and for some months afterward. A small pilot randomized controlled trial of a cognitive behavioral therapy-based intervention for people with dementia and anxiety, Peaceful Mind, showed short-term benefits in terms of improved quality of life and reduced anxiety in participants as well as reduced related distress in carers (Stanley et al. 2013).

A number of other psychotherapeutic approaches have been studied but have low or no evidence (Livingston et al. 2005). Validation therapy emphasizes a person's current feelings as real regardless of the reality of the situation. It encourages and validates expression of feelings. For example, if a person is agitated because they cannot be with a loved one, the therapist using a validation approach will acknowledge their feelings and engage them in a discussion about the relationship. Reminiscence therapy focuses on stimulating memory as it relates to an individual's life history, e.g., past significant events. Materials such as old newspapers or personal items may be used to stimulate memories and enable sharing of their experiences. Reality orientation therapy involves presenting information about place, time, and important others using visual prompts (e.g., calendars, clocks, personal items, regular family visits, lighting appropriate to time of day). The rationale is that reminders, which improve orientation, improve functioning. This therapy also has low-level evidence.

## Pharmacological

Overall, there is only modest evidence for the use of pharmacotherapy in BPSD and risk of clinically significant adverse effects (Royal Australian and New Zealand College of Psychiatrists 2013). Most pharmacotherapy trials, although methodologically sound, are often limited by their short duration and follow-up period and exclusion of non-Alzheimer's dementias. Nonetheless, medication may be indicated in conjunction with nonpharmacological measures when the BPSD is moderate to severe, poses safety concerns, nonpharmacological interventions have failed, or the BPSD is affecting function or the quality of life of the patient or carer. Informed consent from the patient and their substitute decision-maker is essential.

Key issues to be considered before initiating a trial of pharmacotherapy for BPSD are whether drug treatment is warranted and why; whether the particular target symptom is likely to respond to medication; which class of drug is most appropriate/evidence based; adverse effects of the drug; the duration of drug treatment, and planned review and monitoring of response and adverse effects. Other general principles of prescribing include slow and careful titration from a low dose, consideration of the individual's medical comorbidities, which may affect drug metabolism and excretion, and avoiding polypharmacy. Particular care must be taken with people with dementia with Lewy bodies or Parkinson's disease, who have greater sensitivity to antipsychotic medication.

## Pharmacological Cognitive Enhancers

Cholinesterase inhibitors are not currently indicated for BPSD. Meta-analyses of cholinesterase inhibitors in BPSD have found statistically significant differences in global neuropsychiatric scores compared to placebo, but clinical significance is doubtful (Campbell et al. 2008). Subgroup analyses show cholinesterase inhibitors may be useful when targeting specific BPSD symptoms, including apathy and indifference, hallucinations and delusions, anxiety and depression, and

aberrant motor behavior (Setz and Lawlor 2012). Rivastigmine is significantly beneficial in dementia with Lewy bodies, particularly for agitation and visual hallucinations. Withdrawal of cholinesterase inhibitors may lead to worsening of BPSD within 6 weeks. Adverse effects such as diarrhea, gastrointestinal upset, agitation, bradyarrhythmia, and anorexia may limit use.

Memantine, an NMDA glutamate receptor antagonist may be useful for BPSD. Although it was found to modestly reduce scores on the neuropsychiatric inventory, the clinical significance is uncertain. It may be most useful for target behaviors such as agitation, aggression, delusions, hallucinations, and irritability. It may delay the emergence of agitation in people with dementia. Side effects include dizziness, drowsiness, constipation, hypertension, anorexia, headache, anxiety, delirium, and psychosis (in dementia with Lewy bodies).

## Antidepressants

Evidence is lacking for the use of antidepressants in depression with dementia. Nonpharmacological strategies should be used first and antidepressants reserved for when these are unsuccessful or in more severe cases with suicidal ideation. Selective serotonin reuptake inhibitors are first-line agents. Tricyclic antidepressants should be avoided due to the risk of delirium conferred by the high anticholinergic burden. Citalopram, a selective serotonin reuptake inhibitor, may be effective for agitation/aggression and comparable in efficacy to risperidone and more effective than perphenazine (an antipsychotic). Adverse effects may include gastrointestinal symptoms, hyponatremia, falls, and, in citalopram, prolonged QTc interval (an abnormality on electrocardiograph which may predispose to cardiac arrhythmias) at doses 40 mg or greater.

The following case demonstrates the assessment and multimodal management of verbal agitation due to an untreated anxiety disorder.

*Case 2* Mary is an 83-year-old nursing home resident with advanced Alzheimer's dementia

and a history of anxiety. She is unable to walk and stays in her room. The staff ask for assistance to manage her constantly calling out "help." The vocalization has been present for years but has become more frequent and associated with distress in recent months. The general practitioner started risperidone (2 mg nocte), with little effect.

The staff complete a behavioral diary which shows that the calling out is greatest in the evenings and does not occur during bathing or meal times (when she is fed). Sometimes, she grabs at her throat and looks distressed. When her son sits holding her hand, the vocalization reduces. There are no abnormalities on physical examination or pathology tests. The staff have moved her to a room near their station so they can reassure her frequently. This works for a brief time, then she calls out again when they leave. During the assessment, Mary has no spontaneous speech other than calling out "help." She does not maintain eye contact. Tone is mildly increased in her arms. Her affect is fearful. She nods in agreement when asked about feeling worried and later about breathlessness. The vocalization becomes louder and more frequent as the psychiatrist leaves. Further discussion with staff reveals she used to feed the pet rabbits and sit out in the garden area but has not done so in several weeks due to short staffing. She now shares a room with a non-English-speaking resident. Mary's son confirms a history of significant anxiety and depression, with several hospitalizations.

The psychiatrist concludes that Mary has a relapse of her anxiety disorder with probable panic attacks. She is likely to be understimulated and lonely. Following discussions with staff, efforts are made to bring her into the dayroom beside English-speaking residents and for her to resume her role of feeding the rabbits. The risperidone is stopped due to lack of efficacy. With consent from Mary's son, she is recommenced on sertraline, which she responded to previously. The vocalizations reduce over a few weeks; she smiles occasionally at staff and appears less worried. Further review is scheduled to monitor progress.

This vignette demonstrates the importance of comprehensively describing the behavior using the ABC approach while taking into account

individual historical factors, the environment, and nonverbal communication. Psychotropic medication may be indicated and useful but should be ceased if ineffective.

## Antipsychotics

There is modest evidence for the use of either haloperidol or risperidone for aggression but limited evidence for other agitated behaviors in dementia (Schneider et al. 2006). Aripiprazole may be useful for agitation and aggression in Alzheimer's disease. Risperidone also confers modest benefit for psychosis in Alzheimer's disease (Schneider et al. 2006). Quetiapine has been shown not to be of benefit in studies of agitation in dementia with Lewy bodies and Alzheimer's and may be associated with greater cognitive decline in Alzheimer's (Royal Australian and New Zealand College of Psychiatrists 2013).

Antipsychotics are associated with several risks warranting consideration. There is an elevated risk of stroke, neurological symptoms (e.g., headache, dizziness, transient ischemic attacks), and mortality, the latter higher in typical antipsychotics. The extrapyramidal side effects are well recognized, more common with typical antipsychotics, and include parkinsonism (tremor, rigidity, bradykinesia), falls, akathisia, and neuroleptic malignant syndrome. Metabolic side effects include hyperglycemia, hypercholesterolemia, and weight gain. Antipsychotics can also cause delirium and cognitive decline, especially those with prominent anticholinergic side effects, such as olanzapine and quetiapine. Ventricular tachycardia, torsade de pointes, and sudden cardiac death may be associated with some antipsychotics. Importantly, several studies have shown that BPSD remain unchanged or improve when typical antipsychotics are discontinued (Ballard et al. 2009).

## Benzodiazepines

Benzodiazepines may be used for agitation; however, there are no good studies in BPSD.

Use should be time limited, and short-acting benzodiazepines like lorazepam are preferred to reduce the risk of accumulation. Sleep hygiene strategies should be first-line treatment for insomnia and, only if unsuccessful, short-term use of temazepam. Falls, delirium, drowsiness, and ataxia are the main adverse effects.

## Anticonvulsants

Meta-analyses have shown that carbamazepine is modestly effective for agitation (Schneider et al. 2006) but inadequate evidence for sodium valproate (Konovalov et al. 2008). Side effects include falls, cognitive impairment, ataxia, blood dyscrasias, and hepatic dysfunction.

## Analgesics

Systematic, effective treatment of pain may significantly reduce agitation in nursing home residents with moderate to advanced dementia. Regular paracetamol may be sufficient for the majority of this population and buprenorphine patches required for some.

## Electroconvulsive Therapy

Although electroconvulsive therapy may be used for depression, psychosis, and agitation in dementia, especially in life-threatening situations or with symptoms nonresponsive to medication, evidence is restricted to case reports and series. Transient delirium is common after a treatment.

## Conclusion

BPSD syndromes are an important and common development in dementia occurring at all stages in the illness. They have significant and far-reaching implications for the person with dementia and their family and caregivers. As well as considering the particular type of dementia, the behaviors or psychological symptoms should be carefully

observed and described as part of a thorough assessment. Careful evaluation of the individual's social circumstances, experiences, personal history, and their medical, psychiatric, and functional history is essential to understanding the potential contributing factors. Management must similarly be tailored to the individual addressing the component causes in a collaborative approach with significant others and carers. Pharmacotherapy should be reserved for situations where other measures have failed and to target particular symptoms known to be responsive to specific medication. A plan for review and ongoing monitoring is essential. Further research that integrates neurobiological, psychosocial, and environmental domains will better develop understanding of the etiological factors underlying these clinical syndromes.

## Cross-References

- ▶ [Anxiety Disorders in Later Life](#)
- ▶ [Challenging Behavior](#)
- ▶ [Depression in Later Life](#)
- ▶ [Gerontechnology](#)
- ▶ [Horticultural Therapy](#)
- ▶ [Music Therapy, Applications in Geropsychology](#)

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## Berlin Aging Studies (BASE and BASE-II)

Julia A. M. Delius<sup>1</sup>, Sandra Düzel<sup>1</sup>, Denis Gerstorff<sup>2</sup> and Ulman Lindenberger<sup>1</sup>

<sup>1</sup>Center for Lifespan Psychology, Max Planck Institute for Human Development, Berlin, Germany

<sup>2</sup>Institute of Psychology, Humboldt University, Berlin, Germany

### Synonyms

Longitudinal studies of old age and aging

### Definition

The Berlin Aging Studies (BASE and BASE-II) are two consecutive studies of old age and aging with an interdisciplinary focus. The disciplines involved include psychology, psychiatry, geriatrics and internal medicine, genetics, sociology, and economics. The initial BASE data collection involved 14 sessions and took place in 1990–1993 with 516 men and women aged 70 to over 100 years. BASE-II currently involves five sessions with 1,600 older adults aged 60–80 years as well as 600 younger adults aged 20–35 years, who were assessed for the first time in 2011–2014.

The initial Berlin Aging Study (BASE) was launched in 1989. In 1990–1993, 516 women and men aged 70 to 100+ years and living in the former West Berlin completed an intensive protocol of 14 sessions that exhaustively assessed their physical and mental health, life histories, living conditions, and psychological status. Subsequently, seven longitudinal follow-up

assessments of surviving participants who had agreed to take part again were carried out until 2008/2009. In addition, mortality information was obtained regularly from the city registry. This allowed the examination of age- and death-related changes in old age. In 2011, a new study was launched, the Berlin Aging Study II (BASE-II), which focuses on many of the constructs examined in BASE as well as new constructs, but follows a larger group of old participants as well as a group of young adults for comparison.

In the following, BASE and BASE-II are presented in depth, first focusing on BASE, and then drawing attention to select features of BASE-II.

## The Berlin Aging Study (BASE)

### Institutional Background and Organization of BASE

The first study was initiated in 1989 by the West Berlin Academy of Sciences' interdisciplinary working group "Aging and Societal Development." It was initially directed by the late Paul B. Baltes, psychologist, and Karl Ulrich Mayer, sociologist (Baltes and Mayer 2001; Lindenberger et al. 2010; Mayer and Baltes 1999). From 1994 to 1999 the working group and BASE were continued by the newly founded Berlin-Brandenburg Academy of Sciences. BASE was carried out as a collaboration among several institutions including the psychology and sociology research centers at the Max Planck Institute (MPI) for Human Development, the Department of Psychiatry at the Freie Universität Berlin, institutes and research groups at the Virchow Clinic of the Humboldt-Universität zu Berlin, and the Evangelisches Geriatriezentrum Berlin. Over time, the study was funded by various German federal ministries (Federal Ministry for Research and Technology, Federal Ministry for the Family and Senior Citizens, and finally until 1998 Federal Ministry for the Family, Senior Citizens, Women, and Youth). The Max Planck Society for the Advancement of Science currently supports the study. The study also received additional support from the Berlin-Brandenburg Academy of

Sciences and the cooperating institutes and research groups.

The multidisciplinary nature of BASE is reflected in four research units: internal medicine/geriatrics (Elisabeth Steinhagen-Thiessen), psychiatry (Hanfried Helmchen), psychology (Paul B. Baltes, succeeded by Ulman Lindenberger and Jacqui Smith), and sociology/social policy (Karl Ulrich Mayer). At the beginning of the study (1990–1993), the project group consisted of about 60 scientists from different disciplines. In 2015, about ten scientists are still regularly involved in the analysis of the longitudinal data. Since 2004, Ulman Lindenberger heads the current BASE core group at the MPI for Human Development. From the outset, young scientists were heavily involved in BASE. By 2014, 25 diploma and masters' theses and 22 doctoral theses analyzing BASE data were completed. In many cases, the findings were subsequently published in peer-reviewed international journals.

As mentioned above, the study involves eight measurement occasions spaced over 18 years. In addition, several subsamples have been recruited for intensive study. The key features of BASE include (1) a focus on the very old (70 to 100+ years); (2) a locally representative sample, stratified by age and sex; (3) a broadly based interdisciplinarity; and (4) an emphasis on methodological issues, such as selective attrition and the measurement of change.

### Theoretical Orientations

In addition to discipline-specific topics, four integrative theoretical orientations have guided the study: (1) differential aging, (2) continuity versus discontinuity of aging, (3) range and limits of plasticity and reserve capacity, and (4) aging as a systemic phenomenon.

The theoretical orientations led the selection and analysis of the central topics of BASE that were presented in the initial monographs on the study (Baltes and Mayer 2001; Lindenberger et al. 2010; Mayer and Baltes 1999). The concept of *differential aging* covers a broad range of questions. For example, the cumulative effects of early life experience (such as historically explainable

cohort differences in education, consequences of war and epidemics, etc.) on old age, social inequality and aging, and differences between older men and women were analyzed. The question whether dementia represents *discontinuity* or *continuity* in the course of aging was one of the main research topics of the BASE psychiatry unit. Issues related to *reserve capacity and plasticity* in old age were important for the analyses of the geriatrics unit and the psychology unit. The consideration of aging as a *systemic phenomenon* has always been a key focus in BASE. Here, connections were made across domains such as sensorimotor functioning and cognition or health and well-being, and in a holistic person-oriented approach, subgroups of older adults were identified based on their profiles of functioning.

### Sample

The initial focus of BASE (1990–1993) was to obtain a heterogeneous sample, stratified by age and sex, of individuals aged 70 to 100+ years who completed a 14-session intensive protocol that involved detailed measures from each of the four participating disciplines at the first occasion of measurement. The stratified sample participating in this intensive protocol consisted of 258 men and 258 women from the former West Berlin aged 70–74, 75–79, 80–84, 85–89, 90–94, and 95+ years. The parent sample was drawn from the obligatory city register. A standardized intake assessment was also used to collect multidisciplinary data at early stages and as a repeat instrument at each later occasion of measurement. For a detailed documentation of sampling procedures and sample selectivity, see Lindenberger et al. (2001).

### Longitudinal Continuation

In order to focus on the theoretical orientations that actually emphasize the *processes* of aging as well as the dynamics and consequences for differential aging, a longitudinal continuation of the study was put in place. With longitudinal data, decisive information can be gained on all four theoretical orientations. In particular, longitudinal data allow the identification of interindividual differences in intraindividual change, provide

insights into the determinants of change, and enable analyses of systemic linkages among behavioral changes. Seven longitudinal follow-ups of the survivors from the initial sample involving different depths of assessment were completed at approximately 2-yearly intervals. A single-session multidisciplinary assessment was collected in 1993–1994 ( $N = 361$ ), reduced versions of the intensive protocol (six sessions) were collected in the periods 1995–1996 ( $N = 206$ ) and 1997–1998 ( $N = 132$ ), and repeats of parts of the psychology battery together with multidisciplinary outcome variables (e. g., screening for dementia, assessment of well-being) were collected in 2000 ( $N = 82$ ), 2004 ( $N = 46$ ), and 2005 ( $N = 37$ ). In addition, mortality information about the entire BASE sample is updated at regular intervals. At the eighth (and probably final) measurement occasion in 2008–2009, 22 surviving participants were reexamined, concentrating on psychological, geriatric, and dental assessments.

An additional focus that also influenced the design of the longitudinal study deals with the transition of the Third Age to the Fourth Age. Within the last phase of the life span, in old age, scientists differentiate between the Third and Fourth Age or between the “young old” and “old old” (Baltes and Smith 2003). This differentiation is based on the heterogeneity within the elderly population with respect to important characteristics such as morbidity, the need for care, cognitive functioning, well-being, social participation, and mortality. The precise definitions of the determinants of membership in the one or the other group or that characterize the transition from the Third to the Fourth Age still need to be identified. Based on theory, the Third Age can be described as a phase of positive quality of life, whereas the Fourth Age is characterized by dysfunction, illness, and death. Some demographers have identified the age of 85 as the average entrance criterion into the Fourth Age (Suzman et al. 1992). However, the question remains open whether this age is a fixed or mobile criterion for the end of the Third and beginning of the Fourth Age. Therefore, the analysis of the longitudinal BASE data also focuses on the investigation of the transition from

the Third to the Fourth Age and the characteristics of the Fourth Age.

Data from the Berlin Aging Study continue to provide the basis for new original publications on individual differences in late-life development. Furthermore, DNA specimens, derived from blood samples frozen at the first occasion of measurement to allow later analyses, have been retrieved and analyzed for about 380 BASE participants. Adding genetic information to the BASE data set allows researchers to explore and test genetic contributions to individual differences in late-life development.

The initial sample of 516 individuals formed the basis of the cross-sectional analyses reported in two monographs (Baltes and Mayer 2001; Mayer and Baltes 1999). Current interests of the BASE core group include issues of sample selectivity and representativeness; intraindividual variability and change; terminal decline; cognitive aging; mortality prediction; self-related change, well-being, and antecedents of successful aging; and genetic predictors of individual differences in cognitive and self-related change in old age.

The BASE data set is rich: For the first cross-sectional data collection alone, there are already 10,000 variables available per participant. External scientists can apply for access to parts of the BASE data set. Data can then be made available in accordance with the German data protection laws. In the interest of scientific exchange, BASE researchers have invested much effort and time into the documentation and archiving of the data set. This is in line with endeavors in the USA to make central data bases of important studies available to the scientific community. The data of BASE are described in an extensive and detailed documentation that can be provided on a compact disc. Copies of the questionnaires used in BASE can also be requested, and some are already part of the documentation. The BASE website ([www.base-berlin.mpg.de](http://www.base-berlin.mpg.de)) provides an overview of the study and includes a searchable catalog of the numerous BASE publications. It is updated regularly and includes a contact e-mail address ([basempi@mpi-berlin.mpg.de](mailto:basempi@mpi-berlin.mpg.de)) for reprint or information requests.

### Trajectories of Change: Age Versus Time to Death

One example of the kinds of analyses possible with the BASE data was published by Denis Gerstorff et al. (2013). Mortality-related processes are known to modulate late-life changes in cognitive abilities, but it is an open question whether precipitous declines with impending death generalize to other domains of functioning. The authors used 13-year longitudinal data from 439 deceased BASE participants to compare changes as a function of time since birth (i.e., age models) with changes as a function of time to death (i.e., mortality models). Across a large range of functional domains such as subjective health, emotional loneliness, grip strength, perceived control, and the score in the Digit Letter Test (a marker of perceptual speed), mortality models revealed reliably steeper average rates of change than age models. These findings underscore the pervasive presence of processes leading toward death in old age. Multivariate analyses with more closely spaced multi-domain measurements are needed to identify the temporal dynamics and dimensionality of this end-of-life cascade.

### Genetic Contributions to Individual Differences in Late-Life Cognitive Development

Another example of BASE findings highlights the importance of the genetic analyses that have become possible. The brain-derived neurotrophic factor (BDNF) promotes activity-dependent synaptic plasticity and contributes to learning and memory. Paolo Ghisletta et al. (2014) investigated whether a common Val66Met missense polymorphism (rs6265) of the *BDNF* gene is associated with individual differences in cognitive decline in old age. A total of 376 BASE participants with a mean age of 84 years at the first occasion of measurement were assessed longitudinally up to 11 times (due to multiple testing at several occasions of measurement) across more than 13 years on the Digit Letter Test. Met carriers ( $n = 123$ , 34%) showed steeper linear decline than Val homozygotes ( $n = 239$ , 66%). This effect was not moderated by sex or socioeconomic status and was also observed when individuals at risk for

dementia were excluded from the analysis. This finding is in line with the hypothesis that normal aging magnifies the effects of common genetic variation on cognitive functioning.

### The Berlin Aging Study II (BASE-II): Understanding Heterogeneity in Aging

BASE findings confirmed that heterogeneity is one of the most salient aspects of aging. Some individuals maintain their health and preserve their cognitive abilities into advanced ages, whereas others show precipitous and early decline. To understand the mechanisms that produce this diversity of outcomes and trajectories of aging, individuals need to be followed over time. With this goal in mind, researchers from Berlin and Tübingen initiated the Berlin Aging Study II (Bertram et al. 2014). Like BASE, BASE-II was set up as a multidisciplinary and multi-institutional longitudinal study that captures a wide range of different functional domains. Geriatrics and internal medicine, psychology, sociology, and economics are again among the disciplines involved, moreover, immunology and genetics were additionally included. Thus, the BASE-II steering committee represents a wide range of these disciplines and involves many of the scientists who also collaborated in BASE. Elisabeth Steinhagen-Thiessen, Evangelisches Geriatriezentrum Berlin, was the first BASE-II speaker from 2010 to 2014. In 2015, she was succeeded by Denis Gerstorff, Humboldt-Universität zu Berlin. The study received financial support from the Federal Ministry of Education and Research, the Max Planck Society for the Advancement of Science, and other participating institutions.

### The BASE-II Sample

The recruitment of the BASE-II cohort resulted in a consolidated baseline sample of 1,600 older adults aged 60–75 years and of 600 younger adults aged 20–35 years (Bertram et al. 2014). Potential participants were drawn from a pool of individuals originally recruited at the MPI for Human Development for a number of earlier

projects with a focus on neural correlates of cognition.

Briefly, participant recruitment was based on advertisements in local newspapers and the public transport system of Berlin. Interested individuals of the greater metropolitan area of Berlin were further screened to meet the inclusion criteria of BASE-II (either in-house or by telephone) leading to 2,262 healthy individuals who were eligible for inclusion in BASE-II. Individuals were included if they were not taking medication that could affect memory function and did not report a history of head injuries or neurological or psychiatric disorders. Finally, 2,200 individuals were selected to represent the BASE-II baseline cohort.

It is well known that some age-related functional and cognitive changes, such as decline in perceptual speed, evolve in early adulthood. At the same time, recent longitudinal studies indicate that other cognitive abilities, such as episodic memory (EM), are relatively stable until about 60 years of age and start declining thereafter. In order to identify and follow associations of multiple factors influencing age-related changes, the decision was taken to start observing healthy older adults at an age of relative health and stability, but where most would be at risk of subsequent age-related changes on multi-dimensional variables of interest. Thus, a total of 1,600 participants were assigned to an older subgroup aged between 60 and 80 years, and 600 individuals were assigned to a younger subgroup (serving as a reference population) aged between 20 and 35 years. By design, each age subgroup contains an approximately equal number of men and women. To estimate sample selectivity, data from this baseline sample are linked to the German Socio-Economic Panel (SOEP) study, a longitudinal panel survey that is representative of the German population. To date, BASE-II only includes cross-sectional variables but is planned as a longitudinal study.

### **Interdisciplinary Research in BASE-II**

In many countries around the world, current cohorts of adults are living longer than earlier cohorts and are reaching old age in better health. There is a growing need to investigate the

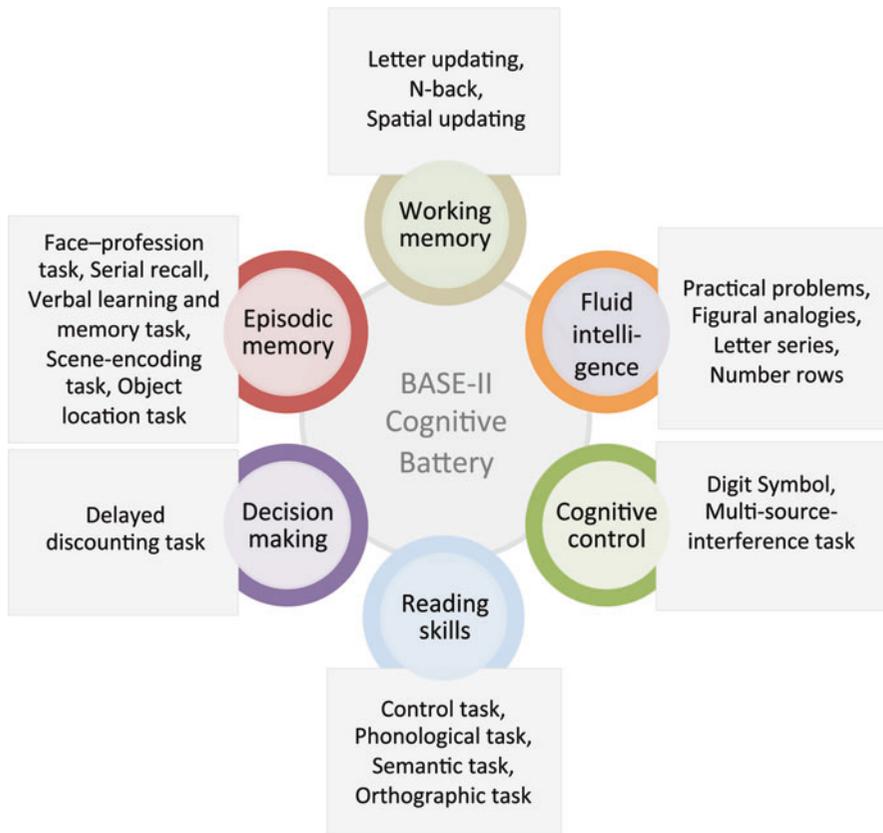
interactions among genetic, psychosocial, demographic, and lifestyle factors that shape individual pathways into old age (Lindenberger 2014). Multidisciplinary approaches are required to understand how individual differences in cognitive and psychosocial domains of functioning relate to the wide range of genetic, somatic, and sociological markers and constructs assessed in BASE-II and how these associations change over time. Additionally, socioeconomic data and data about life satisfaction and habits, the social environment, and attitudes in life were collected and can be taken into account as explaining factors. The BASE-II design allows younger and older participants to be directly compared on all dimensions assessed.

An overarching goal of BASE-II is to follow up the trajectories and the strengths of the multidisciplinary associations revealed in the first wave of BASE-II. Repeated investigations after a certain time will allow more specific observation and classification of individual trajectories of aging. Longitudinal findings may contribute toward bolstering action strategies for demographic change and increasing knowledge of the conditions necessary for independent living.

### **Assessing Cognitive Functioning**

A major aim of the psychology subproject is to obtain a detailed and comprehensive picture of cognitive abilities and psychosocial characteristics that can serve as a solid baseline for subsequent longitudinal observations (Fig. 1). Throughout all analyses, structural equation modeling was used (McArdle 2009) in order to establish latent constructs and examine associations among them. Thus, by relating individual differences in cognitive abilities to variations in lifestyle, environmental factors, and personality, it is possible to identify different patterns and psychosocial contexts of cognitive aging and to investigate links to multiple domains within BASE-II (Fig. 1).

After extensive piloting, a comprehensive battery of cognitive tests and a psychological questionnaire were added to the baseline protocol in 2013. The cognitive battery of BASE-II covers key cognitive abilities such as episodic memory



**Berlin Aging Studies (BASE and BASE-II), Fig. 1** Overview of cognitive domains with associated tasks within the baseline assessment of BASE-II

(EM) as well as measures of working memory (WM), cognitive control, fluid intelligence (FI), reading skills, and decision making. The assessment is distributed across two testing sessions that last three hours each and are seven days apart. The Digit Symbol Substitution Test (WAIS-II; paper-and-pencil version) was applied to relate performance levels observed in BASE-II to other studies, including BASE (cf. Gerstorf et al. 2015). In summary, the psychometric space of human cognitive abilities is represented more broadly than in most other comparable studies.

### Assessing Psychosocial Functioning

To cover a broad range of key psychosocial correlates of health and cognition in old age, a comprehensive psychosocial assessment battery was compiled for BASE-II. A total of eight domains of psychosocial functioning are assessed.

Data collection takes place between the first and second cognitive session at the participants' place of residence (i.e., private household or institution). Overarching constructs include well-being, affect, perceived stress, motivation and control, personality, perceptions of time and aging, social embedding, and perception of neighborhood characteristics. The selection of psychosocial measures was based on conceptual considerations and empirical evidence to permit the investigation of links to physical health and cognitive functioning (e.g., Diener et al. 2006). Selection of (sub) scales and items for the constructs was based on empirical reports attesting that psychometric properties were acceptable. To allow for direct empirical comparison across studies, several (sub)scales and items that were also applied in closely related studies, including SOEP (Headey et al. 2010), BASE (Baltes and Mayer 2001;

Lindenberger et al. 2010; Mayer and Baltes 1999), and the COGITO study (Schmiedek et al. 2010), were chosen. This design strategy allows comparison of individuals from the later-born cohorts of BASE-II with their age peers from earlier cohorts in BASE (e.g., comparing 75-year-olds born in 1915 with 75-year-olds born in 1938). The strategy also makes it possible to analyze longitudinal data from participants who were previously part of the SOEP and COGITO studies.

### Developing New Measures of Active Aging

Maintaining cognitive abilities in aging is important for everyday competence and an independent lifestyle. A lifestyle associated with exposure to novel and varied information (“enriched environment”) is considered beneficial for healthy cognitive aging (Lindenberger 2014; Hertzog et al. 2008). Psychological concepts of motivation postulate that the subjective appraisal of the time left to life affects individuals’ goal- and activity-related motivations (Lang and Carstensen 2002). Hence the “Subjective Health Horizon Questionnaire” (SHH-Q) was developed and validated. This novel questionnaire captures individuals’ expectations regarding their ability to explore and engage with novel information in the future alongside their expectations concerning bodily health and fitness. The SHH-Q is administered within the cognitive session by means of a computer. The SHH-Q forms four correlated but distinct subscales: (1) novelty-oriented exploration, (2) bodily fitness, (3) occupational goals, and (4) goals in life (cf. Düzel et al. [under review](#)).

### Summary of Initial Results from BASE-II

*Changes in psychosocial functioning across cohorts.* Initial analyses of the psychosocial measures focused on secular changes in aspects of motivation and control, social embedding, and perceptions of time and aging. As mentioned above, levels of functioning in more objective and performance-based measures assessed in BASE and BASE-II such as physical health and cognition were higher in more recent cohorts of older people. Does this mean that they also perceive themselves as having more control over

their life and feel socially integrated and young? To examine these questions, Hülür and colleagues ([in press](#)) compared data obtained in BASE (in 1990–93) and BASE-II (in 2013–2014) and applied a case-matched control design based on age, gender, education, comorbidities, and cognition. Results revealed evidence for considerable secular changes in people’s perceptions of their lives. For example, 75-year-olds nowadays hold fewer external control beliefs and report less loneliness. Possible correlates underlying such cohort differences are being examined at the time of writing.

*Cognitive functioning.* Using confirmatory factor analysis (CFA), it was possible to validate a three-factor model of memory for both age groups. This latent approach is important to further investigate the associations between cognitive functioning and other psychosocial, medical, genetic, and socioeconomic indicators assessed in BASE-II.

*Associations between health and cognition.* Being physically active and having a higher overall health status have protective effects on brain structure and function and are associated with later onset or lower degree of age-related cognitive decline (Hertzog et al. 2008; Maass et al. 2015). The examination of associations of health- and fitness-related measures to global measures of cognitive functioning using CFA is in planning. Medical data are used to generate global measures of health (e.g., grip strength) and fitness (e.g., lung functioning). Initial multiple hierarchical regression analyses with the sample of older BASE-II adults showed that grip strength predicts performance in all memory domains (FI, WM, and EM) beyond age, gender, and years of education. In the younger BASE-II subsample, neither of these health and fitness measures was associated with any of the three cognitive abilities. Future analyses will investigate age group differences in the associations between somatic health and cognition.

*Establishing metabolic status as a latent construct.* Epidemiological studies have linked features of the metabolic syndrome (MetS; a clustering of several frequent medical disorders

such as abdominal obesity, hypertriglyceridemia, and hypertension) to cognitive decline in old age. However, it is not clear to what extent each indicator of MetS contributes to pathophysiology and how single or combined MetS features affect cognitive functioning. Additionally, little is known about associations among vascular risk, metabolic status, and cognition in healthy aging. The underlying hypothesis is that memory functions are moderated by metabolic and vascular factors. Biomarkers were collected within the medical subproject of BASE-II and include systolic and diastolic blood pressure, glucose and insulin area under the curve, triglycerides, HDL cholesterol, body mass index (BMI), waist circumference, and trunk fat. To investigate the aforementioned links between MetS and cognition, MetS was established as a latent construct, again using CFA. A one-factor model of MetS provided acceptable model fit, with three measures loading adequately on the MetS factor (triglyceridemia, trunk fat, fasting glucose level). This factor is in line with medical descriptions of MetS. Initial analyses suggest reliable associations among MetS, cognition, and subjective measures of future time horizon.

*Psychosocial functioning.* With the validation of SHH-Q, the new self-report measure of distinct future time perspectives, within the healthy older sample of BASE-II, the SHH was shown to account for a significant proportion of memory performance variability. Initial analyses indicate that greater self-reported novelty orientation is associated with higher EM performance and greater self-reported bodily fitness with better metabolic status (Düzel et al. [under review](#)). These initial results pave the way to a better understanding of the connections between subjective activity-related motivation and health behavior.

## Outlook

The psychometric validation of the BASE-II cognitive battery is an important starting point toward investigating associations with other functional domains. In particular, analyses at the latent level will enhance statistical power and

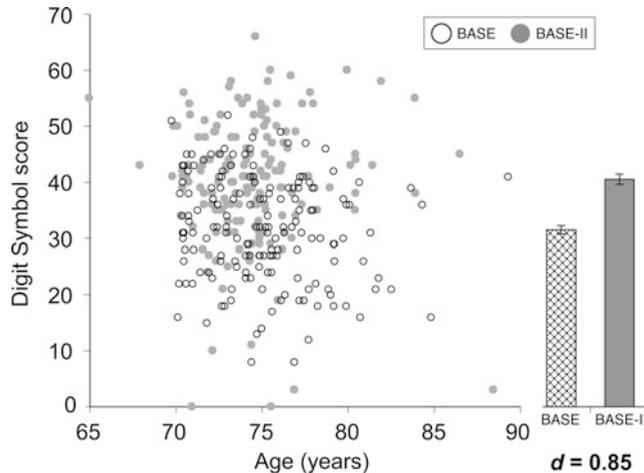
generalizability when exploring links to genetic variation (e.g., Papeberg et al. [2014](#)). Further analyses will explore across-domain associations between aspects of physical health, cognitive functioning, and psychosocial characteristics. Additional analyses will focus on identifying psychosocial variables that may serve as protective or risk factors for dealing with health challenges. To move toward a better understanding of whether and how contextual factors shape individual functioning and development, geo-coded information (e.g., to index distance to green spaces) will be linked to psychosocial characteristics (e.g., chronic stress) and to health information (e.g., biomarkers of stress).

## Synergies between BASE and BASE-II

One way to explore the malleability of the human life course is to directly compare different cohorts of the same age across historical time (Baltes [1968](#); Schaie [1965](#)). The similarities between BASE and BASE-II offer excellent opportunities for comparisons of this kind. In a recent study, Gerstorf and colleagues ([2015](#)) quantified secular increases in fluid intelligence in old age favoring later-born cohorts. They compared data obtained 20 years apart in BASE and BASE-II, applied a case-matched control design, and quantified sample selection using a nationally representative sample as the reference (Fig. [2](#); see also Hülür et al. [in press](#)). The later cohort performed better on the fluid intelligence measure and reported higher morale, less negative affect, and more positive affect than the earlier cohort. The authors concluded that secular advances have resulted in better cognitive performance and perceived quality of life among older adults. To the extent that BASE-II will be continued as a longitudinal study, it will permit researchers to study the ways in which longitudinal trajectories of adult development evolve over historical time.

## Summary

Taken together, the combination of findings from BASE and BASE-II and the possibility to analyze



**Berlin Aging Studies (BASE and BASE-II), Fig. 2** Average cohort differences and individual differences in cognitive performance. The dots represent participants' scores in the matched BASE (*open circles*) and BASE-II (*gray circles*) samples. Sample means and

standard errors for each cohort are displayed separately. Participants in the BASE-II cohort (data obtained in 2013–2014) showed higher levels of cognitive performance ( $d = 0.85$ ) than the BASE cohort (data obtained in 1990–1993). For details, see Fig. 2 in Gerstorf et al. (2015)

BASE-II data in conjunction with BASE data provide singular opportunities to address a wide range of questions about old age and aging. Both studies are unique with their wide-ranging interdisciplinarity that allows processes of aging to be examined across a broad spectrum of domains. As is already the case for BASE (Lindenberger et al. 2010), BASE-II is likely to yield a rich scientific harvest over the next years, as foreshadowed by initial publications (e.g., Bertram et al. 2014; Gerstorf et al. 2015; Hülür et al. *in press*; Maass et al. 2015; Papenberg et al. 2014).

### Cross-References

- ▶ [Aging and Psychological Well-Being](#)
- ▶ [Cognitive and Brain Plasticity in Old Age](#)
- ▶ [Distance-to-Death Research in Geropsychology](#)
- ▶ [Individual Differences in Adult Cognition and Cognitive Development](#)
- ▶ [Plasticity of Aging](#)
- ▶ [Psychological Theories on Health and Aging](#)
- ▶ [Sensory Effects on Cognition in Later Life](#)
- ▶ [Time Perception and Aging](#)
- ▶ [Psychosocial Well-Being](#)

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## Bibliotherapy and Other Self-Administered Treatment

Lisa Mieskowski and Forrest Scogin  
University of Alabama, Tuscaloosa, AL, USA

### Synonyms

Bibliotherapy; Self-administered treatment; Self-help

### Definition

The formal implementation of written or digital materials to facilitate understanding or assist in efforts relevant to a person's developmental or therapeutic needs.

### General Overview

In its simplest form, bibliotherapy uses literature to facilitate improvements in the well-being or functioning of an individual or group of individuals. The literature may be instructional in nature (i.e., a therapeutic manual written in narrative to aid the client in self-administered treatment) or conceptual (i.e., a fictional or autobiographical piece which illustrates issues and/or dealings related to the reader's problem of interest). Through the years, the media of bibliotherapy has broadened. Electronic and auditory formats are often available to the public; websites, handouts, and even smartphone applications have been developed to present material. The role of the psychotherapist in bibliotherapy may vary as well (i.e., completely self-administered, therapist guided, therapist administered). The following entry will outline the basic principles and concepts associated with bibliotherapy and related forms of self-help, discuss current modes of distribution and application, and, finally, review the general state of bibliotherapeutic endeavors in older adult populations and outline future directions.

The general purpose has remained the same despite the varied formats in which bibliotherapy may appear and be administered: to facilitate the participant's consideration and understanding of the problem of interest and to encourage beneficial change in knowledge, perspective, and application of skills. Bibliotherapy has been defined as the use of written material: ". . .for the purpose of gaining understanding or solving problems relevant to a person's developmental or therapeutic needs" (Marrs 1995). In current application, and for the purposes of this entry, this definition can be extended to include media-based products (e.g., DVDs, audio files, community websites).

### **Concepts, Principles, and Modalities of Self-Help**

In many cases in which bibliotherapy is recommended, it provides a portable venue in which therapeutic change may occur both inside and outside the therapeutic setting. Difficult to access populations (e.g., mobility-restricted persons, prison populations) may benefit from this more transportable and time-flexible approach. Furthermore, bibliotherapy may provide a *foot in the door* technique to facilitate a change in one's attitude toward seeking mental health treatment. Those who are unsure of the merits of psychological treatment or hold negative or ambivalent feelings toward mental health treatment may find themselves more open to seeking treatment if given a tangible medium of treatment that they can evaluate and reevaluate at their leisure. This, of course, assumes the recommended self-help material is sound and plausible. Bibliotherapy may also provide anecdotal material to stimulate and direct discussion in group or social settings. For instance, it may be less threatening to talk about an issue embedded in the struggles of a literary character or relevant problem portrayed by the interaction of individuals in a written, spoken, or filmed illustrative example. Reading about others with similar experiences may also decrease feelings of social isolation and promote healthy perspective taking.

Openness to psychotherapy varies as a function of many factors, including one's cohort. The issues faced by older adults may also vary, and physical and geographical access to individuals struggling through similar situations may be limited. In summary, bibliotherapy presents a form of psychological treatment that is easily distributed and is often more financially accessible. It can be retained as a useful resource to refer back to, can help connect older adults with others who share similar experiences, and allows the individual to dictate the pace and frequency in which they approach psychological change.

### **Varying Levels of Administration**

The overarching principle of psychologically based self-help programs such as bibliotherapy is that, for some problems, consumers may be able to implement treatments with little or no professional assistance. The goals of psychotherapy and bibliotherapy are generally the same. The difference is largely in the degree to which professional involvement is included in treatment. One conceptualization has been that professional involvement exists on a continuum. This continuum ranges from traditional psychotherapist-administered psychotherapy (with no self-help augmentation) to entirely self-administered treatment (typified by the purchase of written or DVD materials that are implemented with no therapist assistance). Most of the evidence-bases exist around the midpoint of this continuum and are concerned with the effects of minimal-contact or guided self-help and therapist-administered self-help (defined further below).

Though the categorical definitions of self-help can vary, three broad categories are likely the most common descriptive derivations in use today (Glasgow and Rosen 1978). Varying in the degree of professional, or colloquially stated, therapist assistance, these three categories outline important aspects of bibliotherapeutic delivery and are therefore useful keywords to implement when searching for, or publishing, research in this area. In *therapist-administered self-help*, the psychotherapist or trained professional plays their most active role in treatment process. For example, clarification of and elaboration on materials

by the psychotherapist would be administered in conjunction with self-delivered administration of bibliotherapy to facilitate and guide treatment throughout. The second category, *minimal-contact self-help*, refers to the psychotherapist or trained professional primarily playing a role in familiarizing the client with materials at the outset and subsequently minimizing their involvement to monitoring the client's ongoing experience with intermittent check-ins. These first two categories fall into guided self-help, which may be delivered in person, over the phone, or via computerized communication (e.g., e-mail communication, website or computer program-delivered guidance, or smartphone applications). Conversely, *self-administered self-help* refers to interventions which rely on client or patient administration, without the benefit of a trained professional or psychotherapist's introduction to self-help materials. The evaluation of treatment effectiveness is then, most often, limited to assessment-driven contact. This category of self-help is the type that is most often commercially distributed and is the least scientifically evaluated.

Other useful categorizations include didactic versus imaginative materials (Riordan et al. 1996) and individually delivered versus group administration. In some instances, the use of self-help materials may play a role in a stepped-care approach, or approach where a client's first introduction to treatment efforts begins with self-administered self-help materials. An individual's treatment and care is then "stepped up" as needed into increasingly more direct forms of treatment (e.g., check-in calls, telephone-based sessions, in-person sessions). Inversely, self-help programs may be applied in a form of "stepped-down" care. In other words, guided or minimal-contact bibliotherapy could be utilized as psychotherapists move toward termination and progressively extinguish a client's reliance on in-person sessions and encourage self-efficacy in self-care. In this scenario, bibliotherapy could provide personalized evidence that consumers have the skill to select, maintain, and direct positive change independently. In addition to the varying levels of administration, the delivery of self-help materials will likewise vary depending on the preferences of the

person, the role of clinical judgment where trained professionals are involved, and the accessibility of the self-help materials.

### Modalities of Self-Help

The term bibliotherapy evokes images of written or printed materials. However, as time progresses and technology with it, self-help materials continue to adapt to fit the currently preferred audio formats (i.e., from cassette tapes, to CDs, to podcasts). Visual materials have also been developed to accompany treatment or serve as stand-alone applications (e.g., workbooks, videos, DVDs). Existing printed materials have been modified to fit our ever increasingly technology-savvy population by transforming workbook pages to online tablets or client workbooks to an audio format (e.g., Shah et al. 2014). Internet-based interventions have arisen and evidence for their efficacy is continuing to grow in the research literature. Even commercially available games (i.e., the Nintendo DS version of *Brain Age*) have been evaluated for their efficacy as a self-help memory training application (Presnell and Scogin 2015). Future directions in research should consider the efficacy of available phone apps aimed at preventative care (e.g., phone apps aimed at preventing the onset of clinically significant depressive symptoms).

Clinicians initiating treatment with new clients should consider the self-help methods currently used by their clients, as well as those implemented before they first sought professional psychotherapeutic treatment. Clinicians and clients alike will need to keep in mind the broad range of self-help modalities (e.g., books, videos, websites), as both may neglect recognizing and categorizing readily available materials as "self-help" (e.g., Weight Watchers, various websites providing psychoeducation on depression). With the advent of the smartphone, the varying levels of administration (i.e., client-administered, therapist-guided, and therapist-administered self-help) can likewise take on a more fluid and nuanced role in mental health treatment and the tracking of treatment progress. Moreover, the speed at which these resources become available to the public surpasses the research base's ability to evaluate

their efficacy. With the ready accessibility and near-universal adoption of personal electronic communication devices (e.g., smartphones, tablets), the rate of creation and distribution of self-help materials is expected to be exponential. The following section will discuss current clinical applications of self-help.

### **Clinical Application of Self-Help**

The programs with the greatest evidentiary corpus tend to be those which lend themselves best to self-administration, such as cognitive behavioral approaches (Anderson et al. 2005). The range of self-help applications across the lifespan is quite large and covers much of the territory deemed appropriate for traditional therapist-administered treatments. Materials created and implemented to address issues related to depression and anxiety have received the most extensive review, but areas such as weight-control, sexual dysfunctions, addictive behaviors (e.g., substance abuse, smoking), and less obvious targets such as nail-biting also carve out a place in the literature. Contraindications for self-help and bibliotherapy, primarily based on clinical intuition and not empirical fact, include conditions such as schizophrenia, psychotic depression, and bipolar disorder. Other questionable candidates for self-administered intervention include those with a personality diagnosis, typified by ego-syntonic disorder, who may fail to see the applicability of the materials or have otherwise impeded ability to adhere to a self-directed regimen. For example, a person with narcissistic personality disorder will often perceive their behaviors, feelings, and values as ego aligned (in support of the goals and needs of their ideal self-image) and may see little to no utility for changing their behaviors, feelings, or values. Conversely, a person with a depression disorder (an ego-dystonic disorder) often has a poor self-image and behaviors, feelings, and values that are not aligned with their ideal self and may predispose to attempt the changes and activities outlined in self-help protocols. Client characteristics may also contraindicate the use of self-help programs. Visual ability

and literacy or reading skills should be considered, especially when the material is presented in written form.

None of these contraindications preclude a person from pursuing a purely self-administered program. As Lehane (2005), a community psychiatric nurse in Cardiff, succinctly points out, "Book prescriptions are on the increase and general opinion appears to favor this change." Whether a mental health professional actively incorporates bibliotherapy and self-help techniques into their service repertoire is beside the point. Self-help programs are available, and clients/patients, co-workers, and family members will use them. Unfortunately, there is practically no evidence on the efficacy of entirely self-administered programs. This is due in part to the logistics involved and the understandable reluctance of university IRBs to approve such research. Similarly, selection of evidence-based minimal-contact and psychotherapist-administered programs remains limited, but continues to grow as those in the field turn their interest toward selecting evidence-based treatments (those with randomized control trials establishing the effectiveness of the self-help program in treating or addressing the problem of interest). As a subset of the general population, the evidence for self-help programs targeted toward older adults is similarly limited. Thus, practitioners will need to base their recommendations largely on what is known to work with younger adults.

Individuals will continue to use self-help materials. Thus, psychologists in particular have a continued interest in evaluating the evidence for, selection of, and guidance of self-administered treatments, no matter their form and degree of professional involvement. "Psychologists are in a unique position to contribute to the self-help movement. No other professional group combines the clinical and research experiences that are part of the clinical psychologist's educational background. Clinical psychologists are skilled in current therapeutic techniques, they have clinical experience and sensitivity, and they have the training to assess empirically the efficacy of the programs they develop. This would represent a most significant and new development in the area of

self-help approaches to self-management” (Rosen 1982). As such, familiarizing oneself with the benefits, limitations, and varied administration of self-help therapies is of import to beginning and established psychologists alike.

Used in conjunction with other treatment options, bibliotherapy and related self-help efforts offer cost-benefit opportunities. A plethora of extant self-help materials are commercially available at relatively low cost and may be sifted through in pursuit of extending the reach of the clinician past the therapy room. Non-exhaustive resources (e.g., Norcross et al. 2003, 2013) have been compiled over time in an effort to guide the selection and implementation of bibliotherapy, but selection of material remains largely dictated by the clinician’s own familiarity with the material or, by extension, at the recommendation of their peers.

### **Evidence Base for the Use of Bibliotherapy with Older Adults**

In the early 2000s, several systematic reviews were carried out evaluating evidence-based treatments for older adults. Several of these reviews found promising evidence for the continued use and further development and evaluation of bibliotherapies in this context. The review led by Scogin and colleagues was the only review team in a multi-team effort to establish evidence-based treatments in older adults to find bibliotherapy to meet evidence-based treatment criteria (Scogin et al. 2005). Specifically, though behavioral bibliotherapy and Internet-based cognitive behavioral therapy were deemed as promising (e.g., awaiting a second confirmatory controlled experiment), cognitive bibliotherapy was the only form of self-help with enough research for its establishment as an evidence-based treatment for depression. The systematic review led by the evidence-based treatment search for anxiety also found promising evidence for bibliotherapy treatment, but was unable to establish its effectiveness due to limited, controlled-experiment research in this field. These findings highlight the need for continued efforts to establish and evaluate bibliotherapy treatments in the population as a whole and within older adult populations specifically.

### **Depression**

As previously discussed, the methods and interventions used in self-help largely span the same domains as seen in traditional psychotherapy, and cognitive behavioral models (widely defined) tend to be most frequent (a trend also seen in face-to-face delivery of psychotherapy). With respect to older adult clientele and the self-help materials for depression, there are several well-known self-help books that have been marketed and evaluated. Examples include self-administered self-help books with CBT-based models (e.g., *Feeling Good*, by Burns) as well as those that are more behaviorally based (e.g., *Control Your Depression*, by Lewinsohn) and therapist-administered client manuals (e.g., Dick et al. 1996). Additionally, CBT-based models of self-help have also been adapted or newly generated to be distributed specifically within research contexts to address issues experienced by older adults (e.g., improving self-care management in the frail elderly, improving sleep and preventing depression in rural older adults). Though further materials may be indicated in treatment of late-life depression, relatively few have received adequate scientific scrutiny to promote their recommendation beyond that which can be obtained through careful clinical judgment and solicitation of knowledgeable peers.

### **Anxiety**

Meta-analyses suggest that self-help for common mental health disorders (e.g., depression, anxiety) can be just as effective as face-to-face therapy (e.g., Cuijpers et al. 2010). In addition to their documented efficacy, self-help treatments of anxiety, such as exposure and relaxation, have been applied in digital formats. Specifically, Internet-based treatments such as therapist-guided administrations with in vivo exposure (Andersson et al. 2006) and live versus Internet treatment of panic disorder (Carlbring et al. 2005) are on the rise. Instances that tender prime candidates for self-help treatments include situations where motivation to seek, or accessibility of, services is especially impacted. With the rising frequency in which computers, tablets, and smartphones are readily available and pre-existing in a client’s

accessible environment, the applicability of providing in-home treatments (e.g., exposure and guided meditation from an off-site location) likewise increases. Problematic issues with a depression-related lack of motivation and clinically elevated worry or panic related to leaving one's home (e.g., panic disorder, agoraphobia) may be especially indicated for self-administered or therapist-guided administration. Individuals suffering from these conditions may look to stepped-care approaches and consider self-administered treatment as at their own initiative or at the recommendation of their clinician or concerned family member. Truthfully, many individuals with varying levels of symptom severity may look no further than these commercially or electronically available treatments due to scarcity of, low trust in, or financial inaccessibility of local mental health resources.

### Sleep Problems

Sleep problems, which can be treated with cognitive behavioral interventions, require the individual to apply what they have learned in a clinical setting to their sleeping environment. As such, it could be argued that a major aspect of insomnia-related problems lends itself well to various forms of self-help treatments. Specifically, CBT for insomnia (CBT-I) has been evaluated in pure, self-help formats. Comparisons to therapist-guided versions yield favorable outcomes as well. Though therapist-guided methods tend to produce greater positive change, CBT-I self-help methods serve as a viable first-line treatment (e.g., Rybarczyk et al. 2011). Self-administered and minimal therapist-contact CBT-I have also been shown to be effective in older adult populations (e.g., Morgan et al. 2012; Riedel et al. 1995), even in the context of chronic health conditions that likely exacerbate the formation and endurance of sleep problems.

### Memory Training

Memory or cognitive training is a good fit for various forms of self-administration. The material is largely didactic in nature and involves learning and practicing various techniques. One version of self-administered memory training involves

instruction in several mnemonic techniques and has been evaluated in several experiments (Scogin et al. 1985; Woolverton et al. 2001). Techniques presented in this bibliotherapy approach include categorization and chunking strategies, the method of loci, and novel interacting images for remembering names. Self-administered memory training capitalizes on the finding that self-paced learning is optimal for older adults. Given the concern that many elders have for changes they experience in cognition, it is desirable to have multiple modes of training delivery including self-administered versions and variations on presently available technology. Examples of the latter include the "brain training" programs available through the Internet or digital means. Presnell and Scogin (2015) conducted an experiment on the *Brain Age* program and found that it produced direct effects on a speed of processing task but had no evidence of transfer effects to skills not directly trained. This is a finding often reported in the memory and cognitive training arena but serves as a caution that we should be circumspect in claims for the efficacy of these interventions.

### Other Areas

In addition to the disorders and psychological well-being areas discussed above, self-help materials have been developed and evaluated by the psychological community. Unfortunately, the evidence base specific to older adults is quite limited in these other areas (e.g., assertiveness, death and grieving, sex) and will not be discussed at length here. Clinicians and other medical professionals in the position of recommending self-help materials are encouraged to solicit guidance from the existing evidence base for adults and cautiously extend their recommendations to older adults while being ever mindful that some mediums of self-help may better match the needs and style of younger cohorts.

### Conclusion

Self-help resources should be considered, both for their clinical application and for their obvious continued appeal in community settings.

One need not look further than their local bookstore to find evidence of self-help's popularity. Conversely, one must look a bit further before one finds clinically relevant resources guiding the hand of the psychotherapist or other mental health workers, in selecting and recommending these resources to those we serve. Consequently, the responsibility is upon us to continue the evaluation of the utility, applicability, and efficacy of self-help materials, in their various formats of administration. We must ask ourselves, if we do not take it upon ourselves to apply our training, expertise, and clinical knowledge to the assessment of these materials, which qualified other will?

## Cross-References

- ▶ [Anxiety Disorders in Later Life](#)
- ▶ [Behavior Modification](#)
- ▶ [Cognition](#)
- ▶ [Cognitive Behavioural Therapy](#)
- ▶ [Insomnia and Clinical Sleep Disturbance](#)

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## Bipolar Disorder in Later Life

David B. King<sup>1</sup> and Norm O'Rourke<sup>2</sup>

<sup>1</sup>IRMACS Centre, Simon Fraser University, Burnaby, BC, Canada

<sup>2</sup>Department of Public Health, Ben-Gurion University of the Negev, Be'er Sheva, Israel

### Synonyms

Bipolar affective disorder; Manic depression

### Definition

A chronic affective disorder characterized by major depressive episodes, mild elation (i.e., hypomania), irritability, or extreme elation (i.e., mania).

### Bipolar Disorder

Bipolar disorder (BD; previously known as *bipolar affective disorder and manic depression*) is a chronic affective disorder that affects nearly six million American adults. Classified as a mental disorder by the American Psychiatric Association (APA), BD is characterized by extremes of mood. Although nearly everyone experiences mood variability, people with BD experience very profound shifts in mood (e.g., periods of clinical depression, mild elation [hypomania], or extreme elation [mania] or irritability). The condition is both complex and heterogeneous; an individual with BD can experience symptoms of depression, mania (elated mood), hypomania, or psychosis, or indeed experience combinations of each in varying sequences. Moreover, those with BD may rapidly cycle between these states.

Despite advances in treatment and management, BD remains highly debilitating and can have a profound and deleterious effect on health and quality of life (Murray and Lopez 1997).

The World Health Organization (WHO) estimates that BD is the sixth leading cause of disability worldwide, making it a serious public health concern in the USA and abroad. For instance, up to 15% of people with BD will commit suicide (Goodwin and Jamison 2007). Even optimal medication management fails to forestall all mood episodes; the course of BD is typically characterized by high rates of relapse. Longitudinal study findings suggest that 37% of persons with BD prescribed mood stabilizers will relapse within 1 year, 60% in 2 years, and 73% over 5+ years; moreover, psychosocial functioning often remains compromised even when individuals are euthymic (i.e., in neither depressed nor manic state; (Goodwin and Jamison 2007)).

Given its debilitating effects, BD has been deemed the most expensive mental health diagnosis in the USA (Peele et al. 2003). The estimated annual cost of BD is over \$45 billion in the USA, with treatment alone costing approximately \$5000 per patient (Hirschfeld and Vornik 2005); however, the majority of the economic burden typically arises from indirect costs such as lost productivity and absenteeism. Compared to those with unipolar depression, the relative impact of BD versus unipolar depression indicates that persons with BD have lower income levels, higher mental health disability days, and self-reported job insecurity (McIntyre et al. 2008). Despite these difficulties, there is also evidence demonstrating that people with BD can identify ways to live well and experience good quality of life. Generally, this requires more than pharmacology alone (Suto et al. 2010).

Psychosocial research on BD is nascent (Thomas 2010). Although many persons with BD are living to older adulthood for the first time in human history, there is a paucity of knowledge about the course of BD in later life. There is some evidence suggesting that BD becomes less prevalent with age yet still accounts for the same percentage of psychiatric admissions. Existing research on symptom intensity and variability with older adults with BD has been conducted largely with small samples.

## Prevalence of BD in Later Life

Community surveys have suggested that the prevalence of BD among adults 65+ years of age is between 0.1% and 0.5% (Hirschfeld and Vornik 2005), yet these percentages are likely underestimates. For instance, older adults residing in assisted living were not included. Within mental health settings, however, bipolar disorder remains a common diagnosis for older adults accounting for between 8% and 10% of all psychiatric diagnoses (Depp and Jeste 2004).

There are a number of reasons that BD may appear less prevalent in later life. Higher rates of suicide among younger individuals with BD may reduce the number of persons surviving into older adulthood.

## Characteristics of BD in Later Life

Some have suggested that BD symptoms decrease in intensity over the life span (Kraepelin 1921) yet intervals between depressive and manic episodes may shorten with age. As the age of BD onset is generally between 20 and 25 years, the majority of older adults with BD have lived with the disorder for many years. The impact of BD may change over time as individuals develop effective self-care behaviors; however, kindling theory proposes that with each mood episode, the brain becomes more deficient in its ability to manage shifts in mood, increasing the frequency and intensity of BD symptoms over time (Post et al. 1986).

A small percentage of those with BD experience their first manic or depressive episode after the age of 50. There are important differences between those with early-onset versus late-onset BD. For instance, persons with late-onset BD are more likely to have a history of sustained employment or be in a relationship at the time of diagnosis increasing the likelihood of successful functioning across domains. More commonly, however, those first diagnosed with BD in later

life have gone undiagnosed or misdiagnosed for years or decades.

Existing research suggests that older adults may experience less severe symptoms of mania compared to younger adults (Young and Falk 1989). There is also evidence that community-dwelling older adults experience more symptom-free days (Calabrese et al. 2003). Despite this limited evidence for reduced symptoms, older adults with BD often have additional medical costs, which might, in turn, complicate BD care management in later life. For example, older adults with BD are at higher risk of both diabetes and cardiovascular disease compared to those without a mental health condition (Kilbourne et al. 2004). Moreover, poor health habits such as smoking and physical inactivity are common among older adults with BD. Research also suggests that approximately half of older adults (60+ years of age) with BD display significant cognitive impairment when euthymic (Gildengers et al. 2004). This may further complicate care management and treatment adherence. What remains unknown, however, is whether cognitive impairments such as dementia progress at an increased rate for individuals with BD. Other medical conditions common to later life such as stroke, brain tumors, and multiple sclerosis may mimic symptoms of bipolar disorder.

One important finding that appears to distinguish older adults with BD is a reduced likelihood of substance use disorders. Substance misuse with BD is a common means of self-medication. Whereas the prevalence of substance use disorders may be as high as 60% for younger adults with BD, substance misuse may be as low as 20–30% with older adults (Cassidy et al. 2001). Substance use disorders exacerbate BD-related disability.

## Treatment of BD in Later Life

The efficacy of BD treatments in the second half of life has not been widely studied (Thomas 2010). In clinical settings, treatment

recommendations for older adults with BD are derived largely from studies of younger and middle-aged adults. Yet there are important physiological and psychological changes that occur over a person's lifetime that may limit the effectiveness of various BD treatments.

Pharmacotherapy is the primary treatment for older adults with BD, yet some medications pose challenges for this population. Although anticonvulsant medications are commonly prescribed, lithium carbonate remains a common mood stabilizer. Yet age-related decline in kidney functioning reduces the rate of elimination from the body, and lithium has been shown to negatively affect kidney functioning. Moreover, other medications commonly prescribed in later adulthood can interfere with the body's ability to process lithium.

Antidepressants are also commonly prescribed for older adults with BD as well as anxiolytics for those with comorbid anxiety disorders. Antipsychotic medications are commonly prescribed for those with BD who experience psychosis. For older adults with cognitive loss, however, these medications increase the risk of stroke.

Beyond pharmacological treatments, electroconvulsive therapy (ECT) has also been used effectively with older adults whose mood episodes are mostly depression. Given that memory loss is a common side effect, special consideration must be taken for older adults with cognitive loss. Psychotherapy can be used in conjunction with the above methods, yet few psychosocial interventions for BD have been adapted or validated for older adults.

## Conclusions

It is clear that aging with bipolar disorder presents many unique challenges. As the aging population continues to grow, these challenges will pose greater burdens on individuals and the medical community at large. Despite its highly debilitating and costly nature, little is understood about BD in later life. As a result, the management of BD symptoms for older adults remains deficient. In order to fill this gap, additional research is needed

on the course and characteristics of BD in later life, particularly the potential interference of other medical conditions. As little knowledge has been accumulated regarding treatment of BD in old age specifically, this is an additional area that requires attention in both research and clinical domains. Alternatively, more research is needed on the positive aspects of aging that may contribute to BD management. Our understanding of BD would be greatly enhanced by a more complete life-span perspective on this mental illness.

## Cross-References

- ▶ [Comorbidity](#)
- ▶ [Depression in Later Life](#)
- ▶ [Schizophrenia and Other Psychotic Disorders in Older Adults](#)
- ▶ [Suicide in Late Life](#)

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## Blue Zones

Giovanni Mario Pes<sup>1,2</sup> and Michel Poulain<sup>3,4</sup>

<sup>1</sup>Department of Clinical and Experimental Medicine, University of Sassari, Sassari, Sardinia, Italy

<sup>2</sup>National Institute of Biostructures and Biosystems, University of Sassari, Sassari, Italy

<sup>3</sup>IACCHOS Institute of Analysis of Change in Contemporary and Historical Societies, Université catholique de Louvain, Louvain-La-Neuve, Belgium

<sup>4</sup>Estonian Institute for Population Studies, Tallinn University, Tallinn, Estonia

## Synonyms

Longevity Blue Zone (LBZ)

## Definition

The term *Blue Zone* (BZ) refers to a rather small, homogenous geographical area where the population shares the same lifestyle and environment and its exceptional longevity has been scientifically proven. To date, four regions have been

identified around the world as possessing the requirements to achieve *Blue Zone* status. They are located in Okinawa, Sardinia, Costa Rica, and Greece.

*Blue Zone* or, to be precise, *Longevity Blue Zone* (LBZ) is a term coined in 2000 by the Belgian demographer Michel Poulain and the Italian physician Gianni Pes in the context of age validation of centenarians in Sardinia, and it was used for the first time in 2004 in an article published in *Experimental Gerontology* (Poulain et al. 2004). Initially the term was given to a mountainous area located in the central-eastern part of the Mediterranean island of Sardinia, where the two scholars had found a population with exceptional longevity. Although longevous individuals exist in all parts of the world, in this area Poulain and Pes identified a cluster of villages with an outstanding number of centenarians and they named it *Blue Zone* simply because a blue felt-tip pen was used to draw the first longevity map. The LBZ concept defined above is related to *population longevity* and contributes to defining a new paradigm in the research on longevity determinants. By studying a population that shares the same lifestyle within the same environment and enjoys an extraordinary life-span, the search for longevity determinants could be facilitated. The LBZ concept was later popularized by the American journalist Dan Buettner through the article he published in the *National Geographic* on exceptional longevity in Okinawa, Sardinia, and Loma Linda (USA) (Buettner 2005). Since 2006, Buettner has collaborated with the two scholars and organized expeditions to Costa Rica and Greece where they identified the existence of two other LBZs (Buettner 2008). At present, four LBZs have been validated worldwide: (i) Okinawa, the southernmost island of Japan; (ii) an area covering 14 villages in Ogliastra and Barbagia in the mountainous zone of Sardinia; (iii) an area including five *cantons* within the Nicoya Peninsula of Costa Rica; and (iv) the island of Ikaria in Greece.

The first and most important problem that must be faced with regard to these LBZs is to ascertain age authenticity of the oldest members of these exceptionally longevous populations. In actual

fact, in the past the existence of longevous populations stimulated the collective imagination but belonged far more to folklore than to documented history and stringent validation rules, and none of these early alleged longevous communities were confirmed after thorough scientific investigation (Mazess and Forman 1979). The oldest members of these populations were often the subject of misreporting or exaggeration of their age. Many alleged cases of exceptional longevity examined in Russia, the Caucasus, China, Pakistan, and the Andes were later invalidated through careful demographic investigation (Garson 1991). To be specific, the validation of populations with a longevity level that can be statistically shown as higher than the values usually found elsewhere requires the availability of historical registers, such as birth and death records which can prove, with the greatest accuracy and completeness, the age of the members of the populations under investigation. Validation of the exceptional population longevity characterizing an LBZ is based on conventional individual age validation, as well as on a careful choice of demographic indices that reliably reflect the remarkable survival of community members as a whole (population longevity). To meet these requirements is often challenging, and this may explain why research on longevous populations has only progressed recently and solely where the required documental sources do exist. It is crucial that age be accurately verified before any attempt is made to ascertain the possible determinants of such exceptional longevity.

Currently, the populations of each of these four LBZs are being studied by several groups of researchers aiming to trace the determinants of this phenomenon. When seeking population longevity determinants, the relevant characteristics or behaviors are those shared by a large part of the population. By considering these common characteristics, the chance of finding more powerful explanatory variables is increased as most of the people concerned were born and live in the same place and are thus more likely to share genetic makeup and early life conditions, as well as traditional behaviors and habits, including the consumption of the same locally produced food.

By studying the various LBZ populations, therefore, identification of the causal factors of longevity might be enhanced. As a rule, aging successfully is a multifactorial achievement that implies avoiding diseases and maintaining a high standard of functional and cognitive performance. In the following paragraphs, the main characteristics of these areas, in terms of genetic structure, ethnicity, and lifestyle, are briefly described and a summary given of the features shared by these populations.

### Okinawa

Okinawa is a group of some 160 islands which form the southwesternmost part of Japan's 47 prefectures. There are currently 934 centenarians in Okinawa out of a total population of 1.37 million inhabitants (2015). In Japan, women of Okinawa show the highest life expectancy at birth among all prefectures (87.15 years in 2010–2013). Special attention has been devoted to validation of the individual ages of the oldest people in order to ascertain exceptional longevity in Okinawa (Willcox et al. 2008; Poulain 2011). Since 1976, the Okinawa Centenarian Study has investigated the causes of the exceptional longevity of the islanders, attributing an essential role to genetic, dietary, climatic, cultural, and social factors, although it is likely that the real explanation lies in a combination of all of these. Okinawans are genetically distinct from the Japanese, and even show some of the features of a genetic isolate, a condition that may have reduced their genetic pool variability and favored life extension (Bendjilali et al. 2014). Moreover, traditionally, Okinawans practiced a high rate of endogamy (i.e., marrying within the limits of one's local community); this would have increased the inbreeding coefficient and may possibly have caused the genetic variant related to longevity to be selected. A study revealed that siblings of Okinawan centenarians have 2.58 times (females) and 5.43 times (males) more likelihood of reaching the age of 90 compared with their age-matched birth cohort of the same area (Willcox et al. 2006). Specific HLA DR1 polymorphisms have been found in Okinawan centenarians that may reduce the risk of inflammatory

and autoimmune diseases (Takata et al. 1987). Apart from the influence of genetic factors, the role of environmental (e.g., low level of pollution) and lifestyle factors has also been explored. Sociocultural and psychological factors, in particular the degree of social integration of elderly people and the excellent quality of intergenerational relationships, physical and cognitive functions, and sleep habits, especially the frequency of naps (Uezu et al. 2000), have been considered beneficial. In addition, environmental conditions seem to be important, such as climate, agriculture, and other occupational activities (Robine et al. 2012). A considerable amount of research has addressed the relationship between diet and longevity in Okinawa. A reduced calorie intake (60% of the average Japanese diet) has been claimed to be responsible for longer survival of Okinawans, probably due to reduced mortality from cardiovascular diseases, diabetes, and cancer (Willcox and Willcox 2014). The lower calorie intake is believed to be at the origin of the lower body mass index and shorter stature of Okinawans. Traditionally sweet potato, a good source of trace elements and vitamins, accounted for up to 93% of the staple diet, a percentage far superior to that of the rest of Japan. Other allegedly longevity-promoting foods are green and yellow vegetables, soy products, fish, and moderate amounts of meat, usually goat and pork (Willcox et al. 2014). However, it is clear that in Okinawa, the post-war generations have largely modified their diet, replacing sweet potato soup with rice and meat under the influence of mainland Japan and US cultures (Todoriki et al. 2004). Due to globalization, these post-war generations have largely *westernized* their lifestyle, thus recently causing a drop in Okinawa's ranking among the Japanese prefectures in terms of life expectancy.

### Sardinia

Validation of the age of Sardinian centenarians (Poulain et al. 2006) revealed exceptional longevity and unexpected gender equality and resulted in the identification of the Sardinian LBZ, a cluster of 14 villages nestled around the highest mountain of the island, with their epicenter in the village of

*Villagrande Strisaili*, where men have been found to live as long as women (Poulain et al. 2011). Various hypotheses have been put forward to explain exceptional longevity in the Sardinian LBZ (Poulain et al. 2011; Pes et al. 2013). This population remained isolated for centuries, which contributed to the stabilization of its gene pool (Cavalli-Sforza 2000) and the respective preservation of sociocultural and anthropological features throughout its history. Considering the characteristics of this genetic isolate, as well as the low gender ratio among Sardinian oldest people, several genetic association studies have been performed on Sardinian centenarians, using markers already known to be associated with longevity in a gender-sensitive manner. They include Y chromosome SNP (Passarino et al. 2001), genetic markers associated with cardiovascular mortality, cancer, and inflammation (Pes et al. 2004; Lio et al. 2003). However, in terms of frequency, none of these markers have been shown to diverge significantly from that of the general population, thus the relative importance of genetic factors in Sardinian longevity still remains unknown. Among the non-genetic factors that might be important to account for the exceptional longevity recorded in central Sardinia and the low female/male ratio among the oldest people, the role of physical activity and nutrition has been the subject of recent research (Pes et al. 2013). The role of traditional foods, influenced by the widespread practice of cattle breeding, typical of a society centered on pastoralism, was investigated by means of historical studies (Pes et al. 2014). In addition to any hereditary factor, growing interest has emerged in the role of behavioral factors and the sociocultural context in successful aging of the Ogliastra population. These studies, based on measuring self-referent metacognitive efficiency, subjective wellness, and depression, have revealed that the elderly in central Sardinia self-rated lower levels of depression and cognitive impairment and had greater levels of emotional competence (Fastame and Penna 2014). It will be necessary to await the results of further research to better understand the role of gene–environment interactions as well as epigenetics.

### Nicoya

The population of the Nicoya Peninsula in the northwestern region of Costa Rica shows an overall mortality rate 20% lower than that of the rest of the country, whereas life expectancy at age 60 is 24.3 years for men and 24.2 years for women, compared with 23.6 years for both genders combined in the rest of Costa Rica. This remarkable situation, pointed out by Rosero-Bixby (Rosero-Bixby 2008), aroused some suspicion among demographers as it is usually assumed that longevity increases with economic development, and Costa Rica is still a developing country. Among centenarians, the female/male ratio is close to 1, whereas in most developed countries, it is usually higher. The results of the Costa Rican Longevity and Healthy Aging Study (CRELES, or *Costa Rica Estudio de Longevidad y Envejecimiento Saludable*), which took into account some biomedical markers, showed that the average height of the inhabitants of Nicoya is greater than that of the general population of Costa Rica, and their body mass index is lower, as is the prevalence of physical and mental disability (Rosero-Bixby et al. 2013). From the biological and genetic point of view, telomere length was found to be greater in the inhabitants of Nicoya than in the general population of Costa Rica (Rehkopf et al. 2013), which, however, as reported by Cassidy in 2010 (Cassidy et al. 2010), could also depend on lifestyle-related factors, such as stress and daily physical activity, and not merely reflect the individual's genetic makeup. The diet of the Costa Rica Blue Zone inhabitants is based on low-glycemic-index traditional foods including rice, beans, fish, beef, pork, and chicken and is high in fiber (Rosero-Bixby et al. 2013). Some environmental factors may also be relevant for the longevity of Nicoya: drinking water in the region has a high calcium content that might have exerted a protective effect against cardiovascular disease and age-related osteoporosis. Furthermore, the elderly population residing in the peninsula experiences a particularly low level of stress: this finding seems to be confirmed by certain social indicators like the rate of suicide in Nicoya, with the lowest value in the whole of Costa Rica recorded here. Finally, it should be

noted that current longevity in Nicoya is also related to improved socioeconomic conditions, an efficient social security system, and free healthcare guaranteed by the government (Rosero-Bixby et al. 2013).

### Ikaria

Ikaria, an island in the Aegean Sea inhabited by just over 8,000 inhabitants, has one of the highest life expectancy in Greece and a female/male ratio among the oldest people that is also close to 1. Most of the inhabitants of Ikaria follow a traditional lifestyle involving a local version of the Mediterranean diet, vigorous physical activity, and lack of stress (Siasos et al. 2013). The Ikarian diet includes vegetables, olives, moderate consumption of cheese, and goat milk, with two features curiously reminiscent of those of the Sardinian LBZ: an abundant traditional use of potatoes and relatively low consumption of fish. Perhaps the most striking feature of Ikarians is their widespread lack of stress, as evidenced by their proverbial indifference to money and the accumulation of material goods; their habit of taking naps in the afternoon is also widespread, and according to some research, it might reduce the risk of coronary death (Panagiotakos et al. 2011). As Ikaria is the last LBZ to have been identified, investigations are still ongoing to disentangle the role of possible factors underlying its longevity.

### Lessons from the Longevity Blue Zones and Directions for Future Research

The various LBZs offer an example of how successful aging can be achieved by a significant number of members of a community. The criteria for any candidate LBZ population must, however, be very stringent and not merely based on the emergence of some sporadic cases of exceptional longevity. Genuine LBZ represent indeed a new scientific paradigm that may prove to be particularly fruitful in testing the association between longevity and various potential explanatory factors. At the present state of the research, the number of potential factors behind a complex trait like population longevity is from the start very large, although it is hoped that a core of major *longevity*

*determinants* present in these populations may be identified more efficiently. As for the genetic aspect, it should be noted that some LBZ populations have undergone long periods of isolation due to their geographical location or for cultural-historical reasons. Thus, through mechanisms such as inbreeding and genetic drift, specific genetic variants causing longer survival could have been selected. Moreover, the insularity or near-insularity of most LBZs could explain the delay in socioeconomic development at the beginning of the capitalist era and may have been the cause of the lower per capita income compared with the reference population. This economic insecurity mostly disappeared during the last century when all LBZs experienced relative high-quality life and improved availability of health services without losing the benefits of their traditional lifestyle. This is particularly evident in the case of diet, which until recently was dependent on local production and favored foods with low-calorie-density but higher in nutrients (Willcox and Willcox 2014). Besides, although Calorie Restriction with Optimal Nutrition (CRON) – currently considered the only diet that promotes longevity – was hypothetically included among the longevity-associated factors in some of the LBZ populations like Okinawa, in other LBZs there is no compelling evidence that it has been a constant feature in the history of these populations. It is probable that the quality of foods, rather than the amount of food itself, has exerted a role in maintaining high health standards in these populations. Moreover, the traditional diet could have acquired more positive aspects during nutrition transition (Pes et al. 2014). The delay of economic development in the LBZ, implying low mechanization in agriculture, could have promoted a more active lifestyle in the population, stimulating considerable energy expenditure during outdoor activities and occupational work. The prevailing attitude observed in the LBZ is of collectivist and egalitarian communities rather than individualistic, which in the past may have reduced competitiveness between social classes and limited average stress levels, and may have delayed the onset of age-related diseases. This attitude is reflected in the

psychological solidarity observed in most LBZ inhabitants: these people show a strong sense of their role within the community and strong self-esteem, which might help them to feel a part of society until the end of their existence (Poulain et al. 2013). This has undoubtedly contributed to reinforcing family ties and to the awareness of the most fragile members of the community that they can rely on a network of social support that is still efficient. In the LBZ, the elderly are generally well integrated into the community and cared for by close family relatives (usually a spouse and children) until late in life, thereby experiencing meaningful emotional contacts across generations.

LBZ research is still developing, and a multidisciplinary strategy alone will help to disentangle the complex phenomenon of exceptional longevity, and in particular to address the classic nature-nurture dilemma. From a biomedical perspective, genetic and epigenetic research must be increased, although the relatively small number of LBZ inhabitants makes this strategy difficult. More attention should be devoted to possible gene-environment and gene-nutrition interactions. From a demographic standpoint, a possible extension of the number of LBZ and in-depth analysis of each of them, also including the genealogical reconstruction of large longevous communities, may increase understanding of the characteristics of these rare populations and may enable longevity theories to be tested with greater statistical power (Poulain et al. 2013). It can be concluded that LBZ have gradually changed from being the focus of simple anthropological curiosity to being an effective model of healthy aging that could be followed by the post-industrial societies of the twenty-first century, too, to meet the challenge of the growing elderly population and consequent substantial healthcare costs.

Finally, a theoretical issue that concerns the nature of LBZ is their temporal evolution. Since some of the factors supposedly involved in LBZ emergence tend to disappear, it might arise that the phenomenon of population longevity be transitory in itself. In fact, there is some evidence that attenuation of the phenomenon is underway in Okinawa (Willcox et al. 2014), and the same tendency may occur in other LBZ in the future. Besides, the

survival advantage disappears in out-migrants from Nicoya, indicating a stronger influence of non-genetic environmental factors (Rosero-Bixby et al. 2013). An interesting aspect is that what LBZ have achieved on a small scale could be transferred to larger human aggregates. It is plausible that the geographic clustering of long-livers currently representing the most salient feature of the LBZ will disappear, leaving average-level, widespread longevity. Future trends will reveal whether what is observed today in the LBZ will persist and even become *commonplace* (Appel 2008).

## Cross-References

- ▶ [Aging and Quality of Life](#)
- ▶ [Aging and Mental Health in a Longitudinal Study of Elderly Costa Ricans](#)
- ▶ [Health Promotion](#)
- ▶ [IKARIA Study, Greece](#)
- ▶ [Rural Health and Aging: Global Perspectives](#)

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## Brain Tumors in Older Adults

Gail A. Robinson

Neuropsychology Research Unit, School of Psychology, The University of Queensland, Brisbane, QLD, Australia

Neuropsychology, Department of Neurology, Royal Brisbane and Women's Hospital, Brisbane, QLD, Australia

### Synonyms

Neoplasm

### Definition

A brain tumor is a mass of abnormal cells. There are two broad categories of brain tumors. *Primary* brain tumors arise from an abnormal proliferation of cells within the central nervous system (CNS). In contrast, *metastatic* tumors originate elsewhere in the body and spread to the brain and are therefore “malignant” (Blumenfeld 2010). Brain tumors that are “malignant” usually grow rapidly, are life threatening, and have the potential to spread and infiltrate the CNS (Blumenfeld 2010). Brain tumors are thought to be “benign” if they are slow growing, have distinct borders, and do not infiltrate or disseminate widely within the CNS (Blumenfeld 2010). This entry will focus on primary brain tumors and will overview classification, types, incidence, etiology, symptoms (including cognitive disorders), treatments, and prognosis, with particular reference to older adults.

### Classification of Brain Tumors

The World Health Organization (WHO) classification of tumors of the central nervous system

(Louis et al. 2007a) is a way of grading the biological behavior or “malignancy.” The WHO grading system is based on the microscopic appearance. WHO grade can be a key factor influencing the choice of therapies, particularly the use of specific chemotherapy and radiation protocols (Louis et al. 2007b; Du Plessis 2005). Grade I applies to tumors with low proliferation potential and the possibility of “cure” following surgical resection alone. Grade II usually applies to tumors that are generally infiltrative and can recur, despite low-level proliferation, and some progress to higher grades of malignancy. Grade III tumors are actively reproducing abnormal cells; they infiltrate adjacent normal brain tissue and tend to recur, often as a higher grade. Grade IV tumors are very abnormal and reproduce rapidly, forming new blood vessels to maintain rapid growth (Louis et al. 2007a, b).

**Box 1: Overview of World Health Organization (WHO) Tumor Classification System**

- **Grade I:** Tumors with low proliferation potential
- **Grade II:** Infiltrative tumors with potential for low-level proliferation
- **Grade III:** Infiltrative and actively growing tumors that tend to recur
- **Grade IV:** Highly abnormal and rapidly growing tumor

## Types of Brain Tumor

The most common type of primary malignant brain tumor, accounting for around 70–80% of patients, is malignant glioma (Omuro and DeAngelis 2013; Cancer Council of Australia 2011). Within the malignant glioma group, the following types and WHO grades have been identified: astrocytoma (WHO Grade I-IV), oligodendroglioma (WHO Grade II-III), ependymomas (WHO Grade I-II), mixed oligoastrocytomas,

**Brain Tumors in Older Adults, Table 1** Abridged summary of the main categories of WHO Classification System (2007) for central nervous system tumors. The most common types in older age groups (>55 years) are indicated in **bold** (Dolecek et al. 2012)

<b>Tumors of the neuroepithelial tissue</b>
<b>Astrocytic tumors</b>
<b>Oligodendroglial tumors</b>
<b>Oligoastrocytic tumors</b>
Ependymal tumors
Choroid plexus tumors
Other neuroepithelial tumors
Neuronal and mixed neuronal-glial tumors
Pineal tumors
Embryonal tumors
Tumors of the cranial and paraspinal nerves
<b>Tumors of the meninges</b>
<b>Tumors of the meningotheial cells</b>
Mesenchymal tumors
Lymphomas and hematopoietic neoplasms
Germ cell tumors
Tumors of the sellar region
<b>Metastatic tumors</b>

and other rarer forms (as summarized in Table 1). Astrocytomas grow from glial cells and grow slowly or rapidly. Oligodendrogliomas grow from cells that insulate the nerves (oligodendrocytes). Glioblastoma multiforme or “GBM” (also astrocytoma Grade IV) commonly contains a mix of cell types and is highly malignant. At present, with the advent of new technologies such as next-generation sequencing and proteomics, the classification of malignant gliomas is changing as more information about the molecular changes occurring at each step of the tumorigenesis process comes to light (McKay 2014).

Meningiomas are often WHO Grade I and benign. However, meningiomas can also be malignant, the latter tending to be of a higher WHO Grade (II or III) (Dolecek et al. 2012).

## Incidence and Age

The median age at diagnosis for all primary brain and CNS tumors is 59 years, according to the 2005–2009 CBTRUS statistical report for the

United States (Dolecek et al. 2012). With increasing age, meningiomas are the most common type of brain tumor diagnosed, followed by gliomas which peak in incidence at age 65–74 years (Dolecek et al. 2012; Wrensch et al. 2002). Meningiomas have a significantly higher incidence (3.5 times) in individuals >70 years, compared to <70 years.

## Etiology

The causes of brain tumors remain elusive. However, there is a slightly *higher risk with increasing age*, being male rather than female and with exposure to ionizing radiation (Cancer Council of Australia 2011). Individuals with rare genetic conditions such as neurofibromatosis type 1 or 2 have a higher risk of developing a brain tumor than the general population (Cancer Council of Australia 2011). The molecular causes of malignant glioma are highly variable between individual patients, even within each subset (Omuro and DeAngelis 2013). In the case of malignant gliomas, such as astrocytomas and oligodendrogliomas, it is characteristic for multiple cell changes to be present at the molecular or DNA level. These may include chromosomal aberrations, single DNA base substitutions of mutations, DNA methylation, or epigenetic modifications. Recently, changes in gene activity that are not caused by changes in the DNA sequence, or epigenetic alterations, have been linked to the formation of cancer (McKay 2014).

## Symptoms and Diagnosis

The presenting symptoms of a primary brain tumor are determined by several factors including the tumor's size, location, and rate of growth. Common symptoms include headache, nausea/vomiting, changes in cognition and personality, gait imbalance, urinary incontinence, hemiparesis, aphasia, hemi-neglect, visual field defect, and seizures (Omuro and DeAngelis 2013; McKay 2014).

Headaches are relatively frequent, presenting in about 50% of patients at diagnosis, but usually with a nonspecific pain pattern, progressive severity, and unilateral localization. In an individual older than 50 years, a new-onset headache may be indicative of a tumor-associated headache from a benign headache. However, the likelihood of a brain tumor being the underlying cause of headaches is less than 1 in 1000, and new-onset seizures also has extremely low predictive value for indicating the presence of a tumor, being <2% (McKay 2014). Nevertheless, as one example, the current Australian guidelines recommend that a patient with new-onset seizures or recurrent headache uncharacteristic for that patient should undergo brain imaging to establish the cause, particularly if focal neurological symptoms such as dysphasia, hemiparesis, or hemianopia are present (McKay 2014).

## Neurological Signs

Changes or disturbance to cognitive functions, or “thinking skills,” may develop as a result of brain tumors. Cognitive functions allow an individual to respond to both the demands of the environment and also to their own internal desires and needs. Cognitive skills include the ability to speak, concentrate, remember, reason, reflect, perceive, and understand. Cognitive disorders can occur when the brain is damaged or disrupted, for example, with growth of a brain tumor. Changes in cognitive functions can be interpreted as “personality changes” or can be mistaken for psychiatric disorders or dementia, particularly in older adults (Cancer Council of Australia 2011; McKay 2014). Cognitive difficulties may be a presenting symptom or they may arise during or after treatments such as surgery, radiation, or chemotherapy (see below for further details of cognitive changes).

Focal neurological signs such as hemiparesis, sensory loss, or visual field disturbances are common and typically indicate the tumor location in the brain. Other neurological signs that arise usually in larger tumors that cause mass effect or displacement within the brain include gait imbalance and incontinence.

## Brain Imaging

Imaging of brain tumors is first to diagnose or confirm a suspected diagnosis. Secondary to this is precise localization and characterization to inform further treatment and/or management (Cancer Council of Australia 2011). Computed tomography (CT) and magnetic resonance imaging (MRI) are currently the main brain tumor diagnostic imaging techniques.

MRI has largely replaced CT scanning in the management of patients with brain tumors, with CT only used in initial imaging and in monitoring acutely changing neurological symptoms. When evaluating non-enhancing tumors, MRI has the benefit of being more specific and sensitive than CT. MRI imaging modalities include MR spectroscopy, perfusion imaging, and diffusion scanning. These MRI techniques are beneficial in differential diagnosis of high-grade gliomas, such as anaplastic astrocytoma and anaplastic ependymoma, primary CNS lymphoma, metastatic tumors, brain abscess, and other neurologic processes (McKay 2014). Although both MRI and CT imaging techniques reveal structural information, they are limited in providing information about the tumor itself in terms of biology and activity.

Molecular imaging with positron emission tomography (PET) has recently been used in brain tumors. PET provides the ability to ascertain additional metabolic information that can be helpful for patient management as well as for evaluating the indication of other therapeutics (McKay 2014). For example, there are several benefits to using PET with radiolabeled glucose and amino acid analogues such as MET or  $^{11}\text{C}$ -methionine. In particular, this form of PET can help with the following: tumor diagnosis, differentiation between recurrent tumors and tissue death due to radiation, and guiding a biopsy or treatment. In recent years, fluorinated amino acid tracers such as FET, or  $^{18}\text{F}$  Fluoroethyl-L-tyrosine, have also been used to guide treatments including surgery in patients with primary brain tumors.

## Prognosis

The survival time after treatment can vary and depends on several factors including tumor type

and grade, location of tumor within the brain, gross total tumor resection, age, and general health preoperatively, which is often indicated by the Karnofsky Performance Status score (Chaudhry et al. 2013). However, negative predictors and generally poorer prognosis are indicated if an individual is *older* (>60 years), the tumor is *high-grade*, resection is incomplete, and the tumor location is crossing the midline or is within the periventricular region of the brain (Cancer Council of Australia 2011). Although recent advances in treatments using combined chemotherapy and radiation, post-resection (Stupp et al. 2005), suggest increased survival, in general, glioblastoma multiforme (GBM) has the poorest survival in all age groups. Further, within any brain tumor type, *older adults have poorer survival rates than younger individuals* (Wrensch et al. 2002).

## Treatments

The approaches to primary and metastatic brain tumor treatment are based on the histology and grade of the tumor, as well as the age and medical condition of the patient. The options for treatment include surgical resection, radiation, and chemotherapy either alone or in combination. In addition, for some tumor types or depending on a patient's general condition and age, a conservative approach of "watch and wait" is taken (Rosenfeld and Pruitt 2012). Although not yet a standard practice, increased knowledge about the molecular biology of tumors, the microenvironment of tumors, and immunologic interactions and how these relate to treatment response will lead to new personalized treatment regimes (Omuro and DeAngelis 2013; Rosenfeld and Pruitt 2012).

An important factor in improving brain tumor patient outcomes is receiving centralized care with a team of specialized health professionals (McKay 2014), which is similar to the benefit of care in an organized and centralized stroke unit when compared to a decentralized team. For primary brain tumors, analysis of surgical resections or biopsies identified that large-volume centers

had lower postoperative mortality rates than centers with smaller numbers of patients.

### Surgery

Surgical resection is often the first line of medical management for benign and malignant tumors, including meningiomas and gliomas that are the most common types in older adults. Thus, for benign meningioma tumor, resection is standard, and for higher WHO grade II and III meningiomas, surgical resection and postoperative radiation therapy are recommended to increase the likelihood of reducing recurrence rates. For more aggressive high-grade gliomas, resection with combined radiation and chemotherapy has become a standard care.

In adults over the age of 60 years, surgical resection of meningiomas carries with it a higher risk of mortality and morbidity compared to intracranial tumor surgery in general (Konglund et al. 2013). Specifically, a large study of inpatients following tumor resection ( $N = 8861$ ; 26% older persons  $>70$  years) revealed a marked effect of older age on each of the primary outcomes. Thus, inpatient mortality rate was higher in the older patients, as well as discharge rates to a facility other than home, and older persons were more likely to have a longer inpatient hospital stay (Bateman et al. 2005). In addition, postsurgical complications in older adults have been reported to include hematomas, deep vein thrombosis, and neurological symptoms. Although the medical management for patients with life-threatening tumors is clear in that surgical resection is necessary, the increased risk of complications for individuals  $>70$  years must be weighed against the expected positive outcomes (Bateman et al. 2005). The benefits of meningioma resection can be measured in terms of improved cognitive function on neuropsychological tests and adequate quality of life, as measured by functional independence scales like the Karnofsky performance scale (Konglund et al. 2013).

### Radiation and Chemotherapy

For malignant brain tumors such as glioblastoma, radiation therapy is the treatment of choice. Whole brain radiation has been commonly used

until the last decade during which time the use of stereotactic radiosurgery (SRS) has become increasingly common. The advantage of stereotactic radiosurgery is that, via this image-guided method, a precise radiation dose can be delivered, which has the potential to reduce treatment time and toxicity. Moreover, preservation of neurocognitive function is more likely with targeted rather than whole brain radiation.

As noted above, the current standard of care for the medical management of primary brain tumors and in specifically glioblastoma includes radiation treatment combined with the alkylating agent temozolomide (TMZ), followed by 6 months of adjuvant TMZ (McKay 2014; Stupp et al. 2005). In a 2005 clinical trial, this regime was found to significantly prolong survival (Stupp et al. 2005). However, the benefit of TMZ is fairly modest with a median overall survival 12.1 months for radiation treatment alone compared to 14.6 months for radiation combined with TMZ (Stupp et al. 2005; Quant and Wen 2010). New therapies, including immunotherapy, vaccines, and the use of nanoparticles, are emerging methods of medical management.

### Immunotherapy

A relatively recent therapy is based on the role of immune cells in regulating tumor progression. Each tumor has its own unique set of genomic and epigenomic changes, which can influence the host immune response to tumor. Active immunotherapy relies on stimulation of the patient's immune system to increase the immune response to target tumor cells. To this end either the entire immune system can be boosted or the immune system can be trained to attack the tumor (McKay 2014). McKay and Hadfield recently summarized the three broad categories of immunotherapy strategies:

- (i) *Immune priming (active immunotherapy)*, or sensitization of immune cells to tumor antigens using various vaccination protocols
- (ii) *Immunomodulation (passive immunotherapy)*, which involves targeting cytokines in the tumor microenvironment or using immune molecules to specifically target tumor cells

- (iii) *Adoptive immunotherapy*, which involves harvesting the patient's immune cells, followed by activation and expansion in the laboratory prior to reinfusion

Although this line of treatment is potentially valuable, it has been hampered by factors such as the blood–brain barrier and lack of lymphatic drainage in the brain (McKay 2014).

### **Cognitive Disorders: Detection, Assessment, and Management**

Changes in thinking, behavior, or emotion are quite common in primary and metastatic brain tumors. This section will give an overview of the importance, causes, and types of cognitive disorders and current methods for detection, with examples of practical tips for managing cognitive difficulties.

Cognitive function is an independent prognostic factor in the survival of glioma patients (Taphoorn and Klein 2004). Moreover, cognitive assessment is useful for several reasons: to inform clinicians of areas to target for neurorehabilitation; to monitor progress and facilitate decision-making about further intervention; if there has been a decline in cognitive function, to ask whether the tumor has recurred or progressed; and if there are subtle alterations in cognitive function, to address whether these are significant or not, particularly when monitoring slow-growing low-grade gliomas (Robinson et al. 2015).

Disturbance to cognitive function in the context of a brain tumor can be due to the location and size of the tumor, prognosis (benign or malignant and WHO grade), treatment (surgery, radiation, chemotherapy), secondary medical complications of treatments, and also an individual's psychology response (anxiety, depression) (Cancer Council of Australia 2011).

#### **Cognition and Aging**

An additional factor in older adults is the nature of aging itself. With increasing age, there is a disproportionate loss of both white and gray matter

particularly to the frontal regions of the brain (Resnick et al. 2003). The frontal cortex is associated with complex thinking and adaptive behavior also known as “executive functions.” In addition, age has been found to exacerbate executive dysfunction in patients with focal frontal lesions, such as a brain tumor in the frontal cortex (Cipolotti et al. 2015).

#### **Overview of Cognitive Disorders**

- *Aphasia and language*: A disorder of language that can affect speaking (expressive aphasia) or understanding (receptive aphasia) or both (global aphasia). The most common language disorder affects the ability to retrieve words or names of objects, people, or places (nominal aphasia). In subtle forms of aphasia, an individual may have difficulty thinking of what they want to say (dynamic aphasia). Literacy and numeracy disorders are termed *dyslexia* when the problem is with reading, *dysgraphia* when the problem is with spelling, and *dyscalculia* when arithmetic difficulties are present.
- *Amnesia*: This is a disorder of memory that can affect personal memories (autobiographical memory), learning new information (episodic memory) or general knowledge about the world (semantic memory). Amnesia can affect verbal or visual information (selective amnesia) or both (global amnesia).
- *Agnosia*: This is a disorder of perception and can be present in any form of sensation (e.g., touch, taste, hearing, smell, and vision). The most common form is visual agnosia, that is, when someone does not recognize what they are looking at with their eyes or they have difficulty knowing exactly where something is in the surrounding environment.
- *Attention and concentration*: Disorders of attention and concentration are common in any condition affecting the brain. Difficulties can be in focusing attention or in sustaining attention over time. Problems can manifest as distractibility or impulsivity.
- *Executive dysfunction*: Executive functions are comprised of many different abilities, including problem solving, reasoning,

decision-making, judgment, initiation of behaviors, monitoring and self-regulation of behaviors, abstract thinking, and strategic thinking. These skills can be disturbed separately or several executive functions may be affected. These are the abilities that enable an individual to adapt their behavior in order to respond and interact appropriately in any situation. The executive abilities are uniquely human and especially vulnerable to the aging process.

- *Speed of information processing:* When information processing is disturbed, thinking can be slowed down and other cognitive skills can be affected as the amount of information processed may be limited.

### Detection and Management of Cognitive Disorders

A significant issue in brain tumors is the method for detection of cognitive disorders. The most widely used method is cognitive screening tools such as the mini-mental state examination (MMSE) or the Montreal Cognitive Assessment (MoCA). However, recent studies have shown that, although the MoCA is better at detecting cognitive deficits than the MMSE, the MoCA fails to detect mild and/or focal cognitive deficits in patients with brain tumors (Robinson et al. 2015). This is particularly for attention, language, and executive functions. Thus, best practice is to assess cognitive disorders with a brief cognitive assessment that is tailored to a patient based on tumor location and presenting neurological and neuropsychological symptoms (Robinson et al. 2015).

Simple strategies can help minimize the impact of cognitive disorders. Detailed strategies can be obtained from specialists in neuropsychological rehabilitation. However, see Box 2 for simple handy tips when experiencing thinking problems.

#### Box 2: Examples of Handy Tips for Thinking Problems

- **Stimulation:** Reduce background noise in the environment to limit the amount of  
(continued)

information to be processed. For example, turn off the television or radio unless watching or listening to a program.

- **Memory:** Use technological supports like a smartphone, calendar, or notebook to remember appointments and important information.
- **Fatigue:** If easily fatigued, plan activity in “intervals,” i.e., activity interspersed with rest throughout the day.
- **Words:** If names of people or things are difficult, ask someone to give the name (rather than guess), repeat it aloud, and/or write down important names.
- **Problem solving:** When planning an activity or how to complete a complex task, break it down into steps and then order the steps and complete these.

### General Summary

Age poses an increased risk of developing a primary brain tumor, from the age of 55 years but particularly for those over 65 years of age. The most common types of tumors in older adults are meningiomas and gliomas. Moreover, prognosis for survival is poorer if an individual is *older* than 60 years. In the context of aging, this is associated with an increased loss of brain volume in the frontal region, impacting complex thinking and adaptive behavior. Older adults are particularly vulnerable for tumors disrupting the frontal cortex. Thus, despite the rarity of primary brain tumors, older adults may experience more post-surgical complications, and they have a poorer prognosis for survival.

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## Bridge Employment

Fiona Alpass

School of Psychology, Massey University,  
Palmerston North, New Zealand

## Synonyms

Phased retirement; Work beyond retirement

## Definition

Henkens and van Solinge (2014) note that definitions of bridge employment vary along a number of dimensions. It has been defined as participation in the labor force between retirement from full-time work and complete workforce withdrawal (Shultz 2003; Topa et al. 2014). Alcover et al. (2014) suggest that as such bridge employment can be conceptualized as “forms of retirement that prolong working life” (p. 7). As Topa et al. (2014) note, this type of paid employment can be in the “same occupation or different occupations, on a part-time, temporary or full-time basis” (p. 226). Henkens and van Solinge (2014) note that bridge employment can be for an employer or include self-employment. In sum, bridge employment is paid work undertaken after retirement from the main career job but before exiting the labor force completely (Topa et al. 2014).

## Introduction

The rapid change to the nature of work and working lives in the past few decades has seen a

concomitant transformation of the pathways to workforce exit. Retirement is no longer necessarily a “clean break” characterized by an abrupt departure from the workforce. The transition from work to retirement is now “blurred” and “fuzzy” – retirement is no longer a single discrete event but can be viewed as a dynamic and individual process that may occur over a short period of time in one’s life or may include an extensive period of withdrawal and reentry to the paid workforce (Beehr and Bennett 2007; Bowlby 2007). Individuals may reduce their work responsibilities or hours of employment or take on some form of temporary work or limited contract position. Thus “bridge employment” can be characterized as a “transition into some part-time, self-employment or temporary work after full-time employment ends and permanent retirement begins” (Feldman 1994, p. 286).

### Conceptualizing Bridge Employment

One way to conceptualize bridge employment is through a life course perspective. Dingemans et al. (2015) argue that life transitions, such as those incurred through bridge employment, do not operate within a vacuum. Rather, individuals are embedded within personal and social environments that shape their life histories and these may hinder or facilitate late-life career choices. Thus, the life course approach suggests that many factors, such as socioeconomic, psychosocial, and health factors, interact to influence the participation in bridge employment.

In their recent work, Zhan and Wang (2015) provide another organizational framework for conceptualizing and theorizing bridge employment. First, bridge employment can be viewed within a decision-making framework as rational planned behavior. That is, employees choose to engage in bridge employment (for numerous reasons) voluntarily. The decision to participate in bridge employment may be made multiple times once the retirement process has been embarked upon, and these decisions may be influenced by personal and contextual factors (Wang and Chan 2011; Zhan and Wang 2015). Second, bridge

employment can be seen as a career development stage where employees use bridging opportunities to pursue career goals. Bridge employment may offer the flexibility and autonomy to pursue generativity goals or to fulfill ambitions of self-employment (Zhan and Wang 2015). Third, bridge employment may be regarded as an adjustment process where those intending to retire use bridge employment as a mechanism to adapt to future retirement, both financially and psychologically. Finally, Zhan and Wang (2015) conceptualize bridge employment from the employer’s point of view as a function of human resource management processes to attract, motivate, and retain older workers.

### Types of Bridge Employment

Bridge employment can be categorized into two types – career consistent bridge employment and noncareer bridge employment. In the first, individuals may stay within the same organization or move to a different organization but will remain in the same occupation. In the second, individuals move to a different field where flexibility is a key criterion and status and pay may be reduced to reflect this (Alcover et al. 2014). This type of bridge employment is thought to be the more common and often involves self-employment as it provides greater flexibility and autonomy compared to salaried positions (Alcover et al. 2014).

Zhan and Wang (2015) note that this typology may not be sufficient to accurately capture the nature of bridge employment and suggest four key criteria that can assist in understanding the complexity of patterns of participation in bridge employment. The first criterion is working field. This reflects the typology described above in that individuals may undertake bridge employment in the same field as their career jobs, or in a different field. Reflecting the decision making conceptualization proposed earlier by Zhan and Wang (2015), individuals “assess the information of their personal characteristics and work-related characteristics to determine which working field to choose for bridge employment” (p. 209). These factors can be related to the individual’s financial

situation (Wang et al. 2008) or work attributes such as job strain, job-related skills, and job characteristics (Gobeski and Beehr 2009).

The second criterion suggested by Zhan and Wang (2015), related to their Human Resource Management conceptualization of bridge employment, is the organization or employer. Organizations are increasingly striving to attract, motivate, and retain older employees. Thus they may influence the choice between same versus different organizations by providing flexible work environments that meet the changing needs and abilities of older workers seeking to engage in bridge employment. Along with the notion of same versus different organizations in which to undertake bridge employment, a third option is that of self-employment. Zhan and Wang (2015) note that self-employment increases with age and is one of the most common pathways through bridge employment to full retirement for older workers. This is reflected in the conceptualization of bridge employment as a career development stage, providing arguably the greatest flexibility and autonomy for the adjustment process to retirement.

The third criterion suggested by Zhan and Wang (2015) is that of the time commitment toward bridge employment and reflects the conceptualization of adjustment outlined earlier. Operationalizing bridge employment as the time committed to work-related activities highlights the dynamic process of adjusting to full-time retirement and underscores the fact that most bridge employment is undertaken on a part-time basis. Thinking of bridge employment from a temporal perspective also allows investigation of the transitional nature of the process where individuals may move in and out of part-time employment over a period of time as they move toward full-time retirement.

The final criterion suggested by Zhan and Wang (2015) is that of motive. Citing Mor-Bank's (1995) typology of work-motivation factors for older adults (financial, personal, social, and the generativity factor), the authors argue that different motivations for bridge employment have consequences for outcomes. That is, motivations will work differentially on job and career satisfaction and retirement adjustment.

## Determinants and Outcomes of Bridge Employment

Dingemans et al. (2015) propose a number of life course determinants of bridge employment such as socioeconomic and health factors, work and retirement context, and family commitments.

First, socioeconomic factors and health are determinants of work force participation. Financial circumstances may be a strong determinant of whether individuals engage in bridge employment in the transition to retirement. Bridge employment may offer the opportunity of boosting pension or superannuation payments for some (Doeringer 1990), where for others it may be the only source of income before becoming eligible for such benefits (Atchley and Barusch 2004; Zhan et al. 2009). Dingemans and Henkens (2014) found that those who engaged in "involuntary bridge employment" reported lower levels of life satisfaction than those who were motivated to engage in bridge employment for intrinsic enjoyment. However, engagement in bridge employment after involuntary retirement partially mitigated the negative effects of involuntary retirement on life satisfaction.

Poor health may result in involuntary bridge employment as it dictates the commitment individuals can make to work with reduced hours or responsibilities, often the result of decreased physical and mental capacity. On the other hand, good health can enhance the individual's capacity to continue in some form of paid employment well beyond socionormative expectations (Zhan et al. 2009). Work attributes such as occupational status and level are also related to the probability of undertaking bridge employment (Dingemans et al. 2015). Bridging employment can also help to maintain the sense of structure and worth that full-time employment may have provided (Kim and Feldman 1998; Wang et al. 2008) even though bridging jobs tend to be at a lower status and lower rate of pay than the individuals' previous full-time job (Atchley and Barusch 2004).

The context in which retirement occurs also influences whether bridge employment is undertaken (Zhan and Wang 2015). Involuntary or early retirement through organizational restructuring or

personal circumstances may push retirees toward seeking bridge employment in order to gain a “sense of control” or to comply with societal norms surrounding work roles (Dingemans et al. 2015). Organizations themselves may facilitate or hinder opportunities for bridge employment. That is, organizations in an effort to attract or maintain older workers may provide more flexibility and design the workplace to accommodate the needs of older workers (Zhan and Wang 2015).

Family factors are also important contextual considerations in the retirement process, although the impact of these may be more distal than job-related factors (Wang et al. 2008). The work situation of a spouse may determine the timing and extent of workforce disengagement for individuals, as do caring commitments for family members including spouse, parents, children, and grandchildren.

Wang et al. (2014) distinguish between micro-, meso-, and macro-levels of bridge employment antecedents. Similar to Dingemans et al.’s (2015) life course perspective, micro- or individual factors include financial status and health plus other demographic factors such as age, education, and gender. Older workers are less likely to take up bridge employment, while those with higher education levels are more likely to engage in bridge employment (Wang et al. 2014). Henkens and van Solinge (2014) found that men were more work-oriented postretirement than women, although this was dependent on education level. They also found that married people were more likely to engage in bridge employment than single or divorced older workers.

Meso- or job-related factors include the work environment, work role, and attitudes (Wang et al. 2014) and highlight the role of organizational context in facilitating the uptake of bridge employment (Dingemans et al. 2015). Do organizations put in place practices to encourage bridge employment for older workers such as flexible working hours, improved work design, and reduced workloads? Can organizations provide opportunities for recognition of skills and experience while meeting both organizational goals and employees’ desire for bridge employment?

Flexible work arrangements are often cited as important to older workers, but are often not offered by employers (Alpass et al. 2015).

Finally, macro- or societal-level factors, such as government policies, the employment rate, and the economy can also impact on the likelihood of the availability of opportunities for bridge employment (Wang et al. 2014). As Dingemans and Henkens (2014) note, the impact of these factors on the availability of bridge employment opportunities is not under the individual’s control.

The potential consequences of engagement in bridge employment are many and varied with evidence for improved health, quality of life, life satisfaction, and retirement satisfaction for those who engage in bridge employment compared to those who retire completely from the workforce (Dingemans and Henkens 2014; Topa et al. 2014; Wang 2007; Zhan et al. 2009). Two theoretical perspectives that provide insight into the potential benefits of bridge employment for the individual are continuity and role theory.

*Continuity theory* contends that as people age, they strive to preserve internal and external behavior and circumstances in order to maintain and improve well-being (Atchley 1993). Older adults’ beliefs about self and identity are tied to their roles and activities. Continuity theory would suggest that any new activities will be in the general area of former activities. Thus, based on this theory we would expect retirees that continue some form of employment after exiting their career job to experience better health and well-being, and this would be more so for those who continue in bridge employment in same field of work (Zhan et al. 2009). There is some evidence to suggest this is the case. Kim and Feldman (2000) found in a sample of early retirees that those more involved in bridge employment (both within and outside their previous employer) were more satisfied with both retirement and life in general. Zhan et al. (2009) in a longitudinal investigation using Health and Retirement Study (HRS) data found similar results for the benefits of career and noncareer bridge employment on physical health and functional limitations while controlling for baseline health and demographics, although only

career bridge employment was beneficial for mental health. Consistent with continuity theory, Wang (2007) found, again in longitudinal analyses of HRS data, that retirees with bridge jobs were more likely to be in a “maintaining pattern” of psychological well-being in retirement compared to retirees without bridging employment. That is, they experienced fewer changes in psychological well-being during the transition to retirement compared to their fully retired counterparts. In a longitudinal study, Dingemans and Henkens (2014) found that those who wanted a bridge job but were unable to secure one reported decreased life satisfaction with their lives postretirement. Similar to Baltes’ model of Selective Optimization with Compensation, Atchley’s theory does allow for some changes or withdrawal from activities in order to adapt to changed circumstances, such as declines in health, function, or motivation. Key resources that individuals rely on to maintain continuity include educational level, health, and financial status (Wang et al. 2008).

*Role theory* maintains that the roles available to the individual change as they transition to retirement. Roles may need to be substituted or adapted in order to prevent stress and anxiety and to successfully adjust to retirement (Bosse et al. 1996). One way for retirees to manage the loss of the career work role is to engage in bridge employment to maintain role identity. In doing so they may mitigate the negative health effects of role loss and role transition (Zhan et al. 2009). Zhan et al. (2009) argue that the effects of participation in bridge employment can be viewed as similar to those associated with job reemployment (where the unemployed reenter the work role). That is, where reentering the work role can restore well-being to preunemployment levels, so too can the bridge employment role have a positive impact on health and well-being for those previously engaged in career employment.

On the other hand, substituting the work role with other roles on retirement such as those associated with leisure and family pursuits may also contribute to sustaining and maintaining well-being (Wang et al., 2009).

## Future Directions

What are the promising future directions for research on bridge employment? Zhan and Wang (2015) suggest three areas as foci for new directions in this field of research: the engagement in bridge employment and the transition to retirement from the retirees’ perspective, organizational human resource (HRM) practices and job design, and issues related to refining the measurement of bridge employment.

Wang et al. (2011) note the lack of empirical studies examining individual resources and individual differences such as personality and dispositional traits as predictors of retirement adjustment in general. Zhan and Wang (2015) also cite a lack of evidence around the role of retirees’ psychological characteristics in the bridge employment process and suggest a stronger focus on personality traits (e.g., the big five), individual motivations, and attitudes to work and retirement in general in understanding the nature of retirement transitions. As Zhan et al. (2009) argue, understanding the motivations for engaging in bridge employment (e.g., for fulfilling career goals, transition to full retirement) may provide insight into the different health trajectories that occur in retirement and beyond into older age.

Human resource practices are also suggested as an avenue for future research in understanding bridge employment decision making. What types of work environments encourage older workers to engage in bridge employment either within their own career field or in another field? Flexible work arrangements such as working from home, reduced workload pressures, flexible work schedules, and phased retirement, although valued by older workers, are often not made available by organizations (Alpass et al. 2015). Zhan and Wang (2015) argue that organizations would benefit from an understanding of the work preferences of older workers so that HRM practices can be designed to maximize the potential of older workers for remaining engaged in the workforce.

As noted earlier, there have been numerous definitions put forward to describe the experience and process of bridge employment. In addition, categories for different types of bridge

employment have been put forward (e.g., career bridge employment versus bridge employment in a different field). Alcova et al. (2014) propose that researchers develop internationally useable definitions that precisely specify the different types of bridge employment. This would encourage more cross-country comparisons of the nature and extent of bridge employment. Zhan and Wang (2015) note that precise definitions are required so that the impact on bridge employment decision making of societal and economic factors (e.g., retirement age, workforce age structure, and social security systems) can be more fully investigated. In addition, multiple indicators of retirement adjustment are needed (Wang et al 2011), incorporating inter- and intradisciplinary approaches and the use of longitudinal data to understand both proximal and distal influences on the retirement adjustment process should be prioritized (Alcova et al. 2014).

The participation in bridge employment is not necessarily under the individual's control (Dingemans and Henken 2014). Dingemans and colleagues (2015) found that the transition to bridge employment is "strongly influenced by the opportunities and restrictions in the social context in which the retirement process unfolds" (p. 10). They argue that a "process of cumulative disadvantage" may hinder some older workers who seek to extend their working lives. There is little empirical work that has investigated the process of seeking bridge employment and whether older workers can get the jobs they want (Zhan and Wang 2015). Dingemans et al. (2015) suggest further research needs to investigate the relationship between intentions to engage in bridge employment and subsequent behavior and the factors that can impact on that relationship. The role of social networks and social support in assisting the move from full-time employment to bridge employment and the potential to mediate the relationship between the retirement transition process and health outcomes has also been suggested as a potential future direction for research (Wang et al. 2011; Zhan et al. 2009). One way to incorporate these considerations in future research is to take a dynamic perspective to bridge employment as proposed by Wang and

Shultz (2010). Instead of conceptualizing bridge employment as a one-off decision, a dynamic perspective views bridge employment as part of a longitudinal transition process from the individual's retirement decision to the state of full retirement. The approach allows for the investigation of proximal and distal predictors of bridge employment as well as outcomes variables in retirement such as adjustment, life satisfaction, and mental and physical health.

In sum, it has become increasingly obvious over the past three decades that retirement can no longer be described as a discrete event. Instead, as Wang and colleagues argue, retirement should be viewed as a dynamic process nested within the individual context and societal circumstances. The process of retirement may occur over an extended period of time in one's life and may include an extensive period of withdrawal and reentry to the paid workforce through bridge employment. Engagement in bridge employment may be driven by a number of factors, including personal, work-related, organizational, and societal factors. The effects of bridge employment on postretirement outcomes are coming under increased focus and future research directions provide the opportunity to investigate new theoretical perspectives and further refine measurement.

## Cross-References

- ▶ [Career Development and Aging](#)
- ▶ [Employment of Older Workers](#)
- ▶ [Flexible Work Arrangements](#)
- ▶ [Job Loss, Job Search, and Reemployment in Later Adulthood](#)
- ▶ [Motivation to Continue Work After Retirement](#)
- ▶ [Postretirement Career Planning](#)
- ▶ [Work to Retirement](#)

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## Burden of Disease and Aging

Shane A. Thomas<sup>1,3</sup> and Colette J. Browning<sup>2,3,4</sup>

<sup>1</sup>School of Primary Health Care, Monash University, Melbourne, VIC, Australia

<sup>2</sup>Royal District Nursing Service, St Kilda, VIC, Australia

<sup>3</sup>International Primary Health Care Research Institute, Shenzhen, China

<sup>4</sup>Monash University, Melbourne, VIC, Australia

## Synonyms

Disability-Adjusted Life Years (DALYs); Quality-Adjusted Life Years (QALYs); Years Lived with Disability (YLD); Years of Life Lost (YLL)

## Definition

Burden of disease (BoD) is a population measure of the effects of a specific disease or health problem.

It is usually measured by Disability-Adjusted Life Years (DALYs) and/or by the related concept of Quality-Adjusted Life Years (QALYs). A DALY is a year of healthy life that is “lost” because of a specific condition. When the DALYs associated with a condition within a population are summed, this is the burden of disease (BoD). The burden of disease is the number of healthy years lost in a population compared to full health. The QALY is the person’s length of life multiplied by a valuation of their health-related quality of life. QALY measures are frequently used in the economic evaluation of health interventions. The World Health Organization coordinates a major ongoing global study of BoD, the Global Burden of Disease Study.

## Introduction

The purpose of this chapter is to outline BoD in older populations, define, discuss and critically evaluate BoD concepts and measures, and discuss statistical, moral, and ethical issues in the use of BoD concepts particularly in older populations.

Most countries use DALYs in their health economics analyses and health and social policy-making. There has been strong global co-operation in global burden of disease studies in the form of the Global Burden of Disease program. The Institute for Health Metrics and Evaluation (IHME) at the University of Washington supervises the conduct of the Global Burden of Disease (GBD) program in close collaboration with the World Health Organization. In its initial 1990 emendation, the GBD program was predominantly funded by the World Bank in partnership with WHO, and the outcomes were reported in its landmark 1993 World Development Report (World Bank 1993). The GBD program has grown substantially from its initial Harvard University base. It now involves over 1,000 researchers from over 100 countries. In the 2010

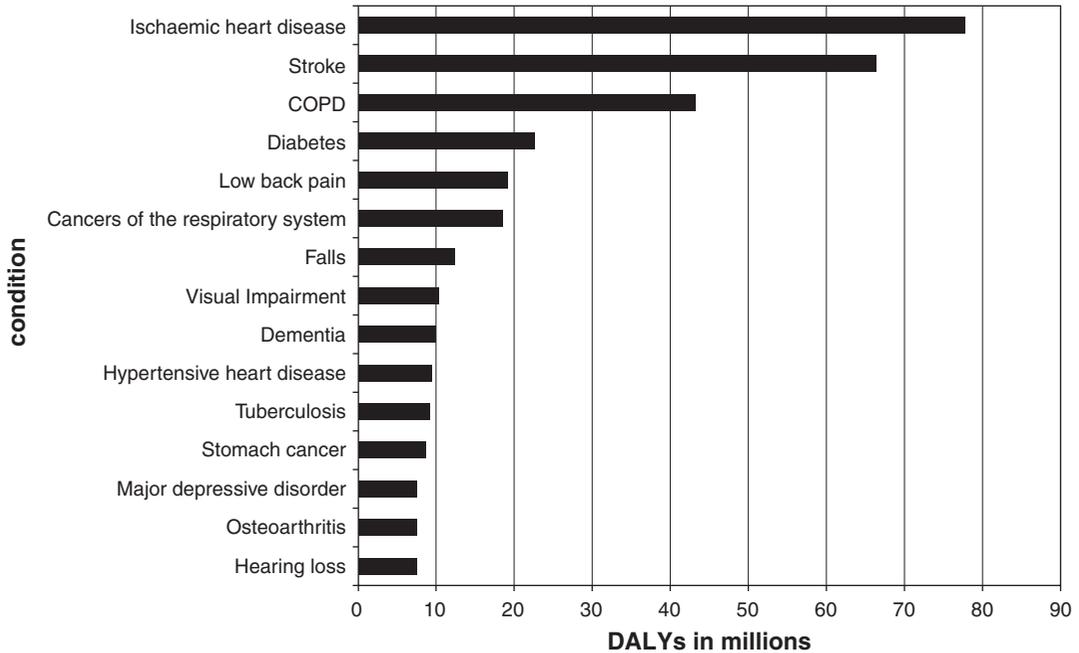
GBD study, the Gates Foundation and other sponsors supported the program, and it includes statistics for 291 diseases across 21 regions and 187 countries across the full sociodemographic range. The GBD program has partnered with *Lancet* to provide a widely accessible publication forum for its results. The 2013 update following on the 2010 study is the first of a series of annual updates that will track changes and trends in GBD into the future. This will provide a more frequent and regular ability to governments to track key trends and patterns in health and disease within their countries. This is a highly useful policy and decision-making tool.

## Patterns of Burden of Disease Among Older People

As outlined in the 2013 GBD update, the growth in global burden of disease is fueled by population aging: “. . . the analysis showed the global transition towards a rapid increase in YLDs due to global population growth and ageing, combined with little progress in reduction in age-specific YLD rates (Global Burden of Disease Study 2013 Collaborators, 2015). Thus, globally policy makers are increasingly focused on the gains that can be made in terms of increased health status and well-being and reduced burden of disease among older people.

As illustrated in Fig. 1 below which shows DALYs for people aged 60 years and over, noncommunicable diseases (NCDs) have been identified as the major global source of and underlying cause for burden of disease. The World Economic Forum’s (Bloom et al. 2011) report asserted that NCDs represent 63% of all deaths being “the world’s main killer.” The Forum asserted that over the next 20 years, NCDs will cost \$USD30 trillion (or 48% of the 2010 global GDP) and that they will have devastating global economic impacts. Burden of disease concepts and data are therefore used to identify where resources may be most optimally allocated to achieve the greatest impact across the target populations. The link between population aging and increased impact of NCDs has been widely

### 2010 Global Burden of Disease Study's estimated DALYs for all people aged 60 years and older



**Burden of Disease and Aging, Fig. 1**

acknowledged both by researchers and policy makers.

These data provide interesting insights into the drivers of population of burden of disease. Many of these conditions are influenced by personal behaviors and lifestyle factors, in addition to the environmental and genetic factors. Before the discussion of the critiques of BoD and the utility of BoD concepts in older populations, the following section describes the operationalization of BoD measures.

#### Rationale for and Operationalization of Measures

Burden of disease is a population measure of the effects of a specific disease or health problem. Murray's (1994) landmark article in the Bulletin of the WHO outlines the intent and technical characteristics of BoD indicators and specifically the DALY indicator.

Murray's paper provides a clear discussion of the design choices made in the construction of the DALY. He stated:

The intended use of an indicator of the burden of disease is critical to its design. At least four objectives are important.

1. To aid in setting health service (both curative and preventive) priorities;
2. To aid in setting health research priorities;
3. To aid in identifying disadvantaged groups and targeting of health interventions;
4. To provide a comparable measure of output for intervention, programme and sector evaluation and planning.

There are various measures of burden of disease with the two most common being Disability-Adjusted Life Years (DALYs) and Quality-Adjusted Life Years (QALYs). These in turn rely upon the measurement of Years of Life Lost (YLL) from premature mortality in the population and the Years Lived with Disability (YLD) for people living with the condition.

The equations and definitions for each of these measures are as follows:

A Disability-Adjusted Life Year (**DALY**) is a year of healthy life that is “lost” because of the condition. When the DALYs associated with a condition within a population are summed, this is the burden of disease. The burden of disease is the number of “healthy” years “lost” in a population compared to full health taking into account both deaths and years lived in suboptimal states of health:

$$\text{DALY} = \text{YLL} + \text{YLD}$$

**Years of Life Lost (YLL)** are years lost to premature disability. Years of Life Lost are the difference between the actual age at death and the longest expected life expectancy for a person at that age. So if a person dies at 70 but the life expectancy is 80, then the Years of Life Lost is 10 years.

**Years Lived with Disability (YLD)** is the number of years lived with less than perfect health. The prevalence of the health condition being measured is multiplied by the (disability) weight for that specific condition. The weights are determined by expert analysis of community studies of health impacts of the condition (See Klarman et al. 1968; Torrance 1986). The disability weight is the severity or extent of health loss for the specific health state or condition. There is a considerable literature concerning the most appropriate methods for estimation of health utilities and weights.

A **QALY** is a year of life spent in perfect health. In this sense a QALY is a mirror image conceptualization of disease burden when compared to a DALY. The National Institute for Health and Clinical Excellence (NICE) has provided the following definition of QALY as a “measure of a person’s length of life weighted by a valuation of their health-related quality of life.”

$$\text{QALY} = \text{Life expectancy} * (\text{weighted quality of the remaining life years})$$

QALYs are typically combined with cost estimates of what it would cost for an intervention to generate a year of perfect health (a QALY) and that process yields a cost utility ratio estimate. This process

enables the benefits of different interventions to be compared with each other, the goal generally being to obtain interventions that have a low cost per QALY. However, the use of these data in this fashion has generated some controversy.

## Critiques of Burden of Disease Concepts and Measurement

The burden of disease concept has been subjected to significant, some may say trenchant, criticism by a variety of scholars since its inception. Park’s (2014) review of burden of disease provides a clear analysis of the key arguments advanced by its critics. She acknowledges that DALYs are “in wide use in the field of global health” but that they have been subjected to a “barrage of criticism” (Anand and Hanson 1997) over an extended period. Phillips argues that “QALYs are far from perfect as a measure of outcome, with a number of technical and methodological shortcomings,” but she also notes that “Nevertheless, the use of QALYs in resource allocation decisions does mean that choices between patient groups competing for medical care are made explicit.”

Essentially the criticism falls into two main categories: linked conceptual and statistical objections and ethical/moral objections.

### Conceptual and Statistical Issues

#### Weighting

The statistical objections concern the measurement and weighting systems used in the measurement process underpinning BoD. Essentially in assessments of the “perfect” health state, the arbitrary value of 1.0 is assigned to perfect health and the arbitrary value of 0.0 is assigned to death. Intermediate values on this continuum are calculated using tools and methods that have been subject to expert review and considerable debate. Arnesen and Nord (1999) express their conceptual concerns neatly when they note that “The disability weightings in use tell us that the value of one year for 1000 people without disabilities on average is set equivalent to the value of one year for 9524 people with quadriplegia, 4202 people with

dementia, 2660 blind people, 1686 people with Down's syndrome without cardiac malformation, 1499 deaf people, 1236 infertile people, and 1025 underweight or overweight people" (1999, p. 1424).

Thus, while these tools may well have been designed by experts, the values assigned at the end of the day are arbitrary constructs that do not relate directly to the natural world. As with all tools measuring constructs, the burden of disease measurement tools are not psychometrically perfect. No tool is. Hence they contain measurement error and hence intrinsically on occasion will provide erroneous results. Nevertheless the statistical assumptions for the tools are clearly stated and therefore can be evaluated. Burden of disease is a key tool in health policy and program evaluation. It has deficiencies in its implementation, but there is a clear focus to address them in its many users.

#### Individual Differences Among Older People and Multi-morbidity

While the uses of concepts such as burden of disease intrinsically take a population or large subgroup perspective, the large individual differences among older people must be recognized and incorporated in service design and policy. Failure to understand that BoD measures use the concept of the average person or the aggregated person who do not in fact exist is a major concern in the use of such measures. Beard and Bloom's 2015 Lancet commentary includes the highly pertinent comment that "great interindividual functional variability is a hallmark of older populations." They go on to conclude that this variability poses major challenges to policy formulation and program design. There are many studies that support the general finding that aging involves the experience of different individual trajectories that one size does not fit all. Hsu and Jones (2012) provide details of the quite variable trajectories that older people follow in aging.

A growing preoccupation in burden of disease research and service delivery is the issue of multi-morbidity or multiple conditions experienced by especially older people. Various studies have identified very high rates of multi-morbidity among older people. Marengoni and colleagues'

(2011) systematic review of multi-morbidity found that among 41 reviewed papers that prevalence of multi-morbidity in older persons ranged from 55% to 98% with increasing rates for older people, females, and low socioeconomic status. The number of conditions experienced especially by older people is quite high. For example, Collerton and colleagues (2016) report a multi-morbidity rate of 92.7% with a median number of 4 conditions among the Newcastle 85+ study sample.

Fortin et al. (2014) who are the pioneers of multi-morbidity research have recently published studies linking multi-morbidity and (unhealthy) lifestyle factors including smoking, alcohol consumption, fruit and vegetable consumption, physical activity, and body mass index. The aggregation of unhealthy lifestyle factors has been found to be strongly associated with multi-morbidity. Multi-morbidity can create technical problems in the measurement of burden of disease because of the need to attribute the unique contributions of individual diseases or conditions to the levels of disability experienced by the individuals concerned.

Afshar and colleagues (2015) have made the pertinent point that while aging is considered an important driver of increased burden of disease, multi-morbidity and socioeconomic factors are also important related factors.

#### Ethical and Moral Issues

In terms of ethical and moral arguments against DALYs and other BoD measures, some disability advocates have argued that the whole concept of disease burden intrinsically devalues the lives of people with disabilities by representing them as of "lesser" value than those experiencing good health.

With regard to the use of QALYS and DALYs in health resource allocation, one might arrive at the conclusion that it is poor public policy to over-invest in services for older people because they will not deliver the returns in terms of DALYs and QALYs that are achievable with other groups. However, the evidence for this proposition is highly arguable as illustrated in the previous sections of this entry. Older people respond well and

effectively in terms of disease burden reduction to investment in them. Ory and Smith's volume contains numerous counterexamples to this position. Murray's exhortation that BoD indicators must "aid in identifying disadvantaged groups" is also a reminder of how the pioneering developers of burden of disease concepts and methodology argued from the outset that burden measures were not intended to be used to justify disinvestment in health programs and services for older people.

### Can Burden of Disease Be Modified and Reduced Among Older People?

There is ample evidence that the health of older people can be improved through interventions. However, the quantification of the benefits that is required to calculate reliable cost utilities is a particular challenge. Providing a key policy framework for healthy aging, the WHO World Report on Ageing and Health (Beard et al. 2015) points to the major gains that can be obtained with coordination of focus on healthy aging in health and social programs. The policy actions outlined in Table 1 below are proposed within the report to enhance healthy aging and reduce age-related burden of disease. There is a strong psychosocial and cultural focus in the proposed actions. The identification of the need to "combat agism," to "improve understanding of the health status and needs of older populations," and to "enable autonomy" for older people reflects an approach that is not merely centered on disease.

Many commentators have argued for the high utility of investment in health promoting actions among older people (Prince et al. 2015). Fortunately there are now many interventions and programs that have established evidence for effectiveness in the prevention and management of NCDs among older people. Most of them include behavioral changes (Browning and Thomas 2005) in the targeted populations. Ory and Smith's (2015) volume in *Frontiers in Public Health* includes 59 contributions concerning successful health-related programs and interventions for older people from a range of countries and is

**Burden of Disease and Aging, Table 1** WHO policy actions to promote healthy aging in older people

Actions
Ensure access to older person-centered and integrated care
Orient systems around intrinsic capacity
Ensure a sustainable and appropriately trained health workforce
Establish the foundations for a system of long-term care
Ensure a sustainable and appropriately trained workforce for long-term care
Ensure the quality of long-term care
Combat agism
Enable autonomy
Support healthy aging in all policies at all levels of government
Agree on metrics, measures, and analytical approaches for healthy aging
Improve understanding of the health status and needs of older populations
Increase understanding of healthy aging trajectories and what can be done to improve them

indicative of the strong and growing evidence base for effective interventions for older people.

### Conclusion

BoD is a widely used system of measurement of the effects of diseases in populations. BoD in older populations is currently driven largely by ischemic heart disease, stroke, and COPD. Criticisms of BoD focus on the arbitrary nature of the statistical weightings and the intrinsic devaluation of people with disabilities involved in measuring their decrements. For older people the concept is often applied in a way that does not address heterogeneity/individual differences in health outcomes in old age and multi-morbidity, but this current practice is not an intrinsic feature of its design. Despite these shortcomings, BoD can help policy makers make transparent and informed decisions about where to place resources to maximize health outcomes for older people. The early prevention and management of chronic diseases and conditions are an obvious approach to promoting healthy aging. However the design and implementation of programs to

promote health and manage disease for older people need to incorporate the structural drivers of health, namely, healthy environments and person-centered, diversity sensitive, and integrated health-care systems.

## Cross-References

### ► Healthy Aging

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## Canadian Longitudinal Study on Aging, A Platform for Psychogeriatric Research

Vanessa Taler<sup>1</sup>, Christine Sheppard<sup>2,3</sup>,  
Parminder Raina<sup>4</sup> and Susan Kirkland<sup>5</sup>

<sup>1</sup>University of Ottawa and Bruyère Research  
Institute, Ottawa, ON, Canada

<sup>2</sup>University of Waterloo, Waterloo, ON, Canada

<sup>3</sup>Bruyère Research Institute, Ottawa, ON, Canada

<sup>4</sup>Department of Clinical Epidemiology and  
Biostatistics, McMaster University, Hamilton,  
ON, Canada

<sup>5</sup>Departments of Community Health and  
Epidemiology and Medicine, Dalhousie  
University, Dalhousie, NS, Canada

### Synonyms

CLSA; Cognition; Cohort; Depression; Mood;  
Personality traits; Psychopathology; PTSD

### Definition

The recently launched CLSA is the largest and most comprehensive study of aging ever undertaken in Canada. Through its innovative design

and advanced data collection methods, the study provides a unique opportunity to examine the aging process and factors that shape healthy aging. After describing the study design of the CLSA, an overview of the measures used to assess psychological functioning is provided. The chapter concludes with a discussion of how the CLSA provides a unique opportunity to investigate the internal and external factors that influence psychological functioning in mid- to late-life.

### Introduction

The ability to maintain autonomy, perform everyday activities, and engage in society is highly dependent on the level of psychological functioning, and this relationship is magnified with age. Changes in cognitive functioning are a component of normal aging and begin in mid-life or even earlier. While some higher brain functions (e.g., processing speed) are highly sensitive to age-related change, other abilities are well preserved in healthy aging (e.g., comprehension of word meaning) (Park and Schwarz 2000). Changes may also be observed in the “pragmatics” of cognitive functioning, which are largely captured under the rubric of social cognition (i.e., how we perceive and interpret our world) (Baltes 1993).

Identifying the links between personality variables and wellness is also emerging as a predominant research topic. Research reveals complex

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Noted at end of chapter On behalf of the CLSA Psychology Working Group (Table 2).

associations between personality and well-being, both physical and mental. In part, these associations appear to be a function of the link between personality traits, mood states, and psychopathology and the resulting effects upon physical wellness. For example, negative emotional states appear to have a significant influence upon biological functions such as immune function and regulation (which become less efficient in later life), thus increasing the risk of many health problems (Kiecolt-Glaser and Glaser 2002).

Longitudinal research is critical in order to achieve a clear understanding of age-related changes in psychological function and the links between psychological function and wellness. The Canadian Longitudinal Study on Aging (CLSA) will follow 50,000 adults aged 45–85 for at least 20 years, collecting critical information on psychological and social function, as well as indices of physical and mental well-being. This will allow for examination of psychological processes as precursors and mediators in relation to measures of social, biological, psychological, and adaptive functioning (e.g., social participation, diseases, everyday functioning).

## The Canadian Longitudinal Study on Aging

The recently launched CLSA is the largest and most comprehensive study of aging ever undertaken in Canada. Through its innovative design and advanced data collection methods, the study provides a unique opportunity to examine the aging process and the factors that shape healthy aging. The goal is to better understand the complex interplay among the many determinants of health through the examination of influences “from cells to society,” providing the most accurate picture possible of the dynamic process of adult development and healthy aging. By collecting information on the changing biological, medical, psychological, social, lifestyle, and economic aspects of people’s lives as they age, the CLSA will contribute to the identification of modifiable factors that can be used to develop interventions to improve the health of Canadians.

Most previous large-scale adult development and aging studies that address psychology have focused on the development of specific psychological processes such as memory and intelligence or have been conducted in the context of specific disorders, such as dementia. The CLSA will expand this domain of research by examining several psychological constructs as precursors or mediators of specific and global aspects of health and health-related outcomes. This chapter describes the study design and measures included in the CLSA, with particular emphasis on those that are focused on the assessment of the transitions and trajectories of psychological functioning over the latter half of the adult life course.

## Methods

### CLSA Study Design

An overview of the CLSA design and methodology was published in a special supplement to the *Canadian Journal of Aging* (Raina et al. 2009a). Additional papers describing the recruitment strategy (Wolfson et al. 2009), methods for ascertainment of chronic disease (Raina et al. 2009b), study feasibility (Kirkland et al. 2009), feasibility of biological sample collection (Balion et al. 2009), and linkage with health-care utilization databases (Raina et al. 2009c) were also included. The CLSA is a prospective cohort study of 50,000 residents of Canada aged 45–85 years at baseline and followed for at least 20 years. Of the 50,000 participants, 20,000 provided data through computer-assisted telephone interviews (CATI), and the remaining 30,000 participated in data collection that included an in-home interviewer-administered questionnaire and a comprehensive physical assessment at a dedicated data collection site. Major data collection is repeated every 3 years and in between waves, a short maintaining contact telephone interview is conducted in order to minimize the loss to follow-up and also to collect additional data as needed.

In addition to the psychological assessment, a vast array of common core information is collected through questionnaires (Table 1). For the 30,000 members of the CLSA who undergo

**Canadian Longitudinal Study on Aging, A Platform for Psychogeriatric Research, Table 1** CLSA baseline measures

Measures	Cohort (n = 50,000)	
	Comprehensive face to face (n = 30,000)	Telephone interview (n = 20,000)
<b>Psychological measures</b>		
<b>Memory</b>		
Rey auditory verbal learning test	Q	Q
<b>Executive function</b>		
Mental alteration test	Q	Q
Prospective memory test	Q	
Stroop neuropsychological screening test	Q	
Controlled oral word association test	Q	
Animal naming	Q	Q
<b>Psychomotor speed</b>		
Simple and choice reaction times	T	
<b>Mood and psychopathology</b>		
Depression	Q	Q
Life satisfaction	Q	Q
Post-traumatic stress disorder	Q	Q
Psychopathology	Q	
<b>Personality traits</b>		
	Q	Q
<b>Physical measures</b>		
Lean muscle mass and body composition	PE	
Waist and hip circumference	PE	
Blood pressure	PE	
Bone density	PE	
Aortic calcification	PE	
Lung function	PE	
Electrocardiogram (ECG)	PE	
Carotid intima-media thickness	PE	
Vision	PE and Q	Q
Hearing	PE and Q	Q
Weight and height	PE	Q
Functional status	PE	Q
Functional performance (grip)	PE	

(continued)

**Canadian Longitudinal Study on Aging, A Platform for Psychogeriatric Research, Table 1** (continued)

Measures	Cohort (n = 50,000)	
	Comprehensive face to face (n = 30,000)	Telephone interview (n = 20,000)
strength, timed up and go, balance, gait)		
Basic activities of daily living	Q	Q
Instrumental activities of daily living	Q	Q
<b>General health</b>		
Life space index	Q	Q
Women's health	Q	Q
Chronic conditions	Q	Q
Health-care utilization	Q	Q
Medication use	Q	Q
Dietary supplement use	Q	Q
Oral health	Q	Q
Injury and falls	Q	Q
Pain and discomfort	Q	Q
Sleep	Q	
<b>Biological measures</b>		
Blood	Collected	
Urine	Collected	
<b>Social measures</b>		
Social networks	Q	Q
Online social networking	Q	Q
Social support availability	Q	Q
Social participation	Q	Q
Care receiving (formal care)	Q	Q
Care receiving (informal care)	Q	Q
Caregiving	Q	Q
Retirement status	Q	Q
Preretirement labor force participation	Q	Q
Labor force	Q	Q
Retirement planning	Q	Q
Social inequality	Q	Q
Wealth	Q	Q
Transportation, mobility, migration	Q	Q
Built environment	Q	Q
<b>Lifestyle and behavior</b>		

(continued)



**Canadian Longitudinal Study on Aging, A Platform for Psychogeriatric Research, Table 1** (continued)

Measures	Cohort ( <i>n</i> = 50,000)	
	Comprehensive face to face ( <i>n</i> = 30,000)	Telephone interview ( <i>n</i> = 20,000)
Physical activity	Q	Q
Nutritional risk		Q
Nutritional intake	Q	
Tobacco use	Q	Q
Alcohol use	Q	Q

Q: assessed via questionnaire (either telephone or face-to-face administration)

T: measured using a performance test involving an interactive computer touch screen

PE: measured by physical examination at the data collection site

face-to-face assessment, the core information is supplemented by additional interview questionnaires about diet, medication use, chronic disease symptoms, and sleep disorders. Measures collected at the data collection site include tests of physical function (e.g., grip strength and 4-m walk test), anthropometrics (e.g., height and weight), and clinical status (e.g., vision and hearing) as well as cognitive function. Each participant also provides a blood and urine sample and signed consent to link their data to provincial health-care databases. In collaboration with Health Canada, air pollution exposures have been estimated for each participant in the CLSA. For the baseline, core chemistry biomarkers are available on all 30,000 participants, gene-wide genotyping on 10,000 participants, and targeted epigenetics on 5,000 participants. The data collection has been further expanded for the first follow-up of the CLSA to include measures of child maltreatment, elder abuse, hearing handicap inventory, oral health, subjective memory, metamemory, gender identity, health-care access, and unmet needs as it relates to health-care delivery.

### Psychological Measures Within the CLSA

Expert working groups selected psychological, physical, biological, social, and lifestyle measures for inclusion in the CLSA. Measures were selected based on their relevance to adult development and aging, availability in English and French,

psychometric properties (e.g., sensitivity and specificity), and feasibility in terms of the time to administer, the cost, and the need for unique resources or equipment. Table 1 presents a summary of the measures included at baseline and at the first follow-up. Furthermore, based on algorithms based on information from disease symptom questions and medication use, the CLSA is able to ascertain whether participants have a number of chronic diseases including cardiovascular diseases; diabetes; hypertension; cerebrovascular disease; arthritis of the knee, hip, and hands; osteoporosis; respiratory diseases such as COPD; hyper- and hypothyroidism; dementia including Alzheimer's disease and Parkinson's disease; and depression.

In CLSA, several instruments measuring various domains of psychological aspects of aging were used at baseline. These domains include cognition (memory, executive function, and psychomotor speed), mood, psychopathology, post-traumatic stress disorder (PTSD), depression, and personality traits (openness, conscientiousness, extraversion, agreeableness, and neuroticism).

### Cognition

Cognition may be defined in terms of domains (e.g., memory, executive functions, speed of processing), each of which can be further characterized into component processes. Age-related changes are observed in many of these domains and processes; for example, robust age-related changes are observed in processing speed, whereas other domains, such as semantic memory (knowledge about facts and concepts in the world), remain relatively intact with aging. There can be great intraindividual variability within a testing session or across testing sessions, and there is reason to believe that marked variability may be predictive of early cognitive impairment.

Participants in the CLSA Comprehensive cohort are assessed in three domains of cognitive function: memory, executive function, and psychomotor speed. The cognitive battery takes approximately 27 min to administer. CLSA telephone-based participants are assessed in two domains of cognitive function, memory and executive function, by telephone only (approximately 8 min to administer).

## Memory

*Rey Auditory Verbal Learning Test (RAVLT) (Trial 1 and Delay Trial).* The RAVLT (Rey 1964) is a 15-item word learning test that assesses both learning and retention. The list of words is read at the rate of one per second, and the participants' responses are recorded. One learning trial and one delayed recall trial (with a delay of 30 min) are used. The RAVLT has been shown to be extremely sensitive in detecting early cognitive decline.

## Executive Function

*Mental Alternation Test (MAT).* The MAT (Himmelfarb and Murrell 1983) comprises two parts, A and B. Part A requires participants to count aloud from 1 to 20 and to say the alphabet as quickly as possible; the purpose is to ensure that participants can perform Part B. If a participant is unable to perform these tasks, then the MAT cannot be administered. In Part B, the participant is asked to alternate between number and letter (i.e., 1-A, 2-B, 3-C ...) as quickly as possible for 30 s. The number of correct alternations in 30 s, discounting any errors, determines the score, which ranges from 0 to 51. The MAT is highly sensitive and specific for detecting cognitive impairment.

*Prospective Memory Test (PMT).* The PMT (Lowenstein and Acevedo 2001) contains both event-based and time-based prospective memory tasks that are cued after either 15- or 30-min delays. The scoring system is based on three criteria: intention to perform, accuracy of response, and need for reminders. There is increasing evidence that both time-based and event-based prospective memory decline with age and the PMT is sensitive to cognitive impairment.

*Stroop Neuropsychological Screening Test (Victoria).* The Stroop test (Golden 1978) is a measure of inhibition, attention, mental speed, and mental control. The Golden version (Golden 1978) of the Stroop test has three parts. First, the participant reads a list of words printed in black. In the second part, the participant is asked to name the ink color of printed "X"s. In the third part

(interference condition), the participant is asked to quickly name the color of the ink in which color words are written in (e.g., say "blue" for the word "green" written in blue ink). There are 100 items in a trial for this version. Scoring may be by time, error, both, or the number of items read or named within a specified time limit.

*Controlled Oral Word Association Test (COWAT).* The COWAT (Spreen and Benton 1977) is a measure of verbal fluency based on an orthographic criterion. It requires the time-limited generation of words that begin with a given letter (e.g., participants are asked to name as many words as possible that begin with the letter "F"). Following standard protocols, CLSA administers three 1-min trials with the letters F, A, and S. The score is the total number of admissible words produced.

*Animal Fluency Test.* The animal fluency test (Himmelfarb and Murrell 1983) is a measure of verbal fluency based on a semantic criterion. Participants are required to name as many animals as possible in 60 s.

## Psychomotor Speed

Computer-administered simple and choice reaction time tests (West et al. 2002) were used to assess psychomotor speed.

*Choice Reaction Time (CRT) (Computer-Administered Test).* In this test, participants receive a warning stimulus consisting of a horizontal row of four plus signs on a computer screen. After a delay of 1,000 ms, one of the plus signs changes into a box. The location of the box is randomized across trials. Participants are instructed to touch the interactive computer touch screen at the location of the box as quickly as possible. Although the instructions emphasize speed, participants are also instructed to minimize errors. The measures used are the latencies and percent correct for the 52 test trials (there are 10 practice trials).

*Choice Reaction Time 1-Back (CRT-1) (Computer-Administered Test).* This task uses the same stimulus display and computer touch screen as the CRT. However, in this version of the task,

when the plus sign changes into a box, participants are instructed to touch the screen at the location where the box appeared on the previous trial as quickly as possible. A total of 10 practice trials and 52 test trials are administered.

### Mood and Psychopathology

Current research indicates complex associations between positive and negative mood states, psychopathology, and physical and mental well-being (O'Rourke 2002; Watson and Pennebaker 1989). Negative emotional states in themselves may increase susceptibility to an array of health conditions and are associated with poorer prognoses. For example, negative emotions appear to influence immune function and regulation (which become less efficient in later life), thus increasing the risk of a myriad of health conditions (Kiecolt-Glaser et al. 2002).

Social science research has been criticized for equating well-being with the absence of psychopathology (Stroller and Pugliesi 1989; Stull et al. 1994). In other words, persons deemed to be free of psychiatric distress were assumed to be well, happy, or satisfied with life. Implicit in such studies was the assumption that emotional experience existed along a single continuum. However, more recent research indicates that psychological well-being and psychopathology (and their correlates) are separable phenomena (Ryff et al. 1998). Therefore, to assume the existence of one on the basis of the absence of the other is empirically unsupported; both need to be assessed in order to arrive at a balanced understanding of emotional wellness.

#### Negative Mood State

Depressive symptoms are measured in the CLSA Tracking and Comprehensive cohorts using the short form of the Center for Epidemiologic Studies Depression (CES-D10) Scale (Andresen et al. 1994), which takes approximately 3 min to administer and has been used extensively in large studies.

#### Positive Mood State (Life Satisfaction)

Life satisfaction is measured using the Satisfaction with Life Scale (SWLS) (Diener et al. 1985),

which comprises five questions and takes about 90 s to administer. The SWLS is one of the most widely used scales to measure the life satisfaction component of subjective well-being.

#### Post-traumatic Stress Disorder (PTSD)

The lifetime prevalence of PTSD in Canada has been estimated at 9.2%. The CLSA includes the four-item primary care PTSD (PC-PTSD) screening instrument (Pins et al. 2003), which takes about 30 s to administer. The CLSA has included this short tool as part of the CLSA Veterans Health Initiative, in which all CLSA participants are asked a set of veteran identifier questions.

#### Psychopathology

Nonspecific psychological distress is measured using the Kessler Psychological Distress Scale (K10) (Kessler et al. 2002), which was developed using the item response theory to maximize discriminant ability at the severe range of psychological distress. The K10 is becoming one of the most widely used screens for psychological distress in epidemiological surveys. It takes approximately 2 min to administer and is included only in the Comprehensive Maintaining Contact questionnaire.

#### Personality Traits

Personality traits are “enduring patterns of perceiving, relating to, and thinking about oneself and the environment that are exhibited in a wide range of social and personal contexts” (American Psychiatric Association 1994). The Big Five personality traits are five broad domains of personality (openness, conscientiousness, extraversion, agreeableness, and neuroticism) that have been extensively studied and are related to self-rated health. The CLSA measures personality traits using the Ten-Item Personality Inventory (TIPI) (Gosling et al. 2003), which takes approximately 1 min to administer and is included only in the Comprehensive Questionnaire.

All the measures described above and in Table 1 will be repeated in each follow-up wave of the CLSA, providing a rich source of information on changing risk factors as well the changing nature of disease, function, and psychosocial outcomes. However, the CLSA also provides the opportunity

to add new measures in each of the follow-up waves to investigate new and emerging areas of research. As noted previously, a new psychological measure of subjective cognitive decline has been added to the follow-up assessment. Complaints about memory are extremely common in middle-aged and older people. While these complaints can occur in the setting of cognitive disorders such as mild cognitive impairment or a dementia, they are also common in individuals without an overt cognitive disorder. The CLSA is an ideal vehicle to explore the natural history, risk factors, and conditions associated with subjective cognitive decline. The Multifactorial Memory Questionnaire (Troyer and Rich 2002) will be used to assess self-reported cognitive ability in everyday life. This reliable and valid measure examines subjective cognitive complaints to capture preclinical signs of cognitive impairment and has been validated in both English and French. Two additional questions have been included to capture perceived change in memory and whether this perceived memory change worries participants.

#### Psychological Factors as Precursors, Mediators, and Outcomes

The CLSA provides a unique opportunity to investigate the multitude of internal and external factors that influence the trajectory of psychological functioning from mid- to late life. These factors may act as **precursors** related to increased risk of illness. It is known that psychological variables such as depressive symptomatology can influence the onset and progression of illness. Research in the area of stress and psychoneuroimmunology speaks to these interrelations. CLSA provides the opportunity to examine stress-disease relationships in a large representative sample of Canadians. Similarly, CLSA data can be used to investigate questions where cognitive changes function as precursors to disease states. For example, is decline in cognitive functioning in mid- and later life associated with subsequent adverse health-related (or biological) outcomes (e.g., diagnosis of dementia, diagnosis of vascular disease, sleep fragmentation, or sleep disturbance)?

Psychological, social or environmental, and biological factors may also serve as **mediators** between illness and health outcomes. There is

ample evidence that psychological characteristics such as attitudes are related to recovery from illness (Institute of Medicine Committee on Assessing Interactions Among Social BaGFih et al. 2006). Similarly, environmental context can influence response to treatment and health outcomes (Institute of Medicine Committee on Assessing Interactions Among Social BaGFih et al. 2006). CLSA will provide a unique opportunity to address research questions where cognitive performance functions as a mediator between biological and functional status, such as: How do cognitive functions mediate relations between biological/health status and adaptive functioning and/or social participation (e.g., what are the underlying mechanisms involved)?

As might be expected, there are numerous factors that influence health **outcomes** at different points in the life span. Cognition and disorders of cognition can be viewed as psychological outcomes that may be related to a number of different precursors and mediators. These changes in cognitive functioning occur in relation to aging and, as noted, may be influenced by many other factors including biological, psychological, and social factors. Thus, CLSA data may be used to address research questions such as: Are changes over time in cognition (memory, executive function, and psychomotor speed) associated with specific biological states and/or lifestyles?

## CLSA as a Data Platform for Research

### Data and Sample Access

A fundamental principle of the CLSA is to provide the research community with the collected data while protecting the privacy and confidentiality of study participants. The Data and Sample Access Committee (DSAC) reviews all applications for the use of CLSA data and is responsible for monitoring the approved applications for progress. Exclusive access to the platform cannot be granted to any applicant. Users are entitled to use the CLSA platform (i.e., data and/or biospecimens) only for the duration and purposes of the approved research as presented in the application. The user is not entitled to publish or otherwise disseminate any CLSA

**Canadian Longitudinal Study on Aging, A Platform for Psychogeriatric Research, Table 2** Authorship: CLSA Psychology Working Group

Last name	First name	Title	Degree	Affiliation
Tuokko	Holly		Ph.D.	University of Victoria
Carrier	Julie	Professeure titulaire		Université de Montréal
Davidson	Patrick	Associate Professor	Ph.D.	University of Ottawa
Doiron	Maxime		Ph.D. research candidate	
Dupuis	Kate	Postdoc fellow	Ph.D., C.Psych.	Baycrest and University of Toronto
Gagliese	Lucia	Associate professor	Ph.D.	York University
Hadjistavropoulos	Thomas		R.Psych., Ph.D.	University of Regina
Hofer	Scott	Director		University of Victoria
Ingles	Janet	Associate professor	Ph.D.	School of Human Communication Disorders
Jutai	Jeffrey	Professor	M.Sc., Ph.D.	Interdisciplinary School of Health Sciences
Loken Thornton	Wendy	Associate professor	R.Psych, Ph.D.	Simon Fraser University
Lorrain	Dominique	Professeure titulaire	Ph.D.	Université de Sherbrooke
MacDonald	Stuart	Assistant professor	Ph.D.	University of Victoria
O'Connell	Megan	Assistant professor	R.Psych., Ph.D.	University of Saskatchewan
Pichora-Fuller	Kathy	Professor		University of Toronto Mississauga
Ritchie	Lesley	Assistant professor		University of Manitoba
Simard	Martine	Professor	Ph.D.	Université Laval
Smart	Colette			University of Victoria
Taler	Vanessa	Associate Professor	Ph.D.	University of Ottawa
Tierney	Mary		Ph.D.	Sunnybrook Hospital

data, any assay data, or any derived variable data at the individual participant level.

- ▶ [Life and Living in Advanced Age, A Cohort Study in New Zealand, Te Puawaitanga o Ngā Tapuwae Kia Ora Tonu \(LiLACS NZ\)](#)
- ▶ [Life Span Developmental Psychopathology](#)
- ▶ [PTSD and Trauma](#)
- ▶ [Resilience and Aging](#)

## Cross-References

- ▶ [Aging and Psychological Well-Being](#)
- ▶ [Age-related Changes in Abilities](#)
- ▶ [Australian Longitudinal Study of Aging \(ALSA\)](#)
- ▶ [Cognition](#)
- ▶ [English Longitudinal Study of Aging \(ELSA\)](#)
- ▶ [Irish Longitudinal Study on Ageing \(TILDA\)](#)
- ▶ [Longitudinal Aging Study Amsterdam](#)

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## Career Development and Aging

Noemi Nagy, Claire S. Johnston and  
Andreas Hirschi  
Institute of Psychology, University of Bern, Bern,  
Switzerland

### Synonyms

Aging workforce; Late career development; Older workers

## Definitions

Career development is defined as the developmental process of an employee along a path of experience and employment in one or more organizations (Baruch and Rosenstein 1992) or a “life-long process of managing work experiences within or between organizations” (Business Dictionary 2015). Late career development is thus the career development of older workers. Some authors define the late career stage as early as from age 40, but usually it is defined as the career of employees aged from 50 years old up to retirement (Hedge and Borman 2012).

## Traditional Views on Late Career Development

Career development over the life-span is usually described by career stage theories. These career development theories describe career development over the life-span as a continuous sequence of stages through which the individual gradually passes. The most influential of these theories are the theories of Super (Super 1990), Levinson (1986), and Cron (1984). Super’s life-span model contains five large career stages: growth, exploration, establishment, maintenance, and decline (Super 1990). These stages pose distinct career developmental tasks which people need to fulfill in order to successfully master the next career stage. In the growth stage, one’s self-concept needs to be developed and work-related attitudes and needs should be identified. In the exploration stage, the relevant tasks are to identify interests and capabilities, find a professional self-image, and establish an optimal fit between the self and work. In the establishment phase, career commitment needs to be increased, career advancement and growth achieved, and a stable work and personal life created. In the maintenance phase, one’s self-concept needs to be maintained and people have to hold onto accomplishments achieved previously. Finally, in the decline phase, workers need to develop a new self-image that is independent of career success (Super 1990). In Levinson’s life stage developmental model, the

career developmental stages are determined according to one’s age, and life periods of stability are usually followed by life periods of change (Levinson 1986). Levinson describes early (age 20–40), middle (age 40–60), and late adulthood (age 60 and over). These life stages have prescriptive developmental tasks: in early adulthood one needs to create and test initial choices about preferences for adult living, develop a sense of personal identity in the world of work and nonwork, and strive toward achievement of personal and professional goals. In middle adulthood one needs to review the life structure earlier adopted and make strong commitments to work, family, and community. In late adulthood one needs to recognize mortality and limits on achievements and answer the questions raised by these issues (Levinson 1986). Cron’s career stage theory (Cron 1984) is the third influential theory that describes adult development in the work context. Cron describes career concerns, developmental tasks, personal challenges, and psychosocial needs of each career stage. The four career stages comprise (1) *exploration* (finding an appropriate occupational field), (2) *establishment* (successfully establishing a career in a certain occupation), (3) *maintenance* (holding on to what has been achieved, reassessing the career and possible redirection), and (4) *disengagement* (completing one’s career) (Cron 1984). Whereas in the earlier stages of one’s career, achievement, autonomy, and competition are important, in the later career stages, reduced competitiveness, higher need for security, generational motives (helping younger colleagues), and, finally, detachment from the organization and the organizational life are central topics.

These three stage models prescribe that older workers have to detach from work and gradually establish a self-identity independent of their career. The described developmental tasks reflect traditional career paths pursued in a small number of organizations, when after a linear and rather conformal working life, older workers are assumed to prepare for retirement.

However, a few decades have passed since the introduction of the delineated career theories, and the working environment underwent some

substantial changes in that time. Today, many countries and organizations are faced with an aging workforce and often longer-lasting careers (Schweitzer et al. 2014). In most developed countries, the number of late career employees is expected to grow substantially in the next decades due to declining birth rates and longer life expectancies (Van Der Heijden et al. 2008) meaning that companies are in need of healthy, productive, and motivated older workers to remain in the workforce longer in order to satisfy the demand for well-educated and experienced staff.

### Changing Career Contexts

Whereas the traditional career theories assumed an intra-firm focus, environmental stability, and hierarchically advancing careers which progressed in a linear manner, today's work environment is characterized by increasing competitiveness and complexity, fewer opportunities for vertical mobility, higher levels of voluntary as well as involuntary inter-organizational mobility, and heightened probabilities of job loss at every career level and stage (Greenhaus and Kossek 2014; Sullivan 1999). Due to global competition, organizations increasingly need to be lean and flexible in order to compete internationally and increasingly opt for short-term transactional exchanges with their employees instead of traditional long-term employment relationships (Direnzo and Greenhaus 2011). This change is also reflected in new psychological career contracts (Hall and Mirvis 1995) which refer to the mutual expectations between employees and employers regarding their career and work. Traditional psychological contracts previously focused on loyalty between the employee and the organization and an expectation of job security in exchange for loyal service of the employee. The new career contract describes the shift from the formerly organizationally driven career to the employee-driven career and focuses on rather short-term transactions of work effort in exchange for career development opportunities (Hall and Mirvis 1995).

### Protean Career Orientation: The Necessity of Self-Directed Career Management

As reviewed above, the traditional career theories introduced in the first section described the late career as a phase of general disengagement, decline, and finally withdrawal from work. These theories need to be complemented by newer understandings of late careers, especially considering the contextual changes in the work environment described in the previous section. The *protean career* describes such a modern type of career that corresponds to the demands that the before-mentioned changes in today's work environment pose on employees (Inkson 2006). The protean career orientation highlights the importance of individual and value-driven agency of the worker when developing one's career according to subjective success criteria (Direnzo and Greenhaus 2011). With careers being less predictable and structured by the organization, employees need to increasingly customize and self-manage their careers in order to balance out the risks of a growingly insecure work environment. Especially for late career employees who might have had a rather traditional career path and did not get accustomed to changes in the labor market, the risk of getting unintentionally laid off might be highly stressful and increases the importance to remain employable as an older worker. Because the protean career is primarily values driven and self-directed, holding a protean career orientation is an adaptive response to performance and learning demands in the current work environment (Sullivan and Baruch 2009).

Greenhaus et al. (2009) emphasize the importance of a protean, self-directed career orientation especially in the maintenance phase: late career employees need to remain productive and satisfy their needs for security and to feel useful as well as potential motivations for passing on their knowledge to younger colleagues through activities such as mentoring. In the late career, sustainability and meaningful work that is aligned with one's values becomes of higher subjective importance. To this end, Newman (2011) describes a model of

sustainable careers with three central propositions that can be of great value for older workers especially: (1) being *renewable* (renewing assignments, refocusing, re-education) in order to prevent burnout and create resilience and engagement in employees; (2) being *flexible* (continuous learning, adaptability) in order to prevent stagnation, facilitate innovation, and create an optimal alignment between employer and employee needs; and (3) being *integrative* (bringing disparate information together, knowledge management) in order to highlight the bigger picture, apply knowledge in new ways, create a meaningful contribution at work, and retain critical knowledge. Sustainable careers provide benefits for both organizations and employees: older employees can stay fully engaged and have the capacity to impart knowledge and use specialized knowledge in new ways. Late career employees are also well suited to integrate knowledge across units and functions as well as to mentor younger colleagues and can thus improve intergenerational relationships as well as facilitate the development of younger generations. From the employer's point of view, sustainable careers enable more productive, motivated, and healthier employees as well as lower employment costs through reduced turnover and better knowledge retention (Newman 2011).

Despite the necessity and benefits of enabling older workers to remain active and valuable at work, research demonstrated that late career employees receive less support from supervisors to participate in career development activities and have generally less access to organizational career support programs (Van Der Heijden 2006). Because older workers have often spent a significant part of their careers developing organization-based identities and job-specific skills, it is of particular importance for this population to acquire the skills needed for the protean, employee-driven career. Of highest importance is the acquisition of so-called meta-skills (Hall and Mirvis 1995). Meta-skills help to acquire new skills and encompass the knowledge of learning how to learn, developed through many career learning cycles – or continuous learning – instead of a single lifelong career stage cycle. According

to Hall and Mirvis (1995), the most important of these meta-skills are identity awareness and heightened adaptability. Identity awareness is considered to be a fundamental resource for career development (Rosso et al. 2010). Because the work domain has a large importance in people's life, individuals identify with key characteristics of their work. Particularly older workers look for meaning in their life and in their work. This meaning can only be found if individuals find their own answers to their identity questions: Who am I? Who do I want to become? What is important to me in the work role? The traditional career paths provided a sense of stability and predictability for employees that facilitated addressing such identity issues. However, in the current work context, employees need to create stability within themselves (i.e., develop a clear professional identity that gives meaning to their work experiences) in order to successfully manage their careers in a self-directed manner. For older workers, who are more likely to be values driven (Briscoe et al. 2006), less likely to be motivated by extrinsic rewards, and more motivated to act autonomously (Ryff 1995), a clear self-concept may already be present. However, this self-concept needs to be constantly reexamined and reconstructed as work demands and typical career development tasks change in late career.

### Career Adaptability

Apart from identity, career adaptability represents the second meta-competency for a self-directed career (Hall and Mirvis 1995). The reviewed career development stage theories imply a sequential and predictable order where experiences, skills, and competencies acquired in the stage before are sufficient preparation to enter the next stage. Thus inherent to stage models of career development is the notion of readiness to move to the next stage. In Super's work, for example, individuals who are ready to make educational and vocational choices are thought to possess career maturity (Savickas 1997). Career maturity was thought to be particularly relevant for adolescents, but the concept of adaptation seemed more

appropriate for adults (Super and Knasel 1981). This focus on adaptation highlights the “continual need to respond to new circumstances and novel situations, rather than to master a predictable and linear continuum of developmental tasks” (Savickas 1997, p. 254). Thus adaptation or adaptability are concepts well suited to the new career context where the capacity to adjust rapidly and display flexibility are prerequisites for career development. Adaptability specific to the career context, known as career adaptability, is a psychosocial coping resource, a set of self-regulation capacities or skills, important for problem solving, career transitions, responding to unexpected events, constructing a career reality, and participating in the work role (Savickas et al. 2009; Savickas and Porfeli 2012).

Because adaptability is a meta-competency (Hall and Mirvis 1995), adaptability permits individuals to develop the skills and competencies associated with a protean career orientation. Career adaptability may thus be a specially beneficial resource for older workers by enabling career orientations more suited to the new career context such as a protean orientation (Chan et al. 2015) and by helping them successfully address specific career development tasks. Because the challenges of reorienting and updating one’s knowledge, skills, and abilities may be particularly evident for older workers, their career adaptability may be an especially useful resource in this regard. The psychosocial aspect of career adaptability is paramount and suggests a responsiveness to the context or environment where adaptability resources can be activated as needed, such as in response to unemployment or during career transitions (Ebberwein et al. 2004; McMahon et al. 2012).

Career adaptability consists of four dimensions: (1) *concern* about the future that includes the anticipation of demands and challenges; (2) *control* entails a personal responsibility for actively managing the self and the environment; (3) *curiosity* implies a broadening of options and self and environment exploration; and finally (4) the *confidence* to implement one’s plans (Savickas and Porfeli 2012). Thus, using the meta-competency of adaptability, older workers

can anticipate that changes may be required, can explore solutions and options to best implement these changes, and can confidently enact the necessary changes. This allows older workers to address the career development tasks of being flexible and open to professional reorientation. Although physical mobility is likely to decrease with age, psychological mobility remains unchanged with age (Segers et al. 2008) suggesting that opportunities for mobility still exist for older workers. Older workers’ adaptability may help them envision more flexible work options that combine paid work with nonwork activities reflecting personal interests, made possible by the increased blurring of the boundaries between work and nonwork domains of life (Hall and Mirvis 1995).

Empirically, the specific subject of career adaptability in older workers has not yet received focused attention. However, a select number of qualitative studies with either mid-career employees (Ebberwein et al. 2004) or women aged above 50 (McMahon et al. 2012; Whiston et al. 2015) highlighted career adaptability as a theme associated to positive experiences at work and transitions. In a quantitative study among a sample of workers older than 54, Zacher and Griffin (2015) found that adaptability positively predicted job satisfaction over time (more strongly for those with still a few years left before retirement), suggesting that enhancing career adaptability may contribute to the retention of older workers.

## Conclusions and Implications

An aging population and workforce provide the opportunity for many people to look forward to a longer, healthier, and more satisfying life and late career. Nevertheless the aging of the workforce also entails some challenges for late career employees as well as for organizations that need to be addressed. In the current chapter, we outlined traditional career development theories and their developmental tasks and put them in relation to new career concepts and changes in the work environment. Special emphasis was put

on the protean career orientation and career adaptability that represent very important career resources (Hirschi 2012) also for older workers. However, there is a need for more research to address how a protean career orientation and career adaptability are affected by age, how older workers understand career adaptability, what career development tasks in the late career (such as changing jobs) mean for older workers, and how a protean career orientation and career adaptability can help older workers cope with these challenges. Future research should also investigate how age influences relationships between protean career orientations, career adaptability, and outcomes over the life-span as well as the magnitude of these effects (Zacher and Griffin 2015).

Also, career counselors should highlight the importance of a protean career orientation and career adaptability for older workers and create interventions aimed at anticipating future demands and challenges. Interventions could emphasize the personal responsibility for actively managing the self and the environment, evoke self and environment exploration through demonstrating and brainstorming possible options, and finally foster the confidence of older workers to implement their plans.

Organizations and HR management should place special emphasis on late career employees and their career development. Most importantly, stereotyping against older workers should be counteracted and awareness about the potentials of older workers raised. A more heterogeneous workforce can be advantageous for organizations (Kunze and Böhm 2013). By providing generative opportunities for older workers (e.g., have older workers act as mentors for younger employees), older workers can feel needed and appreciated and make their work more meaningful. At the same time, younger workers get access to valuable experience and accumulated knowledge, and knowledge retention for critical know-how in the organization is enhanced.

In sum, if older workers stay self-reflective and curious about their career values, preferences, and needs, today's increasingly individualized and horizontal careers might be well suited to them

(Wang et al. 2012) and enable a successful and sustainable late career phase. The meta-competencies of adaptability and identity can help older workers establish the skills and competencies associated with the protean career orientation and consequently extend a productive and satisfying career maintenance phase. When it comes time to fully or partially disengage from the work role, identity and adaptability meta-competencies will also support this transition.

## Cross-References

- ▶ Proactivity and Aging at Work
- ▶ Sustainable Employability and Aging
- ▶ Training at Work and Aging
- ▶ Workplace Mentoring, Role of Age

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## Caregiving and Carer Stress

Daniela Figueiredo

School of Health Sciences, University of Aveiro,  
Aveiro, Portugal

Center for Health Technology and Services  
Research (CINTESIS.UA), Aveiro, Portugal

## Synonyms

Burden; Stress process model; Transactional models of stress

## Definition

Caregiving has been broadly defined as the act of providing unpaid or informal support and assistance to an older person with physical, mental impairment, or both. This assistance might include personal care, emotional support, household activities, financial management, shopping and transportation, and supervising/monitoring care. Informal caregivers are mainly family members. Usually, spouses offer more assistance than adult children, and adult children tend to provide more care than other groups of informal caregivers, such as family friends or neighbors. Caregiving can last for a short period of time or, more commonly, extend over years. The act of caregiving is now seen as a normative life event, at least for spouses and adult children in most Western countries.

Caregiving had been described mainly as a burden or stressful experience. However, there is a lack of consensus and rigor in defining burden. This has led to development of more sophisticated conceptual models about what happens when stress demands exceed coping abilities, also called transactional approaches to stress. The stress process model is one of such models and considers caregiver stress as a process of multiple interrelated conditions, involving the proliferation of stress from direct care-related dimensions to other caregiver's life domains.

## Introduction

Forty years have passed since Fandetti and Galfand (1976) published one of the first articles about family caregiving in a prestigious scientific American journal dedicated to gerontology – *The Gerontologist*. The authors studied a sample of Italian and Polish residents to determine their attitudes toward caring for aged relatives. Since then, there has been a massive expansion of research on caregiving, which is still one of the most researched topics in gerontology.

As would be expected, along with the rapidly growing population of older adults worldwide, the

number of persons with chronic diseases requiring ongoing support and supervision has also increased. Families provide the largest amount of informal long-term care and assistance. In the United States and most European countries, this family involvement in caregiving is due in part to the major emphasis of public policy aimed at promoting community care and delay institutionalization of dependent older persons. Thus, families have been considered the heart of these care systems.

A growing body of evidence has suggested the negative effects of caregiving on the caregivers' physical and psychological health, social life, leisure, and finances. Chronic conditions in the person receiving care entail high caregiving demands and long-term dependency lead to more strains for family caregivers. Contemporary societal changes have also intensified the strains on families' resources to provide care (Sales 2003; Zarit et al. 2007). First, older people are living longer after the onset of disabilities, which demands more extensive care. Usually, the caregiving role is assumed by an older spouse, who has frequently to cope with his/her own age-related limitations, or by adult children (often, a daughter) who have to deal simultaneously with several roles of worker, spouse, and parent of young children. Second, smaller family sizes and greater geographical distance may intensify the constraints of families to provide care. Third, changes in health-care policy, such as delaying institutional placement, have increased system's reliance on family caregivers.

Family caregiving has been conceptualized as a complex and multidimensional experience, primarily explained in terms of stress. The impact of the caregiving process on the caregiver has been described in terms of the "caregiver burden," a concept that encompasses multiple and inconsistent definitions. The following is an attempt to clarify the meanings and use of these two terms – burden and stress – which are often used interchangeably to describe the impacts of caregiving on the caregiver. The stress and burden approaches to understand the caregiving experience have informed, over the last two decades, the

development of interventions targeted to attenuate the negative outcomes of this event.

## Caregiver Burden

The concept of caregiver burden has become one of the core concepts of interest in the field of gerontology. Caregiver burden is typically defined as the physical, emotional, psychological, and financial difficulties experienced by family or informal caregivers as a consequence of older person's disease and impairment. Researchers more or less agree on the need to distinguish the objective and subjective dimensions of burden. However, much less agreement is found about the conceptual definition of burden, which is often studied both as an outcome and a predictor of other caregiving outcomes. The lack of regular conceptualization and operational definition has led to inconsistency in burden measures and results across interventional studies. A clear understanding of burden has been further hindered by the tendency for researchers to use the term interchangeably with stress, impacts, consequences, or strain.

The concept of burden was first introduced by Grad and Sainsbury in regard to the community care for people with psychiatric disorders (Grad and Sainsbury 1996). The authors sought to assess how these patients affected their family life in terms of income, employment, social and leisure activities, domestic routines, health of the family members, and relations with neighbors. Not long after the work of Grad and Sainsbury, Hoenig and Hamilton (1966) suggested the need to distinguish between "objective" and "subjective" burden. The term "objective burden" was related to the adverse effects on the family, such as income loss, poorer health, or general changes in household routines. "Subjective burden" was defined as what families "felt and to what extent they considered the patient's illness had been a burden to them" (p. 287).

During the 1970s and 1980s, Zarit and colleagues (1980) made great strides in establishing and clarifying the concept of burden. Within their

work on dementia caregiving, they have defined burden as the caregiver's feelings about their emotional, physical health, social life, and financial status as a result of caring for their family members. Zarit et al. (1980) viewed caregiver burden as a subjective process and not necessarily as a negative consequence of caregiving. The authors developed one of the most widely used measures of caregiving burden: the Zarit Burden Interview. This self-reported inventory covered several dimensions of burden, including caregiver's health and psychological well-being, social life, finances, and the relationship between the caregiver and the cared-for person.

Subsequent to the work of Zarit et al. (1980), several attempts to refine the conceptualization of caregiving burden had been made. For instance, Poulshock and Deimling (1984) considered burden as the caregiver's appraisal of "the tiring, difficult, or upsetting nature of caregiving tasks" (p. 233). George and Gwyther (1986) defined caregiver burden as the "physical, psychological or emotional, social, and financial problems that can be experienced by family members caring for impaired older adults" (p. 253).

Later, studies have tried to clarify the differences between objective and subjective caregiver burden. Objective burden refers to the events and changes in caregivers' various life domains which result from the caregiving role. These include the direct tasks of care (e.g., helping patients with the activities of daily living, supervising care), indirect tasks of care (e.g., domestic tasks or financial management previously performed by the patient), providing emotional support to the cared-for person, and the effects on other life roles (e.g., family routines, leisure, social relations, finances, job career) (Sales 2003). The subjective burden is related to the caregivers' reactions or emotional responses to care demands. Some argue that objective and subjective burden can be analyzed separately (Montgomery et al. 1985). Others consider that most measures of objective burden rely on caregiver's self-report/subjective perceptions of the extent of their caregiving tasks, which is far from being objective (Sales 2003). Furthermore, while some consider

the consequences of caregiving on various life domains as objective (Montgomery et al. 1985), others regard it as subjective (Braithwaite 1992).

The critical need to document caregiving burden has been shown by the variety of instruments developed to measure it. Some authors argue that burden is a unique domain of the caregiving experience that is not captured by more generic measures of well-being (Stull et al. 1994). There are currently about 30 instruments described in scientific literature to assess the caregiver burden (Van Durme et al. 2012). Most of these measures are multidimensional, assess both objective and subjective burden, and are administered to the primary caregiver. However, as burden is conceptualized differently by various authors, the tools used to measure it differ as well, leading to findings that are difficult to integrate across studies and limiting the ability to inform clinical and policy settings (Bastawrous 2013).

Nevertheless, decades of research on chronic conditions such as dementia, cancer, or stroke have suggested that caregiver's burden increases the risk of negative physical, psychological, and physiological outcomes. However, a number of comparative studies propose that different chronic conditions present different caregiving demands; hence, research needs to distinguish each disease's specificities from the common aspects of caregiving. For instance, chronic diseases characterized by cognitive impairments (e.g., Alzheimer's disease) have been found to be more burdensome (Papastavrou et al. 2012). In addition, disorders with an unpredictable course (e.g., cancer) present more physical burden and psychological distress for caregivers than those with an expected trajectory (e.g., diabetes) (Kim and Schulz 2008).

While many earlier scientific studies on caregiver burden were not based in theory, more recent work has been developed in an attempt to anchor caregiver burden in a broader theoretical framework and to outline some of its basic dimensions, as well as the links among those dimensions. The stress process model, developed by Pearlin and his colleagues (1990), is one of those frameworks, where burden can be treated as a primary stressor. How burden fits within this

model and other the stress process theories is explained in the following section.

### Caregiver Stress in the Context of Transactional Models

Perhaps the first theoretical conceptualization of the term "stress" was introduced by Hans Selye (1956). He defined stress as a response to an antecedent stimulus or event. The underlying assumption is that stress is linearly determined by the nature of the event itself.

However, the experience of caring for an older family member has been conceptualized within the context of transactional models of stress. Among those models, Lazarus and Folkman's model of stress and coping (Lazarus and Folkman 1984) and Pearlin and colleagues' stress process model (Pearlin et al. 1990) have anchored family caregiving research on a stronger conceptual foundation. Lazarus and Folkman (1984) have defined stress as "a relationship between the person and the environment that is appraised by the person as taxing or exceeding his or her resources and endangering his or her well-being" (p. 17). This definition emphasizes the relationship between the person and the context, considering the characteristics of both. From this perspective, stress is viewed as a process rather than simply a reaction to an environmental stimulus. The authors acknowledge the role of individuals' cognitive appraisals which are more important than the actual stressors. So, an event only becomes a stressor if the person interprets it as such. Within their transactional model of stress, Lazarus and Folkman (1984) described three steps: *primary appraisal*, whereby a potential stress can be perceived as irrelevant, benign-positive, or stressful (harm/loss, threat or challenge); *secondary appraisal*, as the person identify coping strategies/resources and their effectiveness to deal with the potential stressor; and *reappraisal*, which refers to a changed appraisal considering the new information from the environment, from the person's own reactions, or both. This three-step stress and coping process involves asking: "Is this event something that I need to respond? Does

it pose a threat, harm or challenge?" If the answer is "no," then no action is necessary. But if the answer is "yes," then a secondary appraisal arises. By this time the question that occurs is: "Which strategies or resources do I have to cope with the event?" The person then selects the mechanism (coping) to deal with the stressor. Next, a reappraisal is made to see if the response has worked, thereby either reducing the perceived threat or leading to a new approach to coping strategies if the perceived threat is not sufficiently reduced (Nolan et al. 1996).

The caregiving literature has moved increasingly toward transactional models of stress. Largely grounded in sociological perspectives of stress, the stress process model proposed by Pearlin and colleagues (1990) is perhaps the most used approach to understand the caregiving experience. Both models proposed by Lazarus and Folkman (1984) and Pearlin et al. (1990) conceptualize stress in terms of transactions between the person and the environment. However, Lazarus and Folkman's work emphasizes cognitive appraisals and the microlevels of the stress process, whereas Pearlin and colleagues' stress process model is more concerned with the contextual and macro-levels (Kinney 1996). This stress process model presents caregiver stress as a multidimensional and interrelated process involving four components (Pearlin et al. 1990): background characteristics and context, stressors, moderators, and outcomes. According to the authors, the caregiving experience is shaped by key characteristics of the caregiver (e.g., gender, age, education, occupational and economic conditions), the caregiving history (e.g., relationship between caregiver and care receiver dyad), the family network, and program/resources' availability in the community. Pearlin et al. (1990) have defined stressors as "the conditions, experiences, and activities that are problematic for people" (p. 586). These are conceptualized as primary and secondary in nature. The *primary stressors* are those that arise directly from providing care to a dependent relative, involving both the *objective* conditions of caregiving (e.g., supporting ADL) and *subjective* reactions incited by these objective conditions (e.g., a sense of role overload or

captivity). The *secondary stressors* consist of those difficulties that derive from the caregiving (but do not directly entail the provision of care) and *proliferate* into other dimensions of the caregiver's life. These include *role strains* that are found in activities and roles outside the caregiving situation (e.g., family conflict, financial strain, work conflict) and *intrapsychic strains* which, for the most part, involve dimensions of self-concept (e.g., doubts about one's competence or mastery). The *moderators* regulate not only the focal stressor-outcome relationships but also the processes whereby stressors generate more stressors. Coping skills and social support are usually regarded as the two main moderators. The final major components of the stress process are the *outcomes*, in terms of caregivers' well-being, physical and mental health, and their ability to sustain themselves in their social roles.

In the light of the stress process model, burden is treated as a primary stressor affected by the caregiver's background and the caregiving context. Burden, in turn, affects directly outcomes such physical and mental health, as well as indirectly through secondary role strains and intrapsychic strains. Coping and social support moderate these interactions and explain differences in outcomes among caregivers experiencing similar situations.

While Pearlin et al. (1990) conceptualize burden as a primary stressor; Yates et al. (1999) suggest that burden should be treated as a secondary appraisal variable based on the argument that it is equal to subjective burden perception. Yates et al. (1999) considered the primary stressors from the Pearlin model (e.g., number of hours of informal care) as a primary appraisal variable that leads indirectly to secondary appraisal of caregiver overload (burden) and depression.

Although the stress process model was developed from research on dementia caregiving, it is considered one of the most comprehensive caregiving theoretical frameworks and has been widely applied to conceptualize and interpret observational and interventional research in a broad range of other caregiving settings such as stroke (Cameron et al. 2014), cancer (Gaugler et al. 2005), and chronic liver disease (Nguyen et al. 2015).

## Caregiving and Ethnicity

A growing body of research has explored how culture and ethnicity influence the caregiving experience. Despite apparent inconstancy in results, this research generally suggests that the caregiving role is experienced differently by different ethnic groups. Ethnic variations in the caregiving experience may be attributable to differences in the levels of stressors, coping strategies, social support, as well as different perceptions of family obligations. For instance, a number of systematic reviews have found that, compared to other ethnic groups, African-American caregivers appear to have lower levels of burden and depression (Pinquart and Sörensen 2005; Dilworth-Anderson et al. 2002) and higher levels of uplifts and subjective well-being (Pinquart and Sörensen 2005). Several studies reported that African-American caregivers receive more informal support than White caregivers. Others suggest that African-American caregivers might be better able to cope with caregiving because they have learned to cope with adversity in their lives and because of their strong religious orientation and the use of more positive reappraisal (Pinquart and Sörensen 2005).

Also, Asian-American caregivers were found to be more depressed than White-American caregivers (Pinquart and Sörensen 2005). Pinquart and Sörensen (2005) reported that Asian-American caregivers used significantly less formal support than Whites. Sampling bias or language barriers might account to partially justify these results. However, the cultural value of filial piety can also add some explanation to these findings. Filial piety is a fundamental Confucian value common among many Asian cultures and historically instructs people to be respectful to their parents, emphasizes intergenerational relationships, and places family needs over individual interests. Adult children are expected to sacrifice their financial, physical, and social needs for the benefits of their aging parents (Miyawaki 2015). In this sense, the cultural expectation of caring for aging parents might pressure some Asian caregivers to perceive the use of formal services as losing face or an evasion of one's own

responsibility, resulting in an underutilization of formal support (Lai 2010). Filial piety was also found to significantly predict the appraisal of the caregiving experience as rewarding among Chinese-Canadian caregivers, although no significant direct effect on caregiving burden was found (Lai 2010).

Research has also explored the experience of caregiving for Latino or Hispanic-American caregivers. This research suggest that, compared to Caucasian-American caregivers, Latino dementia caregivers reported lower levels of perceived burden (Montoro-Rodriguez and Gallagher-Thompson 2009) and lower appraisals of stress (Coon et al. 2004). Latino caregivers also reported higher levels of self-efficacy in managing disruptive behaviors of the patients and controlling upsetting thoughts (Montoro-Rodriguez and Gallagher-Thompson 2009), as well as appraised caregiving to be a significantly more positive experience than Caucasian caregivers (Coon et al. 2004). These findings might be influenced by a cultural perspective that sees the act of caring for an older relative as congruent to the Latino cultural value of *familism* wherein reciprocity and solidarity among family members help support caregivers and their roles. In addition, Latino caregivers' appraisal of stress may be more related to the degree of disruption caregiving eventually brings to their families rather than to themselves as individuals. Also, Latino caregivers were more likely to rely on religious and spiritual activities, which may serve as effective coping strategies for them to help buffer against the daily stress of caregiving throughout their promotion of social integration, social support, and relationship with God (Coon et al. 2004).

The caregiving experience has also been researched in cross-country studies. For instance, high ratings of burden and lower health-related quality of life have been recently found among caregivers of people with dementia in eastern and southern European countries, compared to north or central European countries (Bleijlevens et al. 2015). Differences in health and social care systems may account for variation in these outcomes. In general, the provision of formal support is lower and informal care is higher in southern

and eastern European countries. In Spain, family caregiving plays a more central role compared to other countries. On the other hand, countries like the Netherlands or Sweden offer an extensive health and social care system, and long-term care is primarily considered a responsibility of country councils and municipalities (Bleijlevens et al. 2015).

Together, all these studies underscore the relevance of understanding how social and cultural factors influence both caregivers' outcomes and mediator variables.

### Interventions for Caregivers

The last two decades have seen a substantial increase in the development of caregiver interventions designed to reduce both the adverse effects of care and early nursing-home placement of the dependent older person. Increasingly, these interventions have applied the transactional models of stress, particularly Pearlin's stress process model, to identify modifiable variables of the stress process that can lead to improved outcomes. The approaches to caregiver interventions can be divided into two main groups (Sörensen et al. 2002): (i) those aimed at reducing the objective burden or amount of care provided by caregivers (e.g., respite care) and (ii) those aimed to improve caregiver's well-being and coping skills, generally called psychosocial interventions (e.g., support groups, psycho-education, psychotherapy). More recently, an integrated approach has emerged, combining a range of strategies, and is classified as multicomponent.

Respite care was designed to relieve caregivers periodically or temporarily from the provision of care to their dependent relative. This rest allows the caregiver to take some time for his/her own and carry out other activities. The main types of respite services include (Figueiredo 2009):

(a) *In-home respite*, which provides relief in the home by workers with suitable training. Examples of the type of care provided are help with personal care and housework,

companionship, and supervision. This is, perhaps, the most widely used type of respite services.

- (b) *Day care centers*, which are structured, comprehensive community-based centers that provide a variety of social and health-care services in a supervised setting during part of the day, freeing the caregiver for other activities or rest.
- (c) *Overnight respite*, which involves the admission of the dependent person for a night, weekend, or longer in a residential care facility or nursing home, depending on the needs of the caregiver.
- (d) *Institutional respite* and *vacation/emergency respite*, which includes round-the-clock substitute care, usually used for longer, continuous periods of time, often when caregivers need to be away for short periods of time (e.g., when they need a holiday, become temporarily ill, or in emergency situations such as a death in the family).

In general, there is some evidence that caregivers do not use respite services or use them too little or too late in the caregiving trajectory (Figueiredo 2009). Yet, while Sörensen et al. (2002) observed respite care effectiveness in terms of dementia caregiver burden, depression, or subjective well-being, more recent reviews (Schoenmakers et al. 2010) found that respite was associated with an increase in burden, probably due to family caregivers' concerns about respite care quality and difficulties to accept handing over their dependent older relative. Also, Mason et al. (2007) observed that the effects of all types of respite care upon caregivers were generally small, with better-controlled studies finding modest benefits only for certain subgroups. Further, empirical evidence suggests that respite does not delay institutional placement.

Psycho-education includes structured interventions designed to provide information on the disease process, symptoms management and community support resources, and training to provide care and respond to disease-related problems. It also includes a supportive component aiming to normalize experiences, give mutual support, and

provide problem-solving and emotional-management strategies for coping with the disease demands. Systematic reviews and meta-analysis studies have shown that psycho-educational interventions have consistent short-term effects on a wide range of dementia caregiver's outcome indicators (Sörensen et al. 2002; Pinguart and Sörensen 2006; Parker et al. 2008). Similar findings were found for stroke family caregivers; however, evidence is limited (Cheng et al. 2014).

Support group interventions might include both professionally led and peer-led unstructured support which focuses on building up a rapport among participants and developing opportunities to share experiences of caregiving. In these groups, peers provide emotional support as well as insights into successful strategies for dealing with several aspects of the caregiving role. In contrast to psycho-educational programs, support group interventions are seldom standardized and education is not their primary focus. In their meta-analysis, Chien et al. (2011) found that support groups had a significant positive effect on dementia caregivers' psychological well-being, depression, burden, and social outcomes.

Psychotherapy involves establishing a therapeutic relationship between the caregiver and a trained professional. Most psychotherapeutic interventions with caregivers adopt a cognitive-behavioral approach in which therapists aim to (Sörensen et al. 2002) improve self-monitoring, challenge negative thoughts and appraisals, help caregivers to develop problem-solving skills, and reengage in positive experiences. As with psycho-educational interventions, Sörensen et al. (2002) found that psychotherapy have the most consistent short-term effects over different types of outcomes. Specifically, cognitive-behavioral therapy was found to have a large effect on decreasing depression and a small to moderate effect on lowering burden (Pinguart and Sörensen 2006).

Multicomponent interventions include the combination of several strategies (e.g., education, respite, psychotherapy) and target multiple outcomes. Multicomponent interventions seem to be more effective in improving caregivers' well-being and reducing burden compared to more

narrowly targeted interventions (Sörensen et al. 2002; Parker et al. 2008).

Caregivers can rely on several of interventions and services developed to help them to cope with the caregiving role. However, intervention studies designed to prevent stress and alleviate burden present inconsistent results and have shown only modest effects. No single intervention is completely successful in responding to all the needs and difficulties of caregivers. Some interventions (psycho-education, psychotherapy, multicomponent) seem to have broad, nonspecific effects over several outcomes, while others have more specific effects on target outcomes (respite).

Conceptual and methodological issues have been identified as main reasons to explain inconsistency in results. Some argue that the outcome measures used may be sensitive to change to greater or lesser degrees (e.g., caregiver burden appears to be less changeable than subjective well-being). In addition, studies frequently include outcome measures that do not have obvious relationship or that do not match the intervention goals. Moreover, caregivers are a heterogeneous population with diverse risk profiles, cultural backgrounds, resources, and experiences of stress and burden. Thus, the "one size fits all" approach is not appropriate for caregiving intervention (Zarit and Femia 2008). In some cases, studies use multidimensional measurements of burden but fail to address the distinction between objective and subjective burden, which might mitigate the findings of interventional research (Bastawrous 2013). Finally and perhaps the most basic constraint in caregiving intervention research is viewing caregiving as if it were a psychiatric disorder like major depression (Zarit and Femia 2008). This means that, basically, participants are enrolled in the intervention studies because they are caregivers, independently of feeling or not feeling burdened, depressed, or having other negative outcomes. There are two major consequences of this approach. First, when the goal of treatment is to reduce burden depression, but some of the participants are not burdened or depressed, that means that a part of the sample will not show improvements after the treatment, leading to a loss of statistical power to

detect change. Second, it is possible that treating participants for a problem they do not present may actually worsen their situation (Zarit and Femia 2008).

Many other factors related to intervention characteristics, the caregiving situation, or research design can mediate the effectiveness of interventions, such as the dosage and length of treatment, individual interventions as opposite to group interventions, the characteristics of the cared-for person (e.g., interventions for caregivers of people with dementia are less successful than those designed for caregivers of older people with other chronic conditions), the relationship with the care receiver (adult-children interventions as opposed to spouse interventions), and the extent to which participants adhere to the treatment (regularity of attendance or dropout rate).

## Future Directions

With the current demographic trends on the growth of older people population, the role of informal caregivers is expected to continue to assume a great importance. Research has conceptualized informal caregiving as a stressful event, likely to involve significant burden. Based on this approach, several burden indicators have been developed, and findings have showed that many caregivers experience high levels of burden, depression, anxiety, social isolation, and financial strain. Conceptualizing the caregiving experience in the light of stress and burden paradigms has unquestionably become a major contributor to understanding this complex phenomena, but has also hindered the opportunity to find out more about the neutral and the positive aspects of care and to promote them. There is, however, growing evidence that positive outcomes or rewards, such as a sense of reciprocity or personal growth, can be derived from the caregiving experience, despite of the stressful situation. The rewards of providing care have been associated with better caregivers' well-being (Cohen et al. 2002), but their role in buffering stress is still unexplored. Furthermore, as theoretical models for the negative caregiving outcomes have been strongly

developed, there is a need for conceptual frameworks that explain and predict positive outcomes.

Viewing caregiving as stressful and burdensome event has encourage researchers and practitioners to develop interventions based on a deficit approach in which caregivers are assumed not to have the necessary resources, skills, and competences to cope successfully with their stressful situations (Figueiredo 2009). This negative view, alongside research design and methodological issues, might in part explain the incongruent findings of intervention studies. A more salutogenic approach could provide a focus on the strengths rather than on the burdens, in order to enhance caregivers' resilience and personal empowerment.

Moreover, the stress/burden paradigm can be reductionist. It has emphasized individuals in their caregiving role and had not really examined the cared-for person and the family as a system, as data has been obtained mainly from the primary caregiver. A family systems approach would be focused on the analysis of family dynamics and adaptations, relationships, and patterns of interactions, providing a more comprehensive picture of the caregiving experience. Interventions should be targeted at the family as a system, involving all family members, as they all take part in the adjustment to care demands.

Finally, the dominant focus has been on the use of cross-sectional designs, ignoring the changes in the cared-for person needs and chronic disease trajectory over time. The challenges of families when dealing with the diagnosis or acute phase are different from those of the chronic or terminal phase of the disease. These cross-sectional data hinders to understand how the demands, needs, and coping mechanisms of all family members change over time.

## Cross-References

- ▶ [Family Therapy](#)
- ▶ [Respite care, Current Status and Future of](#)
- ▶ [Stress and Coping in Caregivers, Theories of](#)
- ▶ [Stress and Coping Theory in Geropsychology](#)

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## Challenging Behavior

Casey Cavanagh and Barry Edelstein  
Department of Psychology, West Virginia  
University, Morgantown, WV, USA

### Synonyms

Maladaptive behaviors; Neuropsychiatric symptoms of dementia; Problem behaviors

### Definition

Challenging behaviors among individuals with dementia are defined as maladaptive behaviors that contribute to a diminished quality of life for

an individual or constitute a danger to the individual, other residents, or caregivers. Challenging behaviors typically include verbally or physically aggressive behavior, agitation, sexually inappropriate behavior, or wandering. Interventions discussed in this entry include medications, behavioral interventions, systematic individualized interventions, cognitive/emotion-oriented interventions, sensory stimulation interventions, and psychosocial interventions. For each intervention, a brief description is provided and the effectiveness of the intervention discussed.

## Introduction

In 2013 the number of individuals with dementia worldwide was estimated to be 44.4 million, and this number is expected to increase substantially over the next 15 years (Alzheimer's Disease International 2015). Dementia is often accompanied by a variety of challenging behaviors. For example, approximately 50% of individuals with dementia exhibit agitated behaviors every month (Livingston et al. 2014). These behaviors often have consequences for the quality of life of both the individual with dementia and the caregivers. A variety of pharmacological and non-pharmacological interventions have been used to treat these challenging behaviors, with mixed results. The evidence for interventions that focused on the most commonly targeted challenging behaviors in residential care facilities, with an emphasis on the ones for which there is at least promising evidence to support efficacy, was reviewed. Additionally, a few interventions for which there is limited support, based primarily on reviews that require randomized control trials (RCT), are included. Finally, some interventions with virtually no empirical support are included because they appear to be used in spite of the paucity of support. This is a selected rather than an exhaustive review of all interventions for all challenging behaviors associated with dementia.

Most studies addressed multiple challenging behaviors. Literature reviews (e.g., systematic reviews, meta-analyses, Cochrane reviews) described outcome measures, but many of these

were scores on behavior rating scales that included multiple behaviors or categories (e.g., aggressive behavior, wandering, agitation). Therefore, it was difficult to organize this presentation around specific challenging behaviors. In light of that and in the interest of brevity, much of this discussion is devoted to studies of specific interventions that are often used to address a variety of challenging behaviors.

### Pharmacological Interventions

While the principal focus is non-pharmacological interventions, it is also important to briefly mention these interventions and address some of the issues associated with this approach to behavior management. The US Food and Drug Administration (FDA) has not approved pharmacological interventions for challenging behaviors associated with dementia. Pharmacological interventions are therefore used off-label. The safety and efficacy of pharmacological interventions for dementia-related problems have been questioned for several years. The 1987 Omnibus Budget Reconciliation Act brought about a substantial reduction in the use of psychotropic medications to control dementia-related challenging behaviors in the USA. Strong appeals for reconsideration of pharmacological interventions have come from the UK as well, for example, the NICE Guidelines (National Institute of Clinical Excellence 2007). Clinicians must weigh the benefits against the potential adverse effects of the medications.

First-generation antipsychotic medications (e.g., haloperidol, loxapine) have been used to manage challenging behaviors for many years, but they have associated severe adverse effects (e.g., cardiovascular problems, extrapyramidal symptoms, tardive dyskinesia, increased risk of death). Atypical antipsychotic medications (e.g., risperidone, olanzapine) also have significant adverse effects that vary across medications (e.g., extrapyramidal symptoms, sedation, metabolic syndrome, orthostatic hypotension). Several antidepressant medications (e.g., sertraline, citalopram) have been used to manage challenging behaviors, but there is limited support for their use (Seitz et al. 2011). In addition, adverse effects are associated with the use of antidepressants

(e.g., nausea, drowsiness, sedation), with these effects varying across specific drugs. Sedative-hypnotic medications (e.g., the benzodiazepines) have been used to treat acute cases of agitation, but they increase the risk of impaired cognitive functioning and falls. Mood stabilizers (e.g., carbamazepine, valproate, gabapentin) have been used to manage challenging behaviors, but only carbamazepine has research support. However, carbamazepine has significant adverse effects (e.g., sedation, hyponatremia). The deliberations and recommendations of a panel of experts regarding the use of psychotropic medications to manage neuropsychiatric symptoms of dementia (NPS) were summarized by several researchers (Kales et al. 2014). They concluded that “Given the limitations in the evidence-base, the panel consensus was that psychotropic drugs should be used only after significant efforts have been made to mitigate NPS using behavioral and environmental modifications and medical interventions if needed, with three exceptions” (p. 767) (Kales et al. 2014). These included situations in which there was “significant and imminent risk” to the individual or others.

### Behavioral Interventions

Behavioral interventions for the management of challenging behaviors are variously termed behavior modification, behavior therapy, behavioral problem-solving, and functional analysis-based interventions. These can involve direct interventions by staff and alteration of the environment to reduce the frequency or duration of challenging behaviors or to increase more adaptive behaviors. Interventions emphasize the function of the challenging behavior and typically involve the identification of the variables controlling the target behavior. This includes identification of the antecedent stimuli (A) that set the occasion for (trigger) the challenging behavior (B), which is strengthened or maintained by specific consequences (C). The analysis and intervention is usually individualized, as the controlling variables can differ between individuals. In recent years some researchers have conceptualized challenging behaviors as arising from unmet needs, with the intervention aimed at meeting those

needs. As with earlier behavioral conceptualizations, the focus remains on the function of the challenging behaviors, but the interventions are individualized and conducted across large sample sizes.

One of the difficulties of reviewing this literature was that some researchers employed multiple interventions that focused both on the individual and the environmental determinants of the challenging behaviors. A variety of different caregivers (e.g., nurses, nurses' aides) have been employed as well. Finally, the outcome measures have varied considerably across studies. Some studies focused on the frequency or duration of specific behaviors (e.g., wandering, hitting, biting), some on classes of behaviors (e.g., aggression, agitation), and others on scores obtained on rating scales that incorporated several different behaviors and yielded a total score that included all behaviors.

Several reviews have found mixed results for the effectiveness of behavioral interventions. Results of studies in which an intervention was applied to groups of participants have yielded mixed results even with studies employing similar interventions and outcome measures. In addition, it is difficult to offer an overall judgment regarding the effectiveness of these approaches in light of the variety and combinations used in the literature. The interventions employing what is variously termed a behavior analytic (Spira and Edelstein 2006) or functional analytic approach (Moniz-Cook et al. 2012) appear to have some of the clearest supporting evidence. Studies employing single-case designs with individuals have demonstrated support for the use of stimulus control interventions for wandering behavior. These interventions involved manipulating environmental stimuli (e.g., disguising doors, installing visual barriers, covering doorknobs, placing grids on floors) that contributed to wandering behavior. Several single-case studies have been published demonstrating the effectiveness of individual interventions (e.g., reinforcement of appropriate behaviors, differential reinforcement of other behaviors) for a wide range of challenging behaviors. However, all of these studies need to be replicated to establish the generalizability of

the findings. Overall, there is promising support for the effectiveness of many behavioral approaches to reducing the frequency of challenging behaviors associated with dementias (Moniz-Cook et al. 2012).

### **Systematic Individualized Intervention**

This approach appears to have been developed from a behavioral perspective and is based on the notion that one can reduce agitated behaviors associated with dementia by addressing unmet needs of the individual that are thought to be the basis for the behaviors (e.g., pain, feelings of loneliness or isolation, boredom, sensory deprivation). As previously noted, this approach is similar to other behavioral approaches that focus on the function of the challenging behavior and identify the antecedents and consequences of challenging behaviors. However, the studies of this approach have combined characteristics of group (nomothetic) and individualized (idiographic) approaches with large numbers of participants. This large-scale approach has been used exclusively with agitation. In two placebo-controlled studies, agitation was directly observed. Agitated behaviors included physically agitated (e.g., repetitive movements) and verbally agitated (e.g., screaming) behaviors. Interventions were individualized and included, for example, individualized music, family videotapes and pictures, stress balls, electronic massagers, and pain treatment. The results revealed significant reductions in agitation when compared to the control groups. Although these studies were not included in recent reviews, this approach has sufficient evidence, including one randomized, placebo-controlled study, to support its effectiveness. Please note there is some overlap between some of the stimuli used in these studies and those used in simulated presence therapy, described in a subsequent section.

### **Cognitive/Emotion-Oriented Interventions**

Cognitive/emotion-oriented interventions, such as reminiscence therapy, simulated presence therapy, and validation therapy, have been examined as treatment for a range of challenging behaviors, including agitation/aggression and comorbid

disorders, such as depression and anxiety (O'Neil et al. 2011). Although the effectiveness of these cognitive/emotion-oriented interventions in reducing challenging behaviors is mixed, each intervention will be briefly reviewed (O'Neil et al. 2011).

#### Reminiscence Therapy

Reminiscence therapy for older adults grew out of the work of Robert Butler on "life review." Life review is conceived as a naturally occurring process of recalling past experiences, including unresolved conflicts. Reminiscence therapy involves a progressive awareness of one's past experiences, which affords older adults the opportunity to examine these experiences, resolve conflicts, and place their lives in perspective. Various forms of this approach with dementia patients appear in the literature. Common features include, for example, discussions of past experiences accompanied by familiar objects (e.g., old photographs) that are used to stimulate discussions. There is considerable support in the literature for the reduction of depression (Woods et al. 2009) but little evidence to support the reduction of challenging behaviors associated with dementia.

#### Simulated Presence Therapy

Similar to reminiscence therapy, simulated presence therapy involves the recalling of a patient's positive life experiences and memories (Zetteler 2008). However, in simulated presence therapy, the recalling of positive life experiences is accomplished through the use of audiotaped or videotaped recordings of conversations with a patient's family members (Zetteler 2008). The purpose of these recordings is to bring comfort to the patient by serving as a reminder of the patient's family (Zetteler 2008). There is mixed evidence regarding the effectiveness of simulated presence therapy. Additionally, there is evidence that simulated presence therapy can produce increases in agitation or disruptive behaviors (Zetteler 2008). Overall, these results suggest that simulated presence therapy may be effective in reducing challenging behaviors. However, current findings need to be replicated and extended.

#### Validation Therapy

Naomi Feil developed validation therapy for older adults with cognitive impairment, particularly those with dementia. Feil classifies cognitively impaired individuals according to four stages: mal orientation, time confusion, repetitive motion, and vegetation. The emphasis of the intervention is on acknowledging and dignifying the feelings and experiences of a person. A variety of techniques comprise the approach (e.g., paraphrasing, touching, linking behavior with unmet needs). Feil identified several principles that she believes underlie her approach (e.g., all people are unique and should be treated as such, there is reason behind the behavior of disoriented behavior of older adults, and older adults should be accepted nonjudgmentally).

Outcomes measured employed in studies of validation therapy have included cognition, behavior, emotional state, and activities of daily living. As previously noted (Neal et al. 2005), and unchanged today, there are few experimental studies of validation therapy, and their results are mixed, with insufficient evidence to support this approach.

#### Sensory Stimulation Interventions

Sensory stimulation interventions and complementary and alternative medicine (CAM) include interventions such as massage therapy, acupuncture, aromatherapy, light therapy, music therapy, Snoezelen or multisensory stimulation therapy, and transcutaneous electrical nerve stimulation (O'Neil et al. 2011). Sensory stimulation interventions and CAM therapies have both been investigated as interventions to reduce problem or challenging behaviors, including agitation/aggression, wandering, and inappropriate sexual behavior.

#### Massage Therapy

In general, massage or touch therapies involve applying pressure to the body. This application of pressure may include a variety of styles of touch, such as slow strokes, expressive touch, rubbing, kneading, and effleurage (Hansen et al. 2008; Moyle et al. 2012). Massage may also be applied to different body areas, including

the back, shoulders, neck, hands, lower legs, or feet (Moyle et al. 2012). Typically, massages are conducted by nursing staff or massage therapists (Hansen et al. 2008; Moyle et al. 2012). The limited number of studies precludes the ability to evaluate the effectiveness of massage therapy (Hansen et al. 2008; Moyle et al. 2012). However, the preliminary evidence suggests that massage therapy may reduce agitated behavior among older adults with dementia, at least in a short term.

### Multisensory Stimulation Therapy

The goal of multisensory stimulation (MSS) or Snoezelen therapy is to promote balance of the sensory system through stimulation of the five senses by using a range of stimuli (e.g., music, aromatherapy) (O'Neil et al. 2011). In some cases, guidelines identify specific stimuli that should be included in treatment. Alternatively, patient preferences may be used to identify specific stimuli (Chung et al. 2009). The current evidence for the effectiveness of MSS is mixed. There is preliminary evidence that disruptive behavior decreases during MSS treatment. However, these effects are not maintained when treatment is discontinued (Livingston et al. 2005). Other research concluded that there is no evidence for the effectiveness of MSS on agitation/aggression among individuals with dementia (Chung et al. 2009). Further, the evidence for the effectiveness of MSS on wandering is inconclusive (O'Neil et al. 2011). In sum, the limited evidence available suggests that MSS may be effective in reducing some challenging behaviors (i.e., disruptive behavior).

### Music Therapy

Music therapy typically involves listening to music or playing musical instruments, but may also involve having patients compose music or dance (O'Neil et al. 2011; Livingston et al. 2005). In active music therapy, patients and providers participate in the intervention (e.g., composing, singing, dancing, and playing instruments). Receptive music therapy involves having patients listen to music and therefore involves less interaction (McDermott et al. 2013). Similar to other sensory stimulation interventions, music therapy may be implemented as a stand-alone

intervention or integrated in other activities (O'Neil et al. 2011). Music therapy may be individualized by employing the patient's favorite music. In contrast, standardized music therapy protocols typically employ relaxing, quiet, classical, and big-band music (Livingston et al. 2005; McDermott et al. 2013).

Music therapy is effective in producing short-term (during and immediately following the intervention) decreases in disruptive behavior (i.e., agitation and aggression) (O'Neil et al. 2011; Livingston et al. 2005; McDermott et al. 2013). However, there is no evidence that the decreases in agitation and aggression are maintained (McDermott et al. 2013). Evidence regarding the effectiveness of music therapy in reducing other challenging behaviors is mixed (O'Neil et al. 2011). Despite the promising findings of several reviews, poor methodological quality and reporting of studies prevented the ability to draw conclusions about the effectiveness of music therapy (Vink et al. 2011).

### Light Therapy

Light therapy increases exposure to bright and naturalistic light and is therefore hypothesized to help regulate circadian rhythms and reduce fragmented or disrupted sleep, which in turn is hypothesized to reduce challenging behaviors (i.e., agitation, cognitive dysfunction, functional impairment, and depression) (Forbes et al. 2014). Light therapy involves use of varying levels of brightness (e.g., between 2500 and 10,000 lx). Recent research suggests that light therapy should involve exposure to light in the short wavelength range (i.e., 450 to 500 nm, the blue to green range) as this is the light range at which melanopsin cells are stimulated to shift circadian rhythms (Forbes et al. 2014). Exposure to light can be produced by using a light box, wearing a light visor, light fixtures, or dawn-dusk simulation (Forbes et al. 2014). One advantage of light therapy is that few adverse effects have been reported (Forbes et al. 2014). Overall, there is a lack of sufficient evidence to support light therapy as an effective treatment for reducing challenging behaviors (O'Neil et al. 2011; Forbes et al. 2014).

### Transcutaneous Electrical Nerve Stimulation

Transcutaneous electrical nerve stimulation (TENS) has also been explored as a potential treatment for challenging behaviors, such as aggressiveness, among individuals with dementia. TENS involves the application of biphasic pulsed waveform, pulsed electrical currents, to the skin and can produce muscle contraction depending on the intensity of the current (O'Neil et al. 2011; Cameron et al. 2009). When TENS is used to treat individuals with dementia, electrodes are applied to the head or earlobes, which produce cranial electrical stimulation (Cameron et al. 2009). TENS is associated with minor side effects, such as dull pain in the head, and therefore may be advantageous as compared to other interventions (Cameron et al. 2009). Literature examining the effects of TENS on challenging behaviors is limited. One Cochrane review noted a lack of sufficient data limited the ability to draw conclusions about the effects of light therapy on challenging behaviors, specifically aggressiveness (Cameron et al. 2009).

### Reality Orientation Therapy (Cognitive Stimulation)

Reality orientation therapy was originally developed for the rehabilitation of war veterans and later used to address the disorientation of older adults in hospitals. This approach is typically directed at individuals with dementia and involves the presentation of information regarding time, place, and person with the goal of reorienting the individual. Clocks and calendars are often employed to assist with this endeavor. One review examined all randomized controlled trials (RCTs) of cognitive stimulation for dementia that focused on cognitive change outcomes (Woods et al. 2012). These included studies in which the following terms were used to describe the intervention: cognitive stimulation, reality orientation, memory therapy, memory groups, memory support, memory stimulation, global stimulation, and cognitive psychostimulation. Cognitive stimulation, the overarching term, was defined as "engagement in a range of activities and discussions (usually in a group) aimed at general enhancement of cognitive and social

functioning" (Woods et al. 2012, p. 2). Outcome assessments of challenging behaviors were based on care provider ratings of participant behavior. More specifically, ratings of general behavior and behavior scales were used as outcome measures. No differences in challenging behaviors were found between intervention and control groups. Consequently, reality orientation therapy cannot be recommended as an intervention for challenging behaviors.

### Psychosocial Interventions

Psychosocial interventions, such as animal-assisted therapy and exercise, promote social interaction and communication and have been examined as interventions to reduce challenging behaviors.

#### Animal-Assisted Interventions

Animal-assisted interventions are a broad category, which includes three main types of interventions, animal-assisted activities, animal-assisted therapy, and service animal programs (Bernabei et al. 2013). Animal-assisted interventions can involve the use of living animals such as, dogs, cats, or even fish. Alternatively, these interventions may employ nonliving animals, such as robot animals or toy animals (e.g., plush dog or cat). Animal-assisted activity involves the use of a companion animal. Animal-assisted therapy employs therapy animals, is typically provided by health or human service professionals, and addresses specific treatment goals (Kamioka et al. 2014). Service animal programs employ service animals (Kamioka et al. 2014). Research suggests that exposure to animals has beneficial effects on health, may reduce depressive symptoms, and may improve socialization and interaction (Bernabei et al. 2013). Moreover, animal-assisted interventions reduced challenging behaviors, such as aggressiveness and irritability, although it is unclear whether these effects were maintained (Bernabei et al. 2013).

#### Physical Exercise Interventions

In general, there are several types of physical exercise/activity programs, including mobility training (e.g., walking), isotonic exercises,

strength training, or mixed modalities (e.g., chair exercises, aerobic dance class) (Heyn et al. 2004). These exercise programs may be delivered as an independent activity or may be incorporated into recreational activities/programs. The primary goal of these types of programs is to increase older adults' ability to perform tasks of everyday living (Forbes et al. 2013). An additional goal of some exercise interventions is to increase socialization. Similar to other psychosocial interventions reviewed, the effects of exercise on challenging behavior are mixed (Forbes et al. 2013; Eggermont and Scherder 2006). Currently, there is insufficient evidence to determine if exercise reduces aggressive/agitated or wandering behavior among individuals with dementia (Forbes et al. 2013).

## Summary and Conclusions

The primary focus of this entry is psychosocial interventions for challenging behaviors associated with dementia in residential care. Additionally, pharmacological interventions are briefly addressed. Reliance on pharmacological interventions continues in spite of limited support and potential adverse effects. Psychosocial interventions offer safer alternatives, but conclusions regarding several of the psychosocial interventions are limited for a variety of reasons, including methodological problems and inconsistencies in findings across studies. Most reviews of this literature have relied primarily upon large-scale studies that meet standards that are challenging for research with dementia-related problems. These include, for example, large sample size, equivalent control group, blindness of participants, and assessor to intervention (Cohen-Mansfield et al. 2012). Single-case design studies, which often clearly demonstrate the effects of interventions, have insufficient sample sizes and inadequate design characteristics to be included in most reviews. Cohen-Mansfield et al. (2012) have argued against restricting reviews to studies employing stringent inclusion criteria, such as those for RCTs. They argue that the resulting reviews fail to contain considerable useful

information that is often more externally valid than that obtained from studies with very strict inclusion criteria. The conclusions of this entry are driven largely on the basis of major reviews of the relevant literature. Further, research that does not meet the standards for RCTs (e.g., reviews of behavior analytic interventions) was also reviewed when possible. The conclusions tend to be mixed, which is consistent with the findings of most of the reviews cited in this entry. The most promising approaches to managing challenging behavior appear to be the ones that are individualized in general and those that attempt to address the antecedents and function of the challenging behaviors in particular. Future research should offer a balance of methodologies; address the lack of a consistent operationalization of challenging behavior and use of inconsistent outcome measures; and explore whether the reductions in challenging behaviors are maintained once treatment is terminated. In addition, reviewers should consider the implications of eliminating empirically sound and externally valid studies which may not meet all of the criteria previously required for inclusion.

## Cross-References

- ▶ Behavioral and Psychological Symptoms of Dementia
- ▶ Contextual Adult Life Span Theory for Adapting Psychotherapy (CALTAP) and Clinical Geropsychology
- ▶ Environmental Influences on Aging and Behavior, Theories of
- ▶ Gerontechnology
- ▶ Psychological Theories on Health and Aging
- ▶ Small-Scale Homelike Care in Nursing Homes
- ▶ Stress and Coping in Caregivers, Theories of

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## China Health and Retirement Longitudinal Study (CHARLS)

Xinxin Chen<sup>1</sup>, James Smith<sup>2</sup>, John Strauss<sup>3</sup>, Yafeng Wang<sup>1</sup> and Yaohui Zhao<sup>4</sup>

<sup>1</sup>Institute of Social Science Survey, Peking University, Beijing, China

<sup>2</sup>Rand Corporation, Santa Monica, CA, USA

<sup>3</sup>School of Economics, University of Southern California, Los Angeles, CA, USA

<sup>4</sup>National School of Development, Peking University, Beijing, China

### Synonyms

CHARLS

### Definition

This entry provides an overview of the China health and retirement longitudinal study, focusing on its value in geropsychology research in China. The entry starts with an introduction on CHARLS Sampling and Implementation including the background, the sampling procedure and design, tracking protocol, data release, and demographics of the respondents. It then describes the contents of the questionnaire, followed by psychologic measurements. This entry is concluded with future plans.

### Introduction

China has the largest aging population in the world and also one of the highest aging rates in the world today. It is projected that the proportion of those aged 60 or over will increase from 13% of the population in 2010 (National Bureau of statistics of China 2011) to 33% in 2050 (United Nations 2013), whereas the elderly support ratio (the number of prime-age adults aged 20–59 divided by the number of adults aged 60 or

above) will drop from about 4.9:1 in 2010 to 1.4:1 in 2050 (United Nations 2013).

With the rapid aging of Chinese population, the problem of providing for the aged population is becoming increasingly important. One feature of rapid economic growth is that lifetime incomes for younger people tend to be considerably higher than they were for their elderly parents, making the elderly one of the largest disadvantaged groups in China. At the same time, China's birth control policy means that China's elderly today have fewer children to support them than in the past. How to deal with problems of support for the well-being of the elderly is one of the greatest challenges to the fast-booming Chinese society in the decades to come.

In face of challenges posed by population aging, the health status of the elderly population is of great importance. A healthy older population can not only reduce the financial and personal care needs but can also contribute to the family and society in the form of working or helping to take care of the young children.

Of all dimensions of health, psychological health is at least as important as physical health to the functionality of older persons. Depression is already listed as a major cause of death and disability in China (Yang et al. 2013; Phillips et al. 2002). In the United States, dementia or cognitive impairment has been shown to cause major caring burdens to the family (Hurd et al. 2013).

At present, scientific studies of China's aging psychological health problems are still at an early stage, the greatest obstacle being a lack of sufficient micro-longitudinal data. The existing data tend to be small scale in parts of China, not collecting the breadth of data necessary for good social scientific analysis of psychological health of the older population. China Health and Retirement Longitudinal Study (CHARLS) is the first nationally representative survey of the older population that enables the study of psychological health of the older population in China patterned after the Health and Retirement Study (HRS) in the United States, English Longitudinal Study of

**China Health and Retirement Longitudinal Study (CHARLS), Table 1** Response rates: 2011 Baseline, Wave 2, 2013

	Wave 1 2011	Wave 2 2013			
	Households <sup>a</sup>	Total	2011 household respondents <sup>b</sup>	Refresher Households	Households who did not respond in 2011
Response rate (%)	80.5	N/A	91.0	81.6	51.6
No. of households	10,257	10,832	9,022	615	1,129
No. of respondents	17,708	18,648	15,684	1,107	1,857

<sup>a</sup>Household response rate: the ratio of number of responded households to the number of age-eligible households

<sup>b</sup>2013 Individual R-rate: respondents who completed at least one module/(total individuals in 2011 minus 2011 respondents who died by 2013)

Ageing (ELSA), and the Study of Health, Ageing, and Retirement in Europe (SHARE).

This entry will give a comprehensive introduction of the CHARLS data set, its sampling method, longitudinal tracking protocol, the content of the questionnaire especially existing psychological measures, and plans for future data collection.

## CHARLS Sampling and Implementation

### Baseline Sampling

CHARLS is a biennial survey that aims to be representative of the residents of China aged 45 and older, with no upper age limit. The CHARLS national baseline survey was conducted in 2011–2012 and wave 2 in 2013. CHARLS is a nationally representative survey that includes one person per household aged 45 years of age or older and their spouse, totaling 17,708 individuals in wave 1, living in 10,257 households in 450 villages/urban communities (Zhao et al. 2013, 2014). At the first stage, all county-level units were sorted (stratified) by region, within region by urban district or rural county, and by GDP per capita (Tibet was the only province not included). Region was a categorical variable based on the NBS division of province area. After this sorting (stratification), 150 counties or urban districts were chosen with probability proportional to population size (Zhao et al. 2013). For each county-level unit, three PSUs (villages and urban neighborhoods) are randomly chosen with probability proportional to population

(Zhao et al. 2013). Hence, CHARLS is nationally represented for both rural and urban areas within China. Counties and districts in 28 provinces are included in the CHARLS sample (Zhao et al. 2013).

In light of the outdated household listings at the village/community level due to population migration, CHARLS designed a mapping/listing software (Charls-GIS) that makes use of Google Earth map images to list all dwelling units in all residential buildings to create sampling frames.

The response rate for the baseline survey was 80.5%, 94% in rural areas and 69% in urban areas, lower in urban areas as is common in most surveys undertaken in developing countries (Table 1) (Zhao et al. 2013). A description of the sample for waves 1 and 2 is provided in Table 1. After applying sampling weights created using the sampling procedure, the CHARLS sample demographics mimics very closely that of population census in 2010 (Zhao et al. 2013).

In each sampled household, a short screening form was used to identify whether the household had a member meeting the age eligibility requirements. If a household had persons older than 39 and meeting the residence criterion, one of them will be randomly selected. If the chosen person is 45 or older, then he/she became a main respondent and his or her spouse was interviewed. If the chosen person was between ages 39 and 44, he/she was reserved for refresher samples for future waves. In wave 2, respondents who were aged 43–44 in wave 1 (plus their spouses) were

**China Health and Retirement Longitudinal Study (CHARLS), Table 2** Number and age/sex structure of individuals: 2011 Baseline and Wave 2, 2013

	Baseline, 2011			Wave 2, 2013		
	Total	Male	Female	Total	Male	Female
–50	4,277	1,806	2,471	4,178	1,754	2,424
51–55	2,848	1,412	1,436	2,712	1,302	1,410
56–60	3,523	1,697	1,826	3,523	1,702	1,821
61–65	2,695	1,372	1,323	3,124	1,574	1,550
66–70	1,802	913	889	2,037	1,032	1,005
71–75	1,214	652	562	1,442	732	710
76–80	790	386	404	787	410	377
80+	548	231	317	830	374	456
OBS	17,708	8,476	9,232	18,648	8,882	9,766

Note: There are 11 individuals in 2011 and 15 individuals in 2013 lacking age information

added from the refresher sample. The same for wave 3 (4) will be done in 2015 (2017), out of those aged 41–42 (39–40) in wave 1. Starting in wave 5 (2019), a new mapping/sampling exercise will be conducted to replenish the sample with appropriate aged cohorts.

### Tracking Protocol

Respondents and spouses will be tracked if they exit the original household. While the original CHARLS sample is of the noninstitutionalized elderly population, if a respondent becomes institutionalized, such as entering a nursing home or hospital for a long stay, CHARLS follows them. This potentially matters for obtaining prevalence rates for dementia since it might be that some of the population with dementia is institutionalized. However, in China, the institutionalized population is very small, so in practice for CHARLS, this is unlikely to be an important issue.

Main respondents and spouses in the baseline survey are followed throughout the life of CHARLS or until they die. If a main respondent or spouse remarries, the new spouse is interviewed so long as they are still married to the baseline respondent at the time of the specific wave. In wave 2, only 25 couples split up because of divorce.

For respondents in the baseline, after deaths, 91% of them were recontacted (Table 1). Four hundred twenty-seven exit interviews were conducted on respondents who died between the

baseline and wave 2 (464 deaths), including verbal autopsies using the 2012 version from the World Health Organization. In addition, the households which were not found in the baseline were revisited. One thousand one hundred twenty-nine of these (51.6% of those households who had age-eligible members living in nonempty dwellings) were contacted. The households that split because of divorce or moving were also followed. The total household size in wave 2 is 10,832 households with a total of 18,648 individuals (main respondents plus spouses). The age distribution of respondents in baseline and wave 2 is shown in Table 2.

### Data Release

The national baseline data and documentation were released publicly, on the CHARLS website ([www.charls.ccer.edu.cn/en](http://www.charls.ccer.edu.cn/en)), in early February 2013, less than 1 year after the fieldwork was completed. The second wave of the national CHARLS sample was fielded in the summer and through the fall of 2013. It was released publicly at the end of this January.

### Demographics of the CHARLS Sample

Table 2 describes the age/sex composition of the CHARLS sample. There are 17,708 individuals in the national baseline sample, of which 52.1% are female. While most of the samples are the younger old, 40% are aged 60 years and older. Of the sample, 91.3% were directly interviewed and

8.7% were interviewed by proxy respondent (Table 2).

## Content of the Household Survey

### Household Survey Instruments

The core survey consists of the following sections: (1) demographics; (2) family structure/transfer; (3) health including biomarkers; (4) health insurance and healthcare utilization; (5) work, retirement, and pension; (6) relative income; (7) family income, wealth, and expenditures; (8) personal income, assets; and (9) housing characteristics. All interviews are conducted using the computer-assisted personal interview (CAPI) technology. The health modules will be described in detail.

### Health Status: Self-Reports and Assessments

The self-reports start with the respondent rating health on a scale of excellent, very good, good, fair, and poor or instead very good, good, fair, poor, and very poor. As in HRS, respondent's self-assessment is asked twice, using each scale, once at the start of the module and once at the end of the sub-module asked randomly determined within CAPI. This is followed by questions asking about diagnoses by doctors of a set of chronic diseases, including stroke and separately psychology diseases, and the timing of diagnoses of specific conditions. Where relevant, current medications and treatments for each specific condition are also collected. Questions about eyesight, hearing, and dental health are asked next and then questions on hedonic well-being. The CHARLS team follows this subsection with a section to obtain information on activities of daily living (ADLs), instrumental activities of daily living (IADLs), and physical functioning. For those who have been identified as having difficulties in ADL or IADL, the care givers are collected. Up to three names are chosen from all of list of family members. Time of care and financial arrangement are asked. Sections on depressive symptoms and cognition follow.

In addition to self-reported health outcome variables, information is collected on several

health behaviors. This includes detailed information on smoking, drinking, and physical activities.

### Health Status: Biomarkers

Following ELSA and HRS, detailed biomarkers, blood and non-blood, were collected. Non-blood biomarkers such as anthropometrics and blood pressure were collected in waves 1 and 2 and will again be in wave 3. Then the blood biomarkers was collected in wave 1 and will be collected in every other wave, to harmonize with HRS and other aging surveys. In CHARLS the data are collected on height, lower leg and upper arm lengths (useful to get measures related to height not contaminated by shrinkage), waist circumference, blood pressure (measured 3 times), grip strength (measured by a dynamometer two times for each hand), lung capacity measured by a peak flow meter, and doing a timed sit to stand (5 times starting from a full sit position on a common, plastic stool). The balance tests are also conducted, just the same as those used in HRS, and a timed walk at normal speed for 2.5 m again follows HRS.

### Healthcare Utilization and Insurance

Indicators of curative and preventive healthcare utilization and health insurance coverage are collected in this module. A separate section on health insurance is asked to collect details of current and past coverage and whether coverage was lost. Healthcare utilization of outpatient care for the last 1 month is asked, with details about last visit. Inpatient utilization over the past 1 year is asked, with details about last visit. The questions include from whom and at what location medical care was received, how much was total cost, what was out of pocket cost, whether insurance was used, if others help pay for the care, whom, and how far respondents traveled.

### Life Histories

A special wave to collect life histories was fielded in 2014. Life histories can greatly add to aging surveys because they help to fill in very important details regarding earlier periods in the respondent's life, which are germane to understanding outcomes when older. Ways to minimize recall

**China Health and Retirement Longitudinal Study (CHARLS), Table 3** CES-D questions

English	Mandarin
<b>DC009</b> I was bothered by things that don't usually bother me	我因一些小事而烦恼。
<b>DC010</b> . I had trouble keeping my mind on what I was doing	我在做事时很集中精力。
<b>DC011</b> . I felt depressed	我感到情绪低。
<b>DC012</b> . I felt everything I did was an effort	我得做任何事都很劲。
<b>DC013</b> . I felt hopeful about the future	我对未来充满希望。
<b>DC014</b> . I felt fearful	我感到害怕。
<b>DC015</b> . My sleep was restless	我的睡眠不好。
<b>DC016</b> . I was happy	我很愉快。
<b>DC017</b> . I felt lonely	我感到孤独。
<b>DC018</b> . I could not get "going"	我得我无法继续我的生活

error have been greatly improved primarily through the use of calendars that are anchored to key lifetime or calendar events (both national events, like the Cultural Revolution and local, like a major flood) that are salient to respondents' memory. Such calendars have been developed.

The CHARLS life histories are developed using as a base the ELSA and SHARE life histories, the most complete life histories of the HRS-type aging surveys. The CHARLS life history includes retrospectives on domains that cover family background when the respondent was a child, child health and health care, work and retirement, marriage, childbirths, migration, some retrospective information on income, wealth and poverty status when young, and schooling is collected. Some special history issues germane to China are also included, such as experiences during the Cultural Revolution and the Great Famine and during local events such as a major local flood. These life histories will be especially useful for linkage with the CHARLS ADAMS 2 data.

### Community Survey Instrument

One special feature of CHARLS that is new to the HRS-type surveys is to collect detailed panel data from community-level informants (e.g., formal and informal community leaders). Basic community information is collected on, for example, land and its allocation, population, and the most populous surnames and their numbers. More standard information is also collected, such as details about local infrastructure and public facilities such as roads, electrification, water and sanitation infrastructure, and the availability of schools; health

insurance and health facilities; and pensions and prices. In addition, the Policy Questionnaire collects details of social welfare programs such as pensions and health insurance. In addition, at the county level.

## Psychological Health Measures

### Depression

CHARLS uses the ten-question version of the Center for Epidemiologic Study depression (CES-D) battery (The CES-D ten questions are reported in Appendix Table 3, and CHARLS uses the Chinese translation provided at the Center for Epidemiologic Studies website). The answers for CES-D are on an f-scale metric, from rarely, to some days (1–2 days), to occasionally (3–4 days) to most of the time (5–7 days).

Lei et al. (2014a) provides a descriptive analysis of the depressive symptoms as revealed in CHARLS. They scored these answers using the metric suggested by Radloff (1977). Numbers from 0 for rarely to 3 for most of the time are used for negative questions such as “do you feel sad.” For positive questions such as “do you feel happy,” the scoring is reversed from 0 for most of the time to 3 for rarely. A validation exercise of answers to these questions indicates a reasonable level of internal consistency. Lei et al. (2014b) report that in 2011/12 a high fraction of Chinese people 45 and older, both men and women, are suffering from high levels of depressive symptoms, with some 30% of men and 43% of women having CES-D scores 10 and over (out

**China Health and Retirement Longitudinal Study (CHARLS), Table 4** Word recall list, English and Mandarin

List A	List B	List C	List D
A01. RICE 米	B01. STOOL 凳子	C01. MOUNTAIN 山	D01. WATER 水
A02. RIVER 河流	B02. FOOT 脚	C02. STONE 石头	D02. HOSPITAL 医院
A03. DOCTOR 医生	B03. SKY 天空	C03. BLOOD 液	D03. TREE 树木
A04. CLOTHES 服	B04. MONEY 金钱	C04. MOTHER 妈妈	D04. FATHER 爸爸
A05. EGG	B05. PILLOW 枕头	C05. SHOES 子	D05. FIRE 火
A06. CAT 小猫	B06. DOG 小狗	C06. EYE 眼睛	D06. TOOTH 牙
A07. BOWL 碗	B07. HOUSE 房子	C07. GIRL 女孩	D07. MOON 月亮
A08. CHILD 小孩	B08. WOOD 木头	C08. HOUSE 房子	D08. VILLAGE 村子
A09. HAND 手	B09. SCHOOL 小学	C09. ROAD	D09. BOY 男孩
A10. BOOK 书	B10. TEA 茶	C10. SUN 太阳	D10. TABLE 桌子

of 30 as a maximum). Rural residents have substantially higher levels of depressive symptoms than urban residents.

### Cognition

In the first two waves, CHARLS used a reduced form of the Telephone Interview for Cognitive Status, TICS (Brandt et al. 1988). This includes recognition of date: month, day, year, season (lunar calendar is allowed in addition to Gregorian calendar), day of the week, how the respondent rates their own memory on an excellent, very good, good, fair, poor scale, and serial subtraction of 7s from 100 (up to five times). The respondent is asked to redraw a picture of overlapping pentagons. In addition, immediate and delayed word recall is used, using ten nouns randomly chosen from a list of four groups of words, with approximately 5 min between the immediate and delayed answers. The words will not be read out a second time before the delayed recall (the word lists are reported in Appendix Table 4).

CHARLS shows a steep decline of cognitive functions with age (Lei et al. 2014b). There exist large sex-related differences in cognition to the disadvantage of women, with the large sex-related gap in education being the primary reason for this. These sex-related disparities are eliminated in younger cohorts.

### Future Plans

Starting in wave 3 (2015), CHARLS will be introducing a number series test of fluid intelligence,

patterned on the HRS number series test (Fisher et al. 2013; Prindle and McArdle 2013).

In CHARLS wave 4, it is scheduled to diagnose dementia and impaired of cognition among the CHARLS respondents aged 65 and older. This will be done in two steps. First, a formal validation sample will be collected from which both interviewer assessment and doctor diagnosis will be conducted. From these data, a statistical model will be built to use interview tests to predict dementia and CIND. This information will be used to inform the final choice of tests and the estimation of weights and cutoff points specific to China with which to classify CHARLS respondents as having dementia and CIND. Among the tests currently planned are the mini-mental state exam (MMSE); immediate and delayed word recall; a measure of verbal fluency, animal naming; the symbol digit modalities test; and backwards digit span.

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### Cross-References

- ▶ [English Longitudinal Study of Aging \(ELSA\)](#)
- ▶ [Health and Retirement Study, A Longitudinal Data Resource for Psychologists](#)

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## Chinese Longitudinal Healthy Longevity Study

Danan Gu<sup>1</sup>, Qiushi Feng<sup>2</sup> and Yi Zeng<sup>3,4</sup>

<sup>1</sup>United Nations Population Division, New York, NY, USA

<sup>2</sup>Department of Sociology, National University of Singapore, Singapore, Singapore

<sup>3</sup>Center for the Study of Aging and Human Development and Geriatrics Division, School of Medicine, Duke University, Durham, NC, USA

<sup>4</sup>Center for Healthy Aging and Development Studies, National School of Development, Peking University, Beijing, China

## Synonyms

Centenarian study; Chinese study; Psychological resilience; Psychological traits

## Definition

This entry aims to introduce the centenarian subsample of the Chinese Longitudinal Healthy Longevity Survey (CLHLS) and present some key findings on psychological traits of centenarians.

## Background: Centenarian Studies in the World

Tireless efforts are made to explore the secret of human longevity throughout history. However, it is not until very recent that science-based studies on the mechanism of longevity appeared with sufficient sample sizes and multidisciplinary perspectives have been launched (Poon and Cheung 2012). One shortcoming of most existing longevity research projects is that little research has been done for those who survive to age 100 and

**Disclaimer:** Views expressed in the study are only those of the authors and do not reflect those of the United Nations, National University of Singapore, Duke University, or Peking University

beyond, namely centenarians (Poon and Cheung 2012; Zeng 2012).

The urgent call to study centenarians is largely due to the increasing importance of this special subpopulation. Because of the steady decline of mortality at very old ages (Vaupel et al. 1998; Wilmoth et al. 2000), the number of centenarians is booming in the world (Robine et al. 2010; Wilcox et al. 2008, 2010) and is projected to exceed three million by 2050 and possibly 20 million by 2100 in a conservative estimation of the United Nations Population Division (2015). More importantly, with the world population aging, centenarians come to be considered as a model of successful aging or healthy aging (Andersen-Ranberg et al. 2001; Poon et al. 2010). But why could some people live up to age 100 and beyond, while others die at much younger ages? Why could some people live so long but still remain healthy? Although there has been a consensus among researchers that socioeconomic, behavioral, environmental, and biological factors jointly determine one's longevity and health, to what extent and how exactly these factors contribute to centenarians' exceptional long and healthy life is mostly unknown.

There have been a number of centenarian studies around the world to attempt to address such research questions. For example, the longest ongoing centenarian study in the contemporary world is the Okinawa Centenarian Study (OCS), which was launched in 1975. The OCS has heretofore collected over 900 centenarians and several thousands of their siblings of septuagenarians, octogenarians, and nonagenarians in Okinawa, Japan. The Georgia Centenarian Study (GCS) is the longest centenarian study in the USA, which started in 1988. In the Phase I (1988–1992), the GCS collected 76 centenarians with 92 octogenarians and 89 sexagenarian as comparisons; 250 centenarians were further included with 80 octogenarians as comparison in the Phase III (2001–2009). The largest centenarian study in the USA is the New England Centenarian Study (NECS), which was launched in 1995. The NECS has collected data from about 1,600 centenarians in the USA with 500 children (in their 70s and 80s) and 300 younger controls since

1995. Several European countries have also launched centenarian studies since the early 1990s such as the Italian Multi-center Study on Centenarians (IMUSCE) (around 2,000 centenarians) and the Longitudinal Danish Centenarian Study (about 300 centenarians) (Koenig 2001; Poon and Cheung 2012). These centenarians and all other relevant studies have resulted in a boom in centenarian studies and improved understanding about their secret of longevity.

However, nearly all centenarian studies are from developed countries. There was almost no scientific research project with a sufficient sample size of centenarians in developing countries before the late 1990s (Zeng et al. 2001). Because the contributions of sociodemographics, psychological factors, and behavioral factors to longevity vary in different cultures and societies with different development stages (Poon et al. 2010; Kolovou et al. 2014; Willcox et al. 2006), it would be interesting to study centenarians from developing countries where the socioeconomic resources, healthcare service, and technology are limited. Furthermore, while there were about 50 centenarians per million in Western Europe (Jeune and Vaupel 1995; United Nations Population Division 2015), there were less than three centenarians per million in China in the 1990s (United Nations Population Division 2015). The genomes of long-lived individuals from China may be more enriched for disease-preventive genes than their counterparts in the West, because they survived the brutal mortality regimes of the past when famine, civil wars, and starvation affected their birth cohorts of many millions. In addition, the genetic composition of the Han Chinese ethnic group is relatively homogeneous. Unlike Western countries that received many immigrants from other parts of the world and thus provide relatively heterogeneous genetic compositions even within the same ethnic group, China received very few international immigrants. Consequently, the Han Chinese are relatively genetically homogenous, compared to the Western counterparts. For example, it was estimated that “the average of genetic differences between Han Chinese population samples ( $F_{ST} = 0.002$ ) was much lower than that among

European populations ( $F_{ST} = 0.009$ )” (Xu and Jin 2008). This is a comparative advantage to increase statistical power for studying effects of genetic and GxE interactions on healthy aging.

Another major limitation of existing literature on centenarian studies has been the lack of surveys with large sample sizes. To address above research questions, including investigating genetic variations in longevity and examining gene-environment interaction effects on longevity and health, large samples are required. Small sample sizes of surveys often produce results with insufficient statistical power or poor robustness; and in some cases, small-sized surveys on centenarians often lack representativeness when the size of underlying centenarian population is relatively large, such as in China. Yet, with few exceptions, the sample sizes of most centenarian studies around the world are less than 1,000 centenarians (Koenig 2001; Poon and Cheung 2012). To promote centenarians studies, there is thus a need for studies with large representative samples in developing societies, such as in China which homes about 1.3 billion population or about 19% of the world total population.

## Research Objectives of the CLHLS

### Launch of the CLHLS

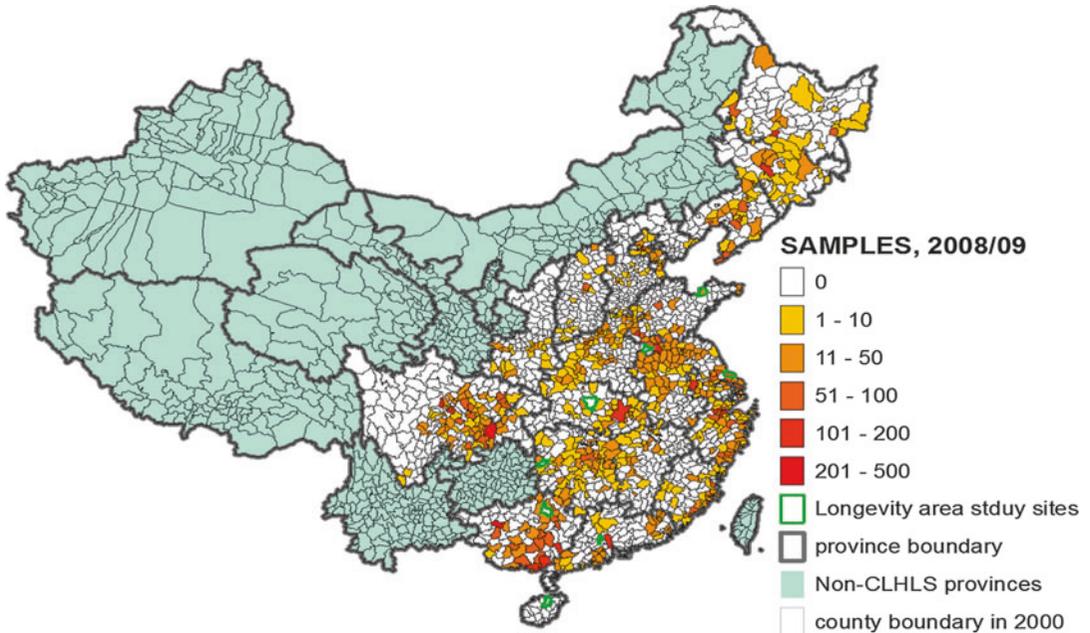
While it is very useful and important to uncover the secrets of human longevity to study centenarians, it is also equally important or even more prominent to study the oldest-old population aged 80 or older. This is because the remarkable increase in the number of oldest-old population in the recent years and near future presents a serious public health challenge to promote the quality of life. Because their large consumptions of social and medical care services and benefits of research on them are far out of proportion to their size, the oldest-old population in aging and longevity studies has received increasing attention over the past decades. In this context, Drs. Yi Zeng and James W. Vaupel launched a nationwide project in China on determinants of healthy longevity in 1998, titled as the Chinese Longitudinal Healthy Longevity Survey (CLHLS). This project received

financial supports from the National Institute on Aging, the National Natural Science and Social Sciences Foundations of China, UNFPA, and other resources.

The CLHLS aims to collect extensive data on a large sample of the oldest-old aged 80 years and older with a comparison group of younger elders aged 65–79. The project also collected information on the offspring of the elderly in 2002 and 2005 to better investigate the role of intergenerational transfers and its association with human longevity. Starting in 2009, adult children of centenarians and controls of nonrelatives of centenarians in seven longevity areas (later becoming eight longevity areas in 2012 and 2014) were included in the CLHLS (see section “Centenarian Sub-Sample in the CLHLS” below). More specifically, the objectives of the CLHLS research project are threefold: (1) to shed light on the determinants of healthy longevity and to discover social, behavioral, environmental, and biological factors that may have an influence on the healthy longevity of human beings, as well as to answer questions such as why some people survive to very old age without much suffering while others suffer considerably; (2) to fill in the data gap and gain a better understanding of demographic and socioeconomic conditions, as well as of the health status and care-giving needs of the oldest-old population; and (3) to provide a scientific base for sound policy making and implementation, so as to improve the system of care-giving services and, ultimately, the quality of life of the elderly.

### Sampling Strategy of the CLHLS

The CLHLS is conducted in a randomly selected half of the counties and cities in 22 of China’s 31 provinces. The 22 provinces are Liaoning, Jilin, Heilongjiang, Hebei, Beijing, Tianjing, Shanxi, Shaanxi, Shanghai, Jiangsu, Zhejiang, Anhui, Fujian, Jiangxi, Shandong, Henan, Hubei, Hunan, Guangdong, Guangxi, Sichuan, and Chongqing (see Fig. 1). The exclusion of nine provinces in the North-West parts of China, where ethnic minorities represent a high proportion of total population, was based on concerns about the inaccuracy of age-reporting among



**Chinese Longitudinal Healthy Longevity Study, Fig. 1** Spatial distribution of the sampled counties/cities in the CLHLS, the 2008 wave. Note: This map was made by the authors based on a county boundary map from the National Bureau of the Statistics of China. The designations employed and the presentation of material on this

map do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, or area or of its authorities or concerning the delimitation of its frontiers or boundaries

local elders. Previous studies have evidenced major inaccuracy (mainly exaggeration) in age reporting at old ages in these nine provinces (Coale and Li 1991; Huang 1993). In contrast, in the 22 provinces as chosen, local people, mostly Han, tend to use the Chinese lunar calendar and/or Western solar calendar to specify their birthdays, which largely reduces the inaccuracy of age reporting. The accuracy and reliability of age reporting for Han Chinese is related to the fact of their cultural tradition that the exact date of birth is significant for them in making decisions on important life events such as matchmaking for marriage, date of marriage, and the date to start building a house, among other events (Coale and Li 1991; Zeng 2012). The total population of the survey areas constituted about 85% of the total population in China in 2000 and 82% in 2010. So far, seven waves in 1998, 2000, 2002, 2005, 2008/09, 2011/12, and 2014 have been conducted.

In the sampling areas, the CLHLS aims to interview all centenarians who voluntarily agreed

to participate in the study. For each centenarian interviewee in each wave, the CLHLS interviewed one nearby octogenarian (aged 80–89 years) and one nearby nonagenarian (aged 90–99 years) with predefined age and sex. “Nearby” is loosely defined – it could be in the same village or in the same street, if available, or in the same town or in the same sampled county or city district. The predefined age and sex are randomly determined, based on the randomly assigned code numbers of the centenarians, to have comparable numbers of males and females at each age group. In the first two waves (1998 and 2000), the CLHLS did not collect data from elders aged 65–79 years. Since the 2002 wave, the CLHLS extended its sample to include elders aged 65–79 under same sampling strategy with approximately three nearby elders aged 65–79 of predefined age and sex in conjunction with every two centenarians. Respondents who were younger than age 100 at an interview but subsequently died before a subsequent wave or resettled or refused to

be interviewed at a subsequent wave were replaced by new interviewees of the same sex and age (or within the same 5-year age group). However, such a strategy was not applied to the sixth and seventh waves where only follow-ups were performed due to shortage of budget, except the eight longevity areas where new participants were recruited to replace the deceased or the refusals.

To avoid the problem of small subsample sizes at the more advanced ages, the CLHLS oversampled respondents at more advanced ages, especially among male elders, in addition to recruiting all centenarians with a consent agreement. Consequently, appropriate weights were generated based on the age-sex-rural/urban-specific population distribution in the census. The method for computing the age-sex-rural/urban-specific weights and the associated discussions are presented in Zeng et al. (2008) and available at the CLHLS web page.

The questionnaire design was based on international standards and was adapted to the Chinese cultural/social context and carefully tested by pilot studies. The CLHLS collects various information covering demographics, socioeconomic conditions, psychological traits, health practice, and various health condition. All data were collected via in-home visits. The basic physical capacity tests were performed by a local doctor, a nurse, or a medical student.

## Centenarian Subsample in the CLHLS

### Subsample of the Centenarian Interviewees

In the research design of the CLHLS, the group of centenarians is one of the major components. As shown in Table 1, the CLHLS from 1998 to 2014 interviewed 10,804 centenarians in total with 2,130 male centenarians and 8,674 female centenarians. The total number of interviews of these centenarians is 16,582, of which 3,876 centenarians have two interviews and 1,360 centenarians have three interviews; only 372, 117, 39, and 14 have 4, 5, 6, and 7 interviews, respectively.

## Data Quality of the Centenarians

Accurate age reporting is crucial in centenarian studies. The CLHLS has employed different methods to verify centenarians' ages, including birth and marriage certificates if available; household registration information; ages of their siblings, children, and relatives; genealogical record; any relevant document from local communities if available; and reported ages in Chinese zodiac. (The Chinese zodiac is a repeating cycle of 12 years, with each year being represented by an animal according to the Chinese lunar calendar. These zodiac animals are used to record one's date of birth). Based on the solid comparisons of various demographic indices, it was concluded that although the age reporting quality of centenarians of Han Chinese was not as good as in Sweden, Japan, England, and Wales, it is almost as good as in Australia and Canada, slightly better than in the USA (white, black, and other races combined), and much better than in Chile (see Zeng et al. 2008).

The systematic assessment of data quality of the CLHLS indicates that there was no substantial underreporting of deaths, and most variables or items in the questionnaire were in high quality. However, the causes of death of centenarians reported by next-of-kin might not be reliable, because nearly 60% of reported deaths had no information on causes of death (Zeng et al. 2008). This might be due to that significant portion of the centenarians did not go to the hospital to diagnose/treat the disease prior to death or they in fact died without specific disease.

### In-Depth Study of Longevity Areas Including Adult Children of Centenarians

The CLHLS launched a subproject for an in-depth study in seven longevity areas where the density of centenarians is exceptionally high in 2009 as part of the 5th wave of the CLHLS, and in eight longevity areas (the previous seven plus a new one) in 2012 and 2014 as part of the 6th and 7th waves of the CLHLS, to investigate why some areas have a much higher proportion of healthy and long-lived individuals than other areas. The seven areas in 2009 were Chenmai County (Hainan Province), Yongfu County (Guangxi

**Chinese Longitudinal Healthy Longevity Study, Table 1** Sample distributions of centenarians in the 1998, 2000, 2002, 2005, 2008–2009, 2011/12, and 2014 waves of the CLHLS

	Waves							Total
	1998	2000	2002	2005	2008–2009	2011–2012	2014	
<b>Men</b>								
New recruits	481	256	420	360	519	62	32	2,130
One follow-up	–	262	124	131	99	146	33	795
Two follow-ups	–	–	132	47	38	44	64	325
Three follow-ups	–	–	–	43	15	21	24	103
Four follow-ups	–	–	–	–	17	6	10	33
Five follow-ups	–	–	–	–	–	8	4	12
Six follow-ups	–	–	–	–	–	–	3	3
Total	481	518	676	581	688	287	170	3,401
<b>Women</b>								
New recruits	1,937	1,022	1,615	1,462	2,100	355	183	8,674
One follow-up	–	891	506	483	420	613	168	3,081
Two follow-ups	–	–	392	156	115	122	250	1,035
Three follow-ups	–	–	–	115	45	41	68	269
Four follow-ups	–	–	–	–	45	19	20	84
Five follow-ups	–	–	–	–	–	20	7	27
Six follow-ups	–	–	–	–	–	–	11	11
Total	1,937	1,913	2,513	2,216	2,725	1,170	707	13,181
<b>Both sexes</b>								
New recruits	2,418	1,278	2,035	1,822	2,619	417	215	10,804
One follow-up	–	1,153	630	614	519	759	201	3,876
Two follow-ups	–	–	524	203	153	166	314	1,360
Three follow-ups	–	–	–	158	60	62	92	372
Four follow-ups	–	–	–	–	62	25	30	117
Five follow-ups	–	–	–	–	–	28	11	39
Six follow-ups	–	–	–	–	–	–	14	14
Total	2,418	2,431	3,189	2,797	3,413	1,457	877	16,582

Note: The number of centenarians at a follow-up wave includes those whose ages were in 90s or 80s in a previous wave of the CLHLS who are not presented in the table. For the number of sample distribution for other ages, please refer to Zeng (2012:138)

Province), Mayang County (Hunan Province), Zhongxiang City (Hubei province), Xiayi County (Henan Province), Sanshui City (Guangdong Province), and Laizhou City (Shandong Province). Rudong County (Jiangsu Province) was added since 2012. The criteria of section for longevity areas come from the Committee of the China's Longevity Areas associated with the Chinese Society of Gerontology, including high density of centenarians and nonagenarians, high life expectancy, and a series of within-area consistency checks including good health status and good environment quality, etc. One biological child of each centenarian interviewee in the

longevity areas was recruited since the 6th wave. The purpose of such design is to collect data on factors associated with longevity by comparing longevity transmission between families with and without centenarians. In addition to the regular home-interviews, the in-depth study on these longevity areas includes more sophisticated health exams and blood and urine sample collections for biomarker analysis.

In 2002, with support from the Taiwan Academy Sinica and Mainland China Social Sciences Academy, the CLHLS collected a sample of 4,478 adult children aged 35–65 of the elderly interviewees in eight provinces out of the 22 CLHLS

**Chinese Longitudinal Healthy Longevity Study, Table 2** Distributions of deceased centenarians between adjacent waves from 1998 to 2014, CLHLS

	Wave interval						Total
	1998–2000	2000–2002	2002–2005	2005–2008/ 2009	2008/ 2009–2011/ 2012	2011/ 2012–2014	
Men	348	292	450	429	437	203	2,159
Women	1,213	930	1,635	1,502	1,722	692	7,694
Both sexes	1,561	1,222	2,085	1,931	2,159	895	9,853

Note: The number of centenarians at death during two adjacent waves includes those whose ages were in 90s in a previous wave

sampled provinces: Guangdong, Jiangsu, Fujian, Zhejiang, Shandong, Shanghai, Beijing, and Guangxi (mostly eastern coastal provinces). Of 4,478 dyadic pairs of data, there are 440 pairs for centenarians and their adult children in these eight provinces. Unlike the dyadic pairs of dataset in the longevity areas which deals with familial transmission of longevity, this dyadic dataset focused on the family dynamics of adult children and their intergenerational transferring. One follow-up survey for these 4,478 adult children was conducted in the 2005 wave. Such a study design is rare and valuable, as these dyadic datasets are particularly useful for studying familial factors that are associated with healthy aging.

### Deceased Centenarian Interviewees Between Surveys

One unique feature of the CLHLS is the relatively comprehensive information collection on the extent of disability and suffering before dying of each centenarian (also of each respondent of other age groups) who died between two adjacent waves. The information was retrospectively collected from the next-of-kin or the primary caregiver of those deceased centenarians as well as other died respondent. The information includes dates and causes of death, and health and healthcare conditions from the last interview to the time of death, such as chronic diseases, activities of daily living (ADLs), number of hospitalizations, whether the centenarian had been bedridden, and whether the subject had been able to obtain adequate medical treatment when

he/she was sick. Data on how many days before death the elder did not go outside and how many days before death the elder spent more time in bed than out of bed were collected as well. Information on socioeconomic and demographic characteristics, such as marital status, family structure, caregivers, financial situation, and living arrangement before death, as well as the caregiving costs within 1 month before the death were also collected.

Table 2 presents the number of the deceased centenarians between two adjacent waves from 1998 to 2014 in the CLHLS, which was 9,853 centenarians with 2,159 males and 7,694 females, for whom the data in the 2 years prior to death have been collected.

### DNA Samples and Home-Based Health Examinations

The CLHLS collected DNA samples from 4,849 centenarians in addition to 5,190 nonagenarians, 5,274 octogenarians, 4,770 aged 65–79, and 4,609 aged 40–64. Health exams for a total of 2,035, 2,862, and 2,651 participants in the longevity areas were performed in 2008/09, 2011/12, and 2014, respectively, by local certified doctors and nurses who are affiliated with the China Center for Disease Control and Prevention (CDC) as contracted for this project. The medical personnel used standard instruments to check heart, lungs, breast, waist, lymph, limbs, and thyroid of the participants. They also wrote down impressions and symptoms of disorder if any, and furthermore enquired about the participants' family disease history and current medications.

In sum, the large population-based sample size, the focus on healthy longevity (rather than on a specific disease or disorder), the simultaneous consideration of various risk factors, and the use of analytical strategies based on demographic concepts make the CLHLS as an innovative project of demographic data collection and research (Zeng 2012).

## Psychological Traits of Chinese Centenarians

### Variables of Psychological Traits

In addition to the internationally standardized mini-mental status examination (MMSE) of cognitive function tests, the CLHLS contains seven variables relevant to psychological traits: (1) Do you look on the bright side of things? (being optimistic) (2) Do you keep things neat and clean? (3) Can you make your own decisions concerning your personal affairs? (self-determination) (4) Do you feel as happy as when you were young? (5) Do you feel fearful or anxious? (6) Do you feel lonely and isolated? (7) Do you feel useless? Each question above has six response options: always, often, sometimes, seldom, never, and unable to answer; proxy responses were not allowed. The first four questions reflect positive affect of psychological traits, while the latter three questions refer to the negative affect.

These questions are mainly derived from the Positive Affect and Negative Affect schedule (PANAS) scale and could also be considered a short version of a recently developed Scale of Positive and Negative Experience (SPANE). Both PANAS and SPANE scales mainly focus on the general adult population (see Diener and Biswas-Diener 2009). Different from the SPANE and PANAS scales, psychological traits questions in the CLHLS contain an option “unable to answer” for each question, which aims to accounting for the possibility that some oldest-olds may not be able to answer the question due to, for example, various health problems or difficulties in making up their minds. Based on the CLHLS data from the 1998 wave to the 2011/12

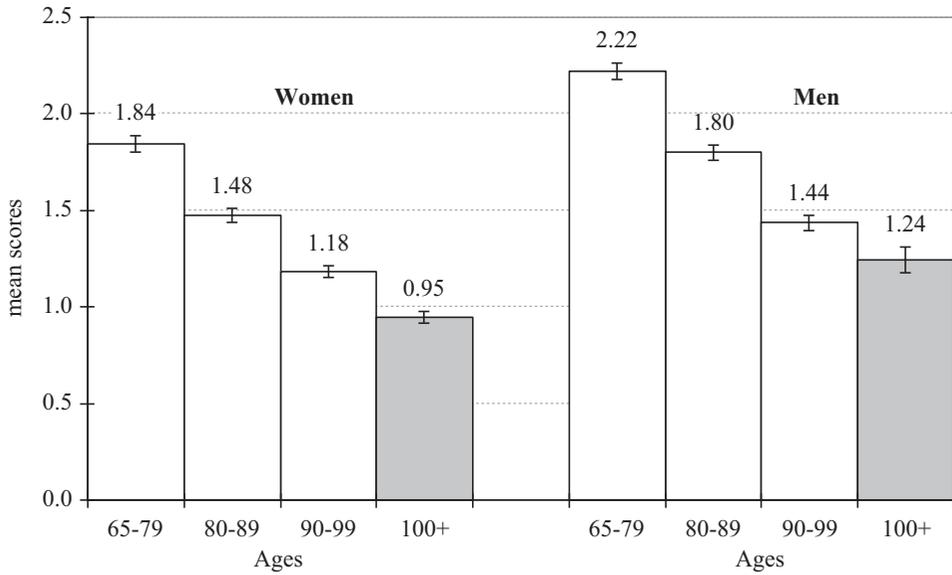
wave, this has been well justified by the fact that about 75% of the oldest-old respondents who were unable to answer these questions were due to health problems (this proportion was about 95% among centenarians who were unable to answer).

In order to better quantify the contribution of these psychological traits to exceptional longevity, these seven variables were dichotomized (coding 1 for answering “always” and 0 otherwise for positive affect called as “always positive affect”, whereas coding 1 for answering “never” and 0 otherwise for negative affect called as “never negative affect”) and then generated an index of always positive and never negative affect (abbreviated as APNNA) by summing these seven dummies, which ranges from 0 to 7. Because the wording of psychological traits questions in the 1998 wave is slightly different from that of the other waves and because the 2014 wave is not publicly available yet, in this section the focus of analyses of psychological trait of Chinese centenarians was on the waves from 2000 to 2011/12.

### Positive and Negative Affect in Centenarians

Figure 2 shows that there was a clear decreasing trend with age in the score of the APNNA index. The overall mean scores of the index in centenarians were significantly lower than those in other age groups (Fig. 2). However, when demographics (age, urban–rural residence), socioeconomic status (education, primary lifetime occupation, economic independence), family and social support (marital status, coresidence with children), health practice (smoking, alcoholic intake, exercising), and health condition (ADLs, instrumental ADLs, cognitive function) were controlled, the pattern was reversed (results not shown). That is, centenarians had the highest mean scores of the APNNA, followed by nonagenarians and octogenarians, whereas the elders aged 65–79 had the lowest mean score. The difference between centenarians and older adults aged 65–79 was significant ( $p < 0.01$ ) for males but not for females.

Table 3 reveals that with few exceptions (e.g., self-determination (column 3) and loneliness



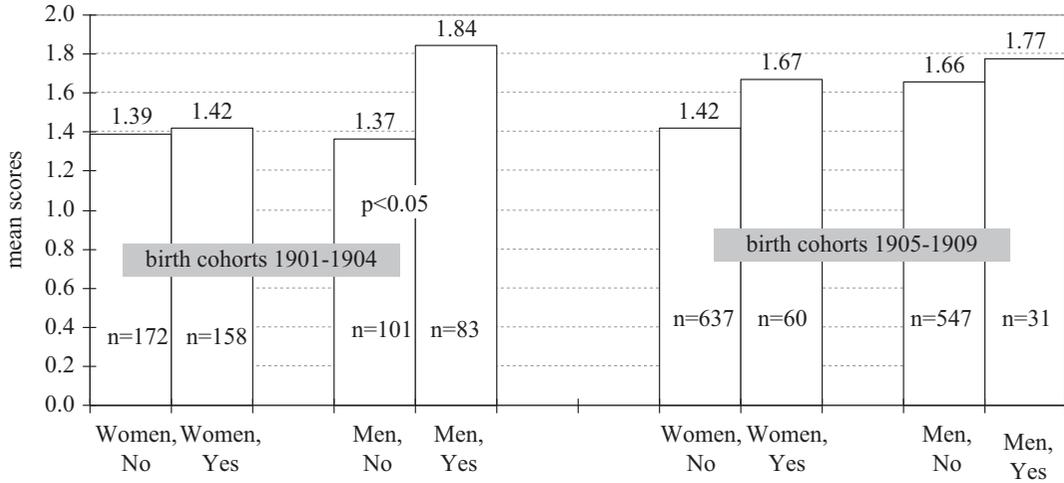
**Chinese Longitudinal Healthy Longevity Study, Fig. 2** Mean scores of the APNNA index and their 95% confidence intervals for centenarians by sex in comparison with other ages, CLHLS 2002–2011/12. Note: The score of

the APNNA index ranges from 0 to 7, which includes four always positive affect variables and three never negative affect variables

**Chinese Longitudinal Healthy Longevity Study, Table 3** Percentage distribution of always positive affect and never negative affect among centenarians by sex in comparison with other age groups, CLHLS 2000–2011/12

	Always positive affect (%)				Never negative affect (%)		
	1	2	3	4	5	6	7
<b>Men</b>							
Ages 100+	11.3	8.1	20.6	18.6	30.1	25.2	14.1
Ages 90–99	10.7	9.0	27.3	20.2	32.9	30.2	14.6
Ages 80–89	11.8	10.6	37.4	22.8	38.8	38.2	16.9
Ages 65–79	15.4	12.1	49.6	29.3	43.9	46.7	23.9
<b>Women</b>							
Ages 100+	8.2	9.8	13.6	15.7	21.6	19.7	8.1
Ages 90–99	8.5	11.6	19.8	17.8	28.2	25.4	11.1
Ages 80–89	8.9	14.0	28.8	21.4	31.3	31.0	13.2
Ages 65–79	11.1	15.1	38.7	26.5	35.1	39.3	19.7
<b>Both sexes</b>							
Ages 100+	9.0	9.4	15.2	16.4	23.6	21.0	9.5
Ages 90–99	9.2	10.8	22.2	18.5	29.7	26.9	12.2
Ages 80–89	10.1	12.6	32.4	22.0	34.4	34.0	14.7
Ages 65–79	13.2	13.6	44.1	27.9	39.5	43.0	21.8

Note: (1) 1, being optimistic; 2, keeping things clean and neat; 3, self-determination; 4, as happy as when you were young; 5, feeling fearful or anxious; 6, feeling lonely; and 7, feeling useless. Please refer to definitions for positive affect and negative affect in section “Variables of Psychological Traits.” (2) Percentages for positive affect refer to “always,” while percentages for negative affect refer to “never.”



**Chinese Longitudinal Healthy Longevity Study, Fig. 3** Mean scores of the APNNA index by birth cohort, sex, and whether the respondents interviewed in 2000 who survived to age 100 (as indicated by yes for survival to age 100 and no for those who deceased before age 100) from

2000 to 2011/12. Note: (1) The score of the APNNA index ranges from 0 to 7, which includes four always positive affect variables and three never negative affect variables. (2) n, sample size. (3) Only the results from birth cohorts 1901–1904 were significant

**Chinese Longitudinal Healthy Longevity Study, Table 4** Relative mortality hazards of the APNNA index of centenarians in comparison with other age groups, CLHLS 2000–2011/12

	Model I	Model II	Model III	Model IV
Ages 100+	0.95***	0.95***	0.96***	0.98**
Ages 90–99	0.92***	0.92***	0.93***	0.97***
Ages 80–89	0.89***	0.89***	0.90***	0.95***
Ages 65–79	0.84***	0.84***	0.85***	0.90***

Note: (1) Please refer to section “[Variables of Psychological Traits](#)” for definition of the APNNA index. (2) The results are almost identical for men and women across age groups and models and thus only results for both sexes are presented. (3) Model I controlled for demographic factors (single-year of age, sex, urban/rural residence, ethnicity, marital status, and coresidence with children). Model II further controlled for socioeconomic factors (education, primary lifetime occupation, and economic independence). Model III additionally controlled for health practice (smoking, alcoholic taking, and doing regular exercise). Model IV added baseline health condition (function in activities of daily living (ADL), cognitive function, and chronic disease conditions) in Model III. All variables in the models were considered as time-varying covariates whenever possible. (4) The sample sizes are 8,036 for centenarians, 10,872 for nonagenarians, 11,593 for octogenarians, and 10,490 for septuagenarians and sexagenarians. Those who were lost to follow-up were excluded from the analyses (with 5,281 females and 3,746 males). (5) \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$

(column 6)), the difference in percentage was not large for both male and female centenarians in comparison with their younger counterparts. Furthermore, Fig. 3 reveals that centenarians were likely more psychologically robust in terms of APNNA than their same cohort peers who died between ages 90 and 99. These results suggest that presence of positive affect and absence of negative affect among centenarians may have contributed to their exceptional longevity.

**Psychological Traits and Healthy Longevity**

Table 4 shows that each additional increase in the APNNA index (or each additional positive possession out of the seven psychological traits) among centenarians reduced mortality risk by 4–5% (Model I to Model III). Even after controlling for baseline health (function in activities of daily living, cognitive function, and chronic conditions), such a protective effect of psychological traits was still significant, although the effective

**Chinese Longitudinal Healthy Longevity Study, Table 5** Odds ratios of onsets of ADL disability and cognitive impairment for the APNNA index for centenarians by sex in comparison with other age groups, CLHLS 2000–2011/12

	ADL disabled at follow-up			Cognitive impaired at follow-up		
	Model I	Model II	Model III	Model I	Model II	Model III
<b>Men</b>						
Ages 100+	0.95	0.94	0.93	0.81**	0.82*	0.85+
Ages 90–99	0.93**	0.92***	0.92***	0.86***	0.86***	0.89***
Ages 80–89	0.91***	0.90***	0.90***	0.87***	0.89***	0.89***
Ages 65–79	0.84***	0.83***	0.83***	0.87**	0.89*	0.89*
<b>Women</b>						
Ages 100+	0.94*	0.94*	0.94*	0.89**	0.89**	0.89**
Ages 90–99	0.93***	0.93***	0.93***	0.91***	0.91***	0.91**
Ages 80–89	0.96*	0.96*	0.96*	0.89***	0.89***	0.90***
Ages 65–79	0.89***	0.89***	0.89***	0.87**	0.88**	0.89**
<b>Both sexes</b>						
Ages 100+	0.94**	0.94**	0.94*	0.87***	0.88***	0.88**
Ages 90–99	0.93***	0.92***	0.92***	0.89***	0.89***	0.90***
Ages 80–89	0.94***	0.93***	0.93***	0.88***	0.89***	0.90***
Ages 65–79	0.87***	0.86***	0.87***	0.87***	0.89***	0.89***

(1) Please refer to section “Variables of Psychological Traits” for the definition of the APNNA index. (2) Model I controlled for demographic factors (single-year of age, sex, urban/rural residence, ethnicity, marital status, and coresidence with children). Model II further controlled for socioeconomic factors (education, primary lifetime occupation, and economic independence). Model III additionally controlled for health practice (smoking, alcoholic taking, and doing regular exercise). All variables in the models were considered as time-varying whenever possible. (3) For onset of disability in activities of daily living (ADL) models, only those who were ADL not disabled were at a given wave were included. The sizes of the female sample are 1,327 for centenarians, 2,714 for nonagenarians, 4,387 for octogenarians, and 4,872 for septuagenarians and sexagenarians model, whereas the sizes of the male sample are 352 for centenarians, 2,065 for nonagenarians, 4,351 for octogenarians, and 5,144 for septuagenarians and sexagenarians. For onset of cognitive impairment models, only those who were cognitively unimpaired were included in a given wave. The size of the female sample are 951 for centenarians, 1,986 for nonagenarians, 3,464 for octogenarians, and 3,411 for septuagenarians and sexagenarians model, whereas the sizes of the male sample are 301 for centenarians, 1,587 for nonagenarians, 3,431 for octogenarians, and 3,552 for septuagenarians and sexagenarians. The cognitive impairment is measured by mini-mental status examination with the cut-off point at a score of 18. In all models of the both panels, those who were lost to follow-up were excluded from the analyses. (4) \*p < 0.05, \*\*p < 0.01, \*\*\*p < 0.001

size was reduced to 2% (Model IV). The protective effect of psychological traits on mortality was larger in other ages: the younger the age group, the greater the protective effect of psychological traits. The results further reveal (not shown) that the protective effect of psychological traits on mortality were the same for both males and females and for both centenarians and other age groups.

The left panel in Table 5 further reveals that each additional increase in the APNNA index among female centenarians reduced the odds of onset of ADL disability by 6%. Such a reduction was similar to those in female nonagenarians and octogenarians and persists even after controlling for a rich set of covariates.

However, such a reduction was not significant in male centenarians, possibly due to the smaller sample size. The reduction in other, younger age groups of males was significant and mostly larger than in the corresponding age groups of females. The right panel of Table 5 shows that the reduction in onset of cognitive impairment due to one additional point of the APNNA index was about 11% in female centenarians and did not change in presence of covariates. Females in other age groups had a similar pattern. In contrast, for male centenarians, such a reduction was slightly larger than in female centenarians and other age groups of males, although the significance was weakened when covariates were added.

## Concluding Remarks

Using data from more than 10,000 centenarians of mainland China, the largest centenarian sample in the contemporary world, this entry presents a summarized introduction of the CLHLS and a brief description on psychological traits of centenarians in comparison with other older adults. We find that centenarians were more psychologically robust than noncentenarian peers of the same birth cohorts when they were all in ages of 90s and further report a significant association between possession of positive psychological traits and mortality and health worsening in centenarians. These findings suggest that centenarians are better able to handle stress, depression, or other unfavorable condition than their cohort peers, which is in line with many other centenarian studies and that maintaining a good psychological well-being is an important pathway to reach age 100 (e.g., Gondo et al. 2006; Jopp and Rott 2006; Perls 2006; Poon et al. 2010).

The findings of the present study are also similar to one recent study by Zeng and Shen (2010) that applied a concept of psychological resilience to Chinese centenarians based on questions (1), (3), (5), (6), and (7) in section “[Variables of Psychological Traits](#)” and two other variables in the CLHLS (to whom the respondent usually talks most frequently in daily life? and who does the respondent ask first for help when having problems/difficulties?). That study reports that centenarians are more psychologically resilient than elders of young ages and that psychological resilience positively contributes to exceptional longevity. Indeed, when further accounting for the response option “unable to answer” for these questions, one recent study found that there are still about 6–9% of centenarians whose psychological well-being is as good as those elders aged 65–79 years (Gu and Feng 2016).

Recently, there is a call among scholars in studies of exceptional longevity, emphasizing the importance of both quantitative and qualitative methodologies, replication of mechanisms, interdisciplinary and systems perspectives, and generalizability of results (Poon and Cheung 2012). Among these new directions of the future studies in centenarians, scholars particularly concern about

instable results from small sample sizes (Willcox et al. 2006). Moreover, more studies are encouraged to examine the association between psychosocial traits and longevity, relative to biologically based studies (Poon and Perls 2007). This entry uses the large-sized sample of the CLHLS to investigate how psychological traits are associated with longevity and subsequent health condition, which echoes the new initiatives above and adds new evidence highlighting the importance of psychological factors to exceptional longevity.

However, due to space limit, details about the role of other psychosocial factors to longevity were not discussed, although many of them were already included in the models as covariates. The interactions between psychological traits, environmental factors, and genetics in determining longevity were also not investigated. As Poon and Cheung (2012) pointed out, to eventually unearth the secrets of longevity, there is still much unexplored on what, how, and why some individuals survive to age 100 with good health. By the end of 2015, only a very small portion of studies focuses on centenarians out of 450 peer-reviewed publications in English, Chinese, and 76 Ph.D. and M.A. theses/dissertations that used the CLHLS data since 1998.

One limitation of the present study in analyzing centenarians’ psychological traits and its association between subsequent survival is the way of coding of those who were not able to answer the psychological trait questions. In the case of always positive affect, they were classified into the group of those who did not always experience positive affect. In the case of never negative affect, they were classified into the group of those who never experienced negative affect. Such a coding system may somewhat underestimate the psychological traits in centenarians. As a consequence, the association between good psychological traits and subsequent survival among the centenarians may be somewhat biased. Nevertheless, as the majority of these respondents were in a very poor health condition, such biases would be only mild. Some researchers adopted an alternative approach by excluding those who were unable to answer the questions in the analyses (e.g., Zeng and Shen 2010). However, since

those who were not able to answer the questions were not missing at complete random, the exclusion approach may overestimate centenarians' good psychological traits to some extent. More research on this issue is clearly warranted.

In sum, more studies on centenarians are warranted in this field, and the CLHLS has been becoming an important resource for scholars in this field with a large and representative sample size of respondents at extremely old ages in a longitudinal context plus the voluminous psychosocial and biological data.

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## Cross-References

- ▶ [Health in Centenarians](#)
- ▶ [Well-being in Centenarians](#)
- ▶ [Resilience and Aging](#)

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## Clinical Issues in Working with Older Adults

Margarida Pedrosa de Lima  
Faculty of Psychology and Educational Sciences,  
University of Coimbra, Coimbra, Portugal

### Synonyms

*Rapport*; Therapeutic relation

### Definition

“Clinical issues” are the aspects that should be taken into consideration when performing clinical interventions with older adults. The term “clinical” is here used primarily for those professionals who work in behavioral health (i.e., nonsurgical, nonmedication), both at an assessments and intervention level, with older individuals.

### Background

Don't tell us, show us (Moreno's Psychodrama Dictum)

The importance of giving attention to clinical issues in working with older adults has been well

emphasized in the last years in emblematic articles (Knight 2004) and in psychological association professional practice guidelines. A representative example is the *Guidelines for Psychological Practice With Older Adults* originally developed by the Division 12, Section II (Society of Clinical Geropsychology) and Division 20 (Adult Development and Aging) Interdivisional Task Force on Practice in Clinical Geropsychology and approved as an American Psychological Association (APA) policy in August 2003. Their main aim is to assist psychologists and gerontology practitioners in evaluating their own readiness for working with older adults, and in seeking and using appropriate education, training, and supervision to increase their knowledge, skills, and experience thought to be relevant for this domain of practice. The specific goals of these professional practice guidelines are to provide practitioners with (a) a frame of reference for engaging in clinical work with older adults and (b) basic information and further references in the areas of attitudes, general aspects of aging, clinical issues, assessment, intervention, consultation, professional issues, and continuing education and training relative to work with this age-group.

The APA Guidelines for Psychological Practice With Older Adults are organized into six sections; the third concerns “Clinical Issues” and comprises three specific guidelines: The first is Guideline 7, which states that “Psychologists strive to be familiar with current knowledge about cognitive changes in older adults.” According to this guideline, from a clinical perspective, one of the greatest challenges facing practitioners who work with older people is acknowledging when to attribute subtle observed cognitive changes to an underlying neurodegenerative condition versus normal developmental changes. Multiple moderating and mediating factors, like lifestyle, contribute to age-associated cognitive changes, maintenance, or decline within and across individuals.

Guideline 8 states that “Psychologists strive to understand the functional capacity of older adults in the social and physical environment.” Here it is strained that the majority of older adults maintain high levels of functioning, suggesting that factors

related to health, lifestyle, and the match between functional abilities and environmental demands more powerfully determine performance than does age (Baltes and Smith 2008). The degree to which the older individual retains “everyday competence” (i.e., the ability to function independently vs. rely on others for basic self-care) determines the need for support in the living environment. In adding aids in the older adult’s living environment, it is important to balance with the person’s need for autonomy and active and safe quality of life. Changes that have impact in functional capacity may immediately lead to modifications in social roles and may place emotional strain in the individual and informal carers. Older people must deal not only with the personal implications of these losses but also with the challenges of finding meaning in a more limited lifestyle. For some older adults, spirituality and other belief systems may be particularly important in dealing with these losses (Ribeiro and Araújo 2013).

Guideline 9 states that “Psychologists strive to be knowledgeable about psychopathology within the aging population and savvy of the prevalence and nature of that psychopathology when providing services to older adults.” This last guideline stresses that although the majority of older adults have good mental health, it should be taken in consideration that approximately 20–22% of older adults may meet criteria for some form of mental disorder, including dementia. For those living in a long-term care setting during their later years, estimates are much higher, with almost 80% suffering from some form of mental disorder. Older adults may therefore present a broad array of psychological issues for clinical attention. These issues include the majority of the problems that affect younger adults and those experienced due to late life events and tasks. These represent challenges that are specific to late life and include developmental and maturational issues and social demands. As examples of developmental issues we can mention the decrease of sensory acuity and increased likelihood of losing significant people and, as a social demand, retirement.

Knight and Poon (2008) proposed CALTAP (Adult Lifespan Contextual Theory for Adapting Psychotherapy) with the aim of providing a

metatheoretical framework to guide an integrated psychotherapeutic approach with the elderly. In this theory the author advocates that an intervention with older people should take into consideration the positive (i.e., cognitive and emotional complexity) and negative (i.e., physical decline) factors of the maturation process of the client, as well as specific sociocultural environments (i.e., values and beliefs), the surrounding context (i.e., living in an institution vs. community), the cohort effect (i.e., influences like education that affect the members of a particular generation), and the challenges of old age (i.e., chronic disease). Together, these contextual and individual factors contribute and influence the problem presented by the older client and his/her expectations and degree of involvement in psychotherapy, as well as to the options of intervention appropriate to a particular case. It is therefore crucial to recognize the intricate interaction between the older adult and his/her environment.

### **Therapeutic Relationship with Older Clients**

To rightly respond to functional, personal, social, cognitive, and psychopathological challenges of older clients it is indispensable to establish a meaningful therapeutic relationship. For the therapeutic process with older adults to successfully unwind theoretical and technical expertise are also necessary. However, independently on the orientation of the intervention, the therapist must have the ability to establish a deep connection with the client – the therapeutic relationship (Fagan and Shepherd 1970; Duffy 1999; Haley 1999; Zarit and Knight 1996). Regardless of the elderly intervention context, the communication skills of the therapist are one essential ingredient to the success of the intervention (Woolhead et al. 2006). Listening and responding accordingly is always important, requiring more attention when the older person has hearing difficulties. Speaking in a simple, direct, clear, and objective way, taking into account the nonverbal communication and without using technical language, is essential. It is also important to be present in the relationship,

“not paddling against the current,” with the therapist open to the flow of experience, recognizing their limits as professionals and with attention to their own prejudices.

Accordingly, geropsychologists must work to actively reduce ageism. Ageism as a pervasive discrimination against older adults is widespread. The nondominant group (older adults in this case) is viewed as homogeneous and portrayed as having a variety of negative characteristics. People in old age are viewed stereotypically as alike; alone and lonely; sick, frail, and dependent; depressed; rigid; and unable to cope (Frazer et al. 2011). This pervasive view portrays all older adults in a negative light, ignoring the incredible heterogeneity of aging and old age and the strengths and positive attributes of older adults. Those geropsychologists working in clinical settings must be particularly cognizant of their own ageist thoughts and beliefs, and acknowledge its impact and try to prevent and minimize them within the therapeutic relationship. Rogers (1951) formulated this issue in a fundamental way: Can the therapist meet with this other individual as a person in the process “of being,” or will he stay tied to his own past or the client’s past? If the therapist relates to the older client as old, rigid, limited, immature, ignorant, unstable, or sick, each of these concepts will limit the relationship. Confirm means accepting the potential totality of the other. If the therapist accepts the other as something fixed, as “diagnosed and classified,” as shaped by the past, he will be doing his part to confirm this restrictive hypothesis. On the other hand, if he accepts the client as in process of “becoming,” he will be doing what he can to confirm or make real the potential of the individual.

Instead of giving unconditional positive regard, most of us give “value conditions,” depending on the satisfaction of our needs and expectations. When we care and we have no qualifications or conditions, there is the “unconditional positive regard.” Rogers (1951) argued that this quality of absoluteness, along with congruence and empathy, would be essential to foster a more confident human being capable of enjoying life more fully. It is then the therapists’ responsibility to create these favorable conditions

for the flourishing of the older client. In this sense, the quality of the relationship has a major weight (though, certainly, other variables such as the therapeutic setting, client motivation, theoretical soundness, and the training and experience of the therapist are also important). By “quality of the relationship” it is meant the ability to establish good contact, i.e., the ability to listen to the other (literal and latent meanings), to produce a real action that can enhance change in the other, and to detect central aspects that can be worked through with the client with the aim of fostering well-being. The therapist’s attitude is based on empathy, willingness to help, and mostly on accepting the patient’s experience without judgment.

Fagan and Shepherd (1970) in a classic text on Gestalt Therapy refer to five aspects that the therapist should take into account for the clinical relationship to be effective: (1) accurate assessment and diagnosis; (2) having control of the therapeutic session (i.e., it is the therapist who wields the session for the client’s benefit); (3) solid theoretical and practical knowledge; (4) humanity and compassion toward the client; and (5) commitment and openness to continue learning. To make a therapeutic intervention involves the therapist as a whole person and constitutes therefore a challenge. Nevertheless, it is a condition for fostering the well-being of the client and will enable the older client to build self-support skills and a more realistic and adaptive view of life.

## Working with Older Adults

The therapist working with older adults should be able to work “outside the box,” i.e., be more flexible concerning place, duration, and frequency of sessions and to have the ability to take on multiple roles (Haley 1999) in order to respond to customers that often have multiple physical and psychosocial problems and diverse and complex needs. Before starting a clinical intervention, the geropsychologist should pay attention to the entire therapeutic setting – i.e., all the details concerning the environment, the physical layout

of the room, and the prevention of possible interruptions (Frazer et al. 2011). If these aspects are attained and an environment where there is trust, openness, and acceptance is provided, patients will express themselves without fear of censorship and engage actively in the therapeutic process. This is why it is important to identify resistances, make them explicit, and not pretend they do not exist. The resistance decreases when people take responsibility for how the interaction functions (Egan 1986).

Depending on the case and on the theoretical framework of the therapist during the therapeutic process several techniques (e.g., challenging, clarification, breathing and body awareness techniques) may be used to explore the material provided in favor of the natural course of the session and, therefore, consolidate and increase awareness and individual power and responsibility, even when the older client is very frail and this seems nearly impossible. Techniques are means not ends and should not divert the therapist from the creative and unique relationship with the older client and from the attention required to the emerging themes and needs in a session. In this sense, there are no “recipes” that the therapist should follow but tools and flexible guidelines that can be used. Moreover, the use of techniques can often mask the quality of a relationship.

Change, support, and problem solving are not made only on the basis of technical aids but come mainly from the relationship between the therapist and the patient. It is the quality of the relationship that will dictate (adduced to the sensitivity of the therapist) the time to use certain techniques (e.g., role play). Accordingly, the personal qualities and advocated values of the therapist are the most important and powerful tools regarding the ease of the therapeutic process. In this sense, the therapist should trust in his/her intuition and be authentic, since the techniques are received in the light of the attitudes of the facilitators that employ them (Egan 1986; Corey et al. 1983; Corey 1990). In short, the techniques are valuable and important but should be used with caution (Yalom 2005; Corey et al. 1983). If the therapist has a solid background and supervised experience, it is less likely to abusively use the

techniques (Corey et al. 1983). Those therapists working with older people also benefit in being more flexible in their roles (i.e., feeding the patient, helping to call for other people, fostering other relationships) and more active and participatory (i.e., speak about themselves, give examples) (Knight 2004).

The conceptual framework and the therapist's personality often dictate the choice of which technique to use, but this is also influenced by the link established with the client. There is always a huge variability of possibilities (i.e., the use of animals for people with dementia (Crowley-Robinson et al. 1996)), depending on age, purpose, and level of functioning of the patient but also on the expertise and creativity of the therapist. However, the therapist should recurrently question the appropriateness of a certain technique. When it is possible and meaningful, it is important to ask the client their willingness to participate and to acknowledge any possible resistance. The clinical/therapeutic setting is a field for authentic human interaction and learning. In this sense, the techniques should not be seen as tricks but tools to be used in support of patient needs.

The therapist's countertransference analysis (“how I feel with what the client said/did? What does it mean to me?”) is crucial in a relationship that is often regulated by unusual changes on the therapeutic context. For instance, in many intervention cases the older client is bedridden (Altschuler and Katz 1999; Smith 2006). However, the transference and countertransference, which depend on the previous relationships of the client and of the therapist, may lead to therapeutic impasse and resistance to treatment (Knight 2004). Taboos (e.g., certain themes should not be spoken with older or younger people) and the complexity of the institutional contexts (e.g., the clinician can have different roles in the same institution; different professionals dealing with the client make clinical decisions more complex) can make the management of this dynamic an enormous challenge. In this sense, the therapist has the responsibility to examine personal prejudices in relation to age, disease and gender, and any beliefs or conflicts with their own parents and grandparents that he may bring as relational

patterns to the therapeutic relation. If this does not happen, the therapist may be limiting the possibilities of helping clients to develop. In general, the therapist is blocked where he/she often has difficulties as a person (Perls 1976).

When clients are considered experts in their own lives, they feel mobilized and encouraged to use their resources toward their goals (Smith 2006) and to be active and interventional agents in their own change process (Smith 2006). This perspective about patients as being a repository of resources, rather than being seen as a confluence of problems, favors the therapeutic alliance. To promote the quality of life of the elderly – in face of the complex amount of problems, difficulties, diversity of personality profiles, and the multiple needs and desires people often have to deal with in the last phase of their life cycle – the availability of a wide range of therapeutic possibilities is crucial. Numerous psychological therapies have been demonstrating their effectiveness in supporting older people. Attention to issues concerning education, training, and supervision are therefore core aspects in providing all the technical capacity to the therapist and in helping to understand each person within a biopsychosocial framework. It is also important to acknowledge that all geriatric care occurs within a team context (see the “► [Interprofessional Care](#)” entry for this purpose) and that integrated care is the preferable model. Clinical geropsychologists should additionally know how to use multiple methods of assessment, including brief assessment tools.

The focus on the relationship, the “meeting” that the encounter between two persons (therapist and client/group) allows, updates some of the principles that have been repeatedly confirmed by research and due to the vicissitudes of the context or of daily life therapists tend to forget. Such principles allow human flourishing and can be summarized in the importance of humanization of health services and interventions, the imperative need of adequate training and supervision in interventions with older patients, the importance of empowering and giving personal responsibility to the individual, and the crucial role of both creativity and dignity interventions. The answer to the wish to grow in all stages and contexts of

life can be the authentic creative encounter that the therapeutic relationship enables and therefore should be promoted.

## Cross-References

- [Acceptance and Commitment Therapy](#)
- [Age Discrimination](#)
- [Interprofessional Care](#)
- [Training Psychologists in Aging](#)

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## Cognition

Yoshiko Lily Ishioka<sup>1,2</sup> and Yasuyuki Gondo<sup>3</sup>

<sup>1</sup>Tokyo Metropolitan Institute of Gerontology, Tokyo, Japan

<sup>2</sup>Graduate School of Science and Technology, Keio University, Yokohama, Japan

<sup>3</sup>Department of Clinical Thanatology and Geriatric Behavioral Science, Osaka University Graduate School of Human Sciences, Suita, Japan

## Synonyms

Alzheimer's disease; Cognitive aging; Cognitive impairment; Dementia

## Definition

This entry reviews the literature on the prevalence of dementia among centenarians, the cognitive function in centenarians without dementia, as well as risks and protective factors of cognitive function in very late life. Dementia prevalence among centenarians might be substantially higher than that among younger older individuals; however, the exact prevalence rate among centenarians is unclear. First, we examine the methodological problems to be considered in future studies. Large representative data sets and similar protocols across studies are needed to clarify the inconsistent results. Second, we discuss the characteristics of domain-specific cognitive functions

in centenarians without dementia. In the future, an important goal is to further clarify the nature of cognitive changes among centenarians. Finally, we summarize risks and protective factors that might influence cognitive decline or dementia in centenarians. Findings from genetic, biomedical, and psychosocial perspectives can help clarify the mechanism of cognitive aging throughout the life span.

Taking into account the changing demographic structure in aging societies, the proportion of individuals aged 75 years and over is expected to increase substantially. As a consequence, the number of individuals presenting cognitive decline with and without dementia is also expected to increase. The World Health Organization and Alzheimer's Disease International (2012) reported an overview of the epidemiology of dementia and policy and plans in the world. It is estimated that the number of people aged 60 years and over with dementia worldwide doubles every 20 years, from 35.6 million in 2010 to 65.7 million in 2030 and 115.4 million in 2050 (World Health Organization and Alzheimer's Disease 2012). Thus, coping with dementia is a common challenge in aging societies. Dementia has received attention as one of the key health threats and social issues in the twenty-first century.

One of the major predictors of dementia is age. The age-specific prevalence of dementia nearly doubles every 5 years from 60 to 95 years old (Hofman et al. 1991). The Leiden 85+ study (Heeren et al. 1991) found that the prevalence of dementia was 15.2% in the 85–89-year-old age group, 32.5% in the 90–94-year-old age group, and 41.2% in the  $\geq 95$ -year-old age group. Although the total number in the  $\geq 95$ -year-old age group in the study was only 14, these findings suggested that the probability of a dementia diagnosis seriously increases in very old age.

In this entry, we focus on two topics relating to cognitive function among centenarians. Centenarian studies could provide information on the characteristics and degree of aging-related cognitive changes until the final stage of human life. At first, we will give an overview of dementia prevalence in centenarians; however, the exact

prevalence rate among centenarians is unclear. We will also state the methodological problems to be considered in future studies. Second, we will present the characteristics of domain-specific cognitive functions in centenarians, although there are few existing studies on this. Finally, we will summarize significant risk and protective factors that might influence cognitive decline or dementia in centenarians from genetic, biomedical, and psychosocial perspectives.

## Prevalence of Dementia

Dementia prevalence among centenarians has been reported over the past 20 years in various countries. Three review papers on centenarians' dementia prevalence have been published (Calvert et al. 2006; Gondo and Poon 2007; Slavin et al. 2013). All three papers pointed out that dementia prevalence varies across studies, due to methodological problems. Based on the estimation of the age-specific prevalence of dementia (Hofman et al. 1991), prevalence among centenarians is assumed to range between 60% and 70%. Following reports of prevalence in previous reviews, we can roughly divide these findings into the following three categories: considerably lower than the estimated prevalence (e.g., less than 50%), almost within the estimated range (e.g., around 60%), and much higher than the estimated prevalence (e.g., more than 70%). Table 1 gives a detailed overview of 11 centenarian studies reporting on dementia prevalence. These studies showed that the dementia prevalence ranged from 33% to 100%, and the average prevalence was 62% (males; 48.5%, females; 66.1%). The study that presented the highest prevalence, the Dutch Centenarian Study (Blansjaar et al. 2000), included only 17 centenarians. On the other hand, the study with the lowest prevalence, the Finnish Centenarian Study (Sobel et al. 1995), excluded mild dementia. Except for one study, the Yamanashi prefecture study (Asada et al. 1996) showed only slightly more than 70%, and the other prevalence ranged from 50.7% to 67.6%. These results suggested that dementia prevalence

among centenarians was very high, but there were dissociations in the prevalence across studies.

The varying prevalence of dementia across studies might indicate ethnic or cultural influences on the progression of dementia with aging. However, before we go on to discuss this issue, two essential problems need to be pointed out. One is related to methodology, and the other is gender differences. The methodological problems include sampling, definition of dementia, and assessment procedures in centenarian studies. Gender differences refer to the issue that the dementia prevalence in centenarian samples varies depending on the ratio of female and male centenarians.

A small sample size can lead to an overestimation or underestimation of results and yield inconsistent dementia prevalence among centenarians. Previous centenarian studies include sample size ranging from 17 to 304 (Table 1). Furthermore, there are often wide individual variations and possibilities of large amounts of missing data in cognitive tests on centenarians. A total number exceeding hundreds of participants might therefore be required for reliable statistical analyses and valid estimations (Calvert et al. 2006). In addition, researchers have to make an effort to obtain representative data and to carefully interpret results having a potential selection bias.

The definition of dementia is one of the fundamental problems in the comparison of results from different studies. Most studies have used standardized diagnosis criteria for dementia. However, these criteria emphasize different dimensions considered for evaluation, to enable identification of dementia. The third edition revised and fourth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-III-R, DSM-IV) have often been used for the diagnosis of dementia. Pioggiosi et al. (2004) explored the variation in dementia prevalence among 34 nonagenarians and centenarians using four common diagnostic criteria. They found different prevalence rates applying these criteria to the same participants. The prevalence of dementia was 47.1% with the use of the DSM-III-R; 41.2% with the DSM-IV; 29.4% with the World Health Organization's International Classification of Disease, 10th revision (ICD-10); and

**Cognition, Table 1** Prevalence of dementia in centenarian studies

Project name	Authors (publication year) countries	Subjects	Those who agreed (women: N, %)	Those who were tested (women: N, %)	Participated ratio (%)	Age range mean ± SD	Assessments	Cognitive status	Males	Females
Dutch Centenarian study	Blansjaar et al. (2000) The Netherlands	17 in three Dutch towns	17 (15, 88.2%) agreed, 2 females did not test	15 (13, 86.7%)	88.2	100–104 M = 101.2	CDR, Informant Questionnaire on Cognitive Decline in the Elderly, Amsterdam Dementia Screening Test, Clock Drawing, Explaining says	Dementia: 100% (15/15) CDR = 1: 20.0% (3/15) CDR = 2: 53.3% (8/15) CDR = 3: 26.7% (4/15)	Dementia: 100% (13/13) CDR = 1: 15.4% (2/13) CDR = 2: 53.8% (7/13) CDR = 3: 30.8% (4/13)	No gender data
New England Centenarian Study	Silver et al. (2001) The United States	43 in Massachusetts state	36 (31, 86.1%) agreed, 2 females died before test	34 (29, 85.3%)	79.1	100–107	MMSE, CDR, DSM-IV, Mattis Dementia Rating Scale, Boston Naming Test, Trail-Making Test A & B, Clock Drawing, Drilled Word Span Test, Cowboy Story, Presidents since Franklin Delano Roosevelt, Spiers' Calculations, Geriatric Depression Scale, Telephone Interview for Cognitive Status, Test for Severe Impairment, Tactile Naming, Cognition and Health History, Psychiatry History	CDR = 0: 20.6% (7/34) CDR = 0.5: 11.8% (4/34) Dementia: 67.6% (3/34) CDR = 1: 8.8% (3/34) CDR = 2: 29.4% (10/34) CDR = 3: 20.6% (7/34) CDR = 4: 2.9% (1/34) CDR = 5: 5.9% (2/34)	No gender data	No gender data
Yamanashi prefecture study	Asada et al. (1996) Japan	50 in Yamanashi prefecture	50 (39, 83.0%) agreed, 3 died before visit	47 (39, 83.0%)	94.0	100–109 M = 102	HDSP, DSM-III-R, NINCDS-ADRDA, ICD-10, physical examination, Barthel index, medical and psychiatric history, a family history, current health status, Hachinski Ischemic Scale score	Normal: 6.4% (3/47) Cognitive impairment without dementia: 23.4% (11/47) Dementia: 70.2% (33/47) Mild: 31.9% (15/47) Moderate: 23.4% (11/47) Severe: 14.9% (7/47)	No gender data	No gender data

(continued)



**Cognition, Table 1** (continued)

Project name	Authors (publication year) countries	Subjects	Those who agreed (women: N, %)	Those who were tested (women: N, %)	Participated ratio (%)	Age range mean $\pm$ SD	Assessments	Cognitive status	Males	Females
Korean Centenarian Study	Choi et al. (2003) Korea	103 in Seoul, Kyungsang, Chunra, and Cheju; the mean age was 102.4 $\pm$ 2.6 years	89 (78, 87.6%)	89 (78, 87.6%)	86.4	100-115	CDR, physical and mental examination, laboratory tests	CDR 0: 6.7% (6/89) CDR 0.5: 31.5% (28/89) Dementia: 61.8% (55/89) CDR 1: 27.0% (24/89) CDR 2: 14.6% (13/89) CDR 3: 20.2% (18/89)	CDR 0: 18.2% (2/11) CDR 0.5: 36.4% (4/11) Dementia: 45.5% (5/11) CDR 1: 36.4% (4/11) CDR 2: 9.1% (1/11) CDR 3: 0% (0/11)	CDR 0: 5.1% (4/78) CDR 0.5: 30.8% (24/78) Dementia: 64.1% (50/78) CDR 1: 25.6% (20/78) CDR 2: 15.4% (12/78) CDR 3: 23.1% (18/78)
Heidelberg Centenarian Study	Kliegel and Skwinski (2004), Kliegel et al. (2004b) Germany	156 from 60 km around Heidelberg	91 agreed, 1 did not test	90 (81, 90.0%)	57.7	100 M = 100.2 $\pm$ 0.41	A shortened MMSE (21 points max.), GDS	No cognitive impairment 22% Very minor: 7% Minor: 12% Moderate: 10% Substantial: 21% Severe: 16% Very severe: 12%	No gender data	No gender data
Northern Italian Centenarian Study	Ravaglia et al. (1999) Italy	154 in Bologna and Ravenna	100, 1 woman died, 7 persons were out of the study setting	92 (56, 60.9%)	59.7	100-107 M = 101.8 $\pm$ 1.6	MMSE, CDR, DSM-IV, ICD-10, NINCDS-ADRDA	No dementia 20.7% (19/92) Cognitive impairment without dementia: 15.2% (14/92) Psychiatric diseases other than dementia: 2.2% (2/92) Dementia: 62.0% (57/92) CDR = 0.5: 6.5% (6/92) CDR = 1: 2.2% (2/92) CDR = 2: 7.6%	No dementia: 30.6% (11/36) Cognitive impairment without dementia: 19.4% (7/36) Psychiatric diseases other than dementia: 3.6% (2/56) Dementia: 69.6% (39/56) CDR = 0.5: 7.1% (4/56) CDR = 1: 1.8% (1/56) CDR = 2: 7.1% (4/56)	No dementia 14.3% (8/56) Cognitive impairment without dementia: 12.5% (7/56) Psychiatric diseases other than dementia: 3.6% (2/56) Dementia: 69.6% (39/56) CDR = 0.5: 7.1% (4/56) CDR = 1: 1.8% (1/56) CDR = 2: 7.1% (4/56)

Finnish Centenarian Study	Sobel et al. (1995) Finland	271 in Finland	185 were interviewed	179 (151, 84.4%) took blood sample	66.1	100+	Pfeiffer's Short Portable Mental Status Questionnaire, DSM-III-R	(7/92) CDR = 3: 17.4% (16/92) CDR = 4: 14.1% (13/92) CDR = 5: 14.1% (13/92)	CDR = 1: 2.8% (1/36) CDR = 2: 8.3% (3/36) CDR = 3: 19.4% (7/36) CDR = 4: 11.1% (4/36) CDR = 5: 2.8% (1/36)	CDR = 3: 16.1% (9/56) CDR = 4: 16.1% (9/56) CDR = 5: 21.4% (12/56)
Longitudinal Study of Danish Centenarians	Andersen-Ranberg et al. (2001) Denmark	276 in Denmark	207 (162, 78.3%)	207 (162, 78.3%)	75.0	100	ICD-10, CDR, MMSE, medical records, physical examination, ADLs, IADLs, proxy interview	CDR = 0: 25.1% (52/207) Probably no: 11.1% (23/207) CDR = 0.5: 7.7% (16/207) Dementia: 50.7% (105/207) CDR = 1: 16.9% (35/207) CDR = 2: 20.3% (42/207) CDR = 3: 13.5% (28/207) Not classified: 5.3% (11/207)	Normal: 57.1% (16/28) Cognitive decline/mild dementia: 22.5% (34/151) Dementia: 25.0% (7/28) Dementia: 17.9% (5/28)	Normal: 41.7% (63/151) Cognitive decline/mild dementia: 22.5% (34/151) Dementia: 35.8% (54/151)

(continued)



**Cognition, Table 1 (continued)**

Project name	Authors (publication year) countries	Subjects	Those who agreed (women: N, %)	Those who were tested (women: N, %)	Participated ratio (%)	Age range mean ± SD	Assessments	Cognitive status	Males	Females
Tokyo Centenarian Survey	Homma et al. (1992) Japan	509 in Tokyo	509 (379, 74.5%)	218 (155, 71.1%)	42.8	100+ M = 100.6 ± 1.3	HDS, CDR, family history, medical record, physical examination, ADLs	CDR = 0: 15.1% (33/218) CDR = 0.5: 16.5% (36/218) Dementia: 62.8% (137/218) CDR = 1: 21.6% (47/218) CDR = 2: 21.1% (46/218) CDR = 3: 20.2% (44/218) Unknown: 5.5% (12/218)	CDR = 0: 31.7% (20/63) CDR = 0.5: 14.3% (9/63) Dementia: 71.0% (110/255) CDR = 1: 20.6% (32/155) CDR = 2: 23.2% (36/155) CDR = 3: 27.1% (42/155) Unknown: 3.2% (5/155)	CDR = 0: 8.4% (13/155) CDR = 0.5: 17.4% (27/155) Dementia: 71.0% (110/255) CDR = 1: 20.6% (32/155) CDR = 2: 23.2% (36/155) CDR = 3: 27.1% (42/155) Unknown: 3.2% (5/155)
Georgia Centenarian Study	Poon et al. (2012) The United States	about 1200 in Northern Georgia	244 (207, 84.8%), four females had missing data	240 (203, 84.6%)	20.0	98-108 M = 100.6 ± 2.04	GDS, MMSE, CDR, Wechsler Adult Intelligence Scale, Direct Assessment of Functional Status scale, Controlled Oral Word Association Test, Behavioral Dyscontrol Scale, ADLs, IADLs	GDS = 1-2 (no dementia): 22.4% (54/241) GDS = 3 (MCI): 25.3% (61/241) GDS = 4-7 (dementia): 52.3% (126/241)	GDS = 1-2: 20.9% (9/43) GDS = 3: 37.2% (16/43) GDS = 4-7: 41.9% (18/43)	GDS = 1-2: 22.7% (45/198) GDS = 3: 22.7% (45/198) GDS = 4-7: 54.5% (108/198)

Tokyo Centenarian Study	Gondo et al. (2006) Japan	1194 in the 23 wards of metropolitan Tokyo	514	304 (239, 78.6%)	25.5	100–107 $M = 101.1 \pm 1.7$	MMSE, CDR, GDS, scales for mental state and daily living activities for the elderly	CDR = 0:24.3% (74/304) CDR = 0.5: 13.8% (42/304) Dementia: 61.8% (188/304) CDR = 1:18.8% (57/304) CDR = 2: 9.5% (29/304) CDR = 3: 16.4% (50/304) CDR = 4: 8.9% (27/304) CDR = 5: 8.2% (25/309)	CDR = 0: 43.1% (28/65) CDR = 0.5: 15.4% (10/65) Dementia: 41.5% (27/65) CDR = 1: 16.9% (11/65) CDR = 2: 7.7% (5/65) CDR = 3: 7.7% (5/65) CDR = 4: 3.1% (2/65) CDR = 5: 6.2% (4/65)	CDR = 0: 19.2% (46/239) CDR = 0.5: 13.4% (32/239) Dementia: 67.4% (161/239) CDR = 1: 19.2% (46/239) CDR = 2: 10.0% (24/239) CDR = 3: 18.8% (45/239) CDR = 4: 10.5% (25/239) CDR = 5: 8.8% (21/239)
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Note: *ADLs* activities of daily living; *CDR* clinical dementia rating; *DSM-III-R* the revised third edition of the Diagnostic and Statistical Manual of Mental Disorders; *DSM-IV* fourth edition of the Diagnostic and Statistical Manual of Mental Disorders; *GDS* the Global Deterioration Scale; *HDS* Hasegawa Dementia Scale; *HDSR* Hasegawa Dementia Scale Revised; *IADLs* instrumental activities of daily living; *ICD-10* the World Health Organization's International Classification of Disease, 10th revision; *MMSE* the Mini-Mental State Examination; *NINCDS-ADRDA* the National Institute of Neurological and Communicative Disorders and Stroke and the Alzheimer's Disease and Related Disorders Association

38.2% with the Cambridge Examination for Mental Disorders of the Elderly (CAMDEX). The ICD-10 criteria for dementia yielded the lowest rate of dementia among the four criteria. This dissociation appears to be due to requirements for evaluation. The ICD-10 criteria always required impairments in three executive functions. On the other hand, the DSM-III-R criteria, leading to the highest rate, required at least one or more impairments in abstract thinking or judgment or impairment of higher cortical functions or personality changes. The DSM-III-R is less restrictive than the DSM-IV in assessing cognitive function except for memory. Consequently, the DSM-IV criteria, including impairments in executive function or condition of having central nerve damage, such as aphasia, lead to the second highest rate. The CAMDEX, with the second lowest rate, has different characteristics in requirements of progressive deterioration for the diagnosis and of impairments in behavioral and emotional functions. This is why the proportion of dementia by the ICD-10 seems to be lowest among these criteria. As mentioned in a later section, centenarians tend to show large dissociations in the decline of different cognitive domains. This characteristic might increase the chances of variations occurring as a result of the use of different definitions.

Differences in exclusion criteria of cases with questionable dementia were also observed. Some studies, for example, excluded in their reports cases where the criteria to identify dementia were not sufficient and the diagnosis was uncertain. In the Longitudinal Study of Danish Centenarians (Andersen-Ranberg et al. 2001), a comprehensive survey was conducted on all individuals living in Denmark who were aged exactly 100 during the survey period. One-hundred sixty-two out of 222 women and 45 out of 54 men participated in this study. According to the criteria of ICD-10 and the Clinical Dementia Rating scale (CDR), the identified prevalence rate of dementia, including mild, moderate, and severe dementia, was 51% in 100-year-old individuals. They excluded cases with the probably no dementia cases and the questionable cases. If they had treated these cases as the category with dementia, the prevalence would have increased. Some studies have also considered individuals with visual or

hearing disabilities as questionable cases. These sensory impairments are very common in very old age and are likely to hinder the understanding or following of instructions of the cognitive tests, which may result in overestimating the cognitive issues in centenarians. Thus, dementia prevalence is influenced by how researchers define and use these questionable cases in their studies (e.g., considering them as part of the dementia group will lead to an increase of the prevalence, while treating them as a part of the group without dementia will decrease the prevalence).

Gender differences can also result in varying prevalence. The Northern Italian Centenarian Study (Ravaglia et al. 1999) reported different prevalence rates, depending on gender and severity of dementia. Their reports on dementia prevalence were based on the DSM-IV criterion and included questionable cases. At 69.6% (N = 39/56), dementia prevalence among women was higher than that among men, at 50.0% (N = 18/36). However, there was no significant difference in prevalence rate and severity of dementia between female and male centenarians, likely due to the small case number in each subgroup. Using a larger sample of 304 individuals, the Tokyo Centenarian Study (Gondo et al. 2006) reported different prevalence rates for dementia according to gender. In this sample, the ratio of women to men was roughly 1:3.6, which was almost similar to the total centenarian population in this research area. They showed that the dementia prevalence was 61.8% (188/304) of the total, 67.4% (161/239) among women, and 41.5% (27/65) among men, based on a CDR score with the range of 1–5 to determine dementia. The findings showed clear differences in prevalence between female and male centenarians. The higher the percentage of female centenarian sample, the higher the dementia prevalence in the overall sample. Thus, gender-specific data should be reported to interpret results while taking into account the gender ratio.

Currently, the direct comparison of dementia prevalence across centenarian studies is problematic due to the issue mentioned above. For precise comparisons, researchers should collect data from larger representative samples, with uniform

procedures and definitions of dementia. Adopting this kind of careful assessment procedures would reduce errors in identification of dementia among centenarians. Otherwise, discussion of cohort, regional, and cultural differences in dementia prevalence among centenarians is likely to lead to questionable conclusions.

### **Cognitive Function in Non-demented Centenarians**

As described above, there is a very high prevalence of dementia among centenarians. Most centenarian studies have assessed cognitive function, using dementia screening tests such as the Mini-Mental State Examination (MMSE), CDR, or the Global Deterioration Scale (GDS). The mean of MMSE scores among 244 individuals aged 98–108 years old was  $16.2 \pm 8.80$  (SD) (Dai et al. 2013), indicating that mean cognitive function in non-demented centenarians was much lower than that among younger older individuals. Considering 68 centenarians who had a CDR score of 0, the mean of MMSE was  $22.3 \pm 3.32$  (Inagaki et al. 2009). These findings showed global cognitive function in centenarians to be equal to or only slightly lower than the established clinical cutoffs in younger older individuals. At the same time, large individual differences were reported among non-demented centenarians.

To date, no study has reported trajectory of domain-specific cognitive aging from younger older individuals to centenarians. Descriptions of domain-specific conditions in centenarians can contribute toward an understanding of normal, aging-related cognitive change and stability in very old people. Few studies mentioned this issue. The Georgia Centenarian Study provided norm data of domain-specific abilities in verbal abstract reasoning, fluency, and memory (Mitchell et al. 2013). They reported that centenarians obtained cognitive performance averages that were lower than those of octogenarians. Moreover, age differences in verbal abstract reasoning, fluency, and recognition were smaller than those in immediate and delayed recall. Using data from the Tokyo Centenarian Study, Inagaki

et al. (2009) compared the scores of centenarians and younger controls on five cognitive domains, as measured by the MMSE. They reported that concentration, language and praxis (i.e., reading and obeying, listening and obeying, writing a sentence, copying pentagons, and naming), and repetition among centenarians were not lower, compared to those of individuals in the younger age groups. Both studies showed small age differences in the domain relating to language, but large age differences in episodic memory. These findings might indicate that a fundamental characteristic of intellectual aging, namely, a smaller decline in the pragmatic domains and a larger decline in the mechanic domains are well-known phenomena, was still preserved among centenarians.

The Georgia Centenarian Study examined the role of intelligence, memory performance, and problem-solving ability in cohorts aged from 60 to 80 and to 100 years old (Poon et al. 1992). The study showed that centenarians had maintained their everyday problem-solving abilities, measured by the nine real-life problems encountered at home on an everyday basis. Furthermore, the study also showed that problem-solving abilities had an effect on mental health as well as personality and coping. Moreover, centenarians with high cognitive function obtained high levels of activity of daily living. These findings suggested that the maintenance of the mechanic domains of cognitive function might be possible in centenarians and that it might enable them to manage and cope with old-age adversity.

### **Risk for Cognitive Decline and Dementia in Centenarians**

Recently, the risk factors for dementia and cognitive decline among individuals in very old age have received increasing attention. The disclosure of risk factors might contribute toward the development of strategies for a healthy long life. To date, few centenarian studies have addressed this issue. Interestingly, limited findings suggest that centenarians and younger older people may not

have the same risk factors. Complex and mutual relationships among risk factors for cognitive decline and dementia are still not clear, even for the younger older adults. Findings from centenarian studies might help clarify these conundrums. We will describe this issue by focusing on brain aging in centenarians from genetic, biomedical, and behavioral viewpoints.

### Genetic Factor

The apolipoprotein E (*APOE*) gene, recognized for its important roles of transporting and delivering lipids, is one of the most commonly investigated gene polymorphisms. Among three common alleles, including  $\epsilon 2$ ,  $\epsilon 3$ , and  $\epsilon 4$ , the  $\epsilon 4$  allele might facilitate ineffective repair and protection from neuronal damage. The presence of the  $\epsilon 4$  allele has been identified as a major risk factor for the development of AD in younger older adults (Ashford and Mortimer 2002). However, whether the *APOE*  $\epsilon 4$  has an effect on cognitive function among individuals in very old age is still controversial. While there was a significant negative association between the  $\epsilon 4$  allele and cognitive function among 103 Korean centenarians (Choi et al. 2003), this association was not observed in 179 Finnish (Sobel et al. 1995) and 33 Japanese centenarians (Asada et al. 1996). Compared to younger older people, centenarians tend not to have the  $\epsilon 4$  allele. Thus, the survival effect for individuals with the *APOE*  $\epsilon 4$  might hamper the evaluation of the effect of the *APOE* on cognitive function in centenarians.

### Cardiovascular Factors

Hypertension, a cardiovascular disease, is a significant risk factor for cognitive impairment. However, some centenarian studies have shown higher blood pressure (BP) to be associated with better cognitive performance and survival. Richmond et al. (2011) showed that systolic BP (SBP) positively correlated with the MMSE score

in centenarians ( $r = 0.37$ ,  $p = 0.001$ ), also showing a pulse pressure (PP) range that was narrower in individuals with dementia, as compared to those without it. Moreover, Szewieczek et al. (2015) reported that centenarians with  $SBP \geq 140$  mmHg and with diastolic BP (DBP)  $\geq 90$  mmHg had higher likelihood for a subsequent 180-day survival. The association between SBP and MMSE scores was expressed in an inverted-U-shaped curve, whereas that between DBP and MMSE scores was best in a liner curve. These results indicate an association between high BP and good cognitive function, depicting a contradictory relationship to that found among individuals in younger older age. Centenarians with moderately high BP might show better cognitive performance.

### Nutrition Factors

As factors related to metabolic activities of the brain, we must focus attention on nutrition in old age. The Georgia Centenarian Study examined the role of diet for cognitive function in centenarians (Johnson et al. 2013). Significant relationships were observed between cognitive performance and dietary carotenoids, including serum lutein, zeaxanthin, and  $\beta$ -carotene in the serum and brain. However, these relationships differed from those observed in other studies for the younger older population.

Arai et al. (2015) showed that well-nourished centenarians who showed high serum albumin levels had significantly higher MMSE scores. In addition, the study found that high serum albumin levels and inflammation suppression were associated with low CRP and IL-6 levels among centenarians. Although the nutritional status in the blood serum shows a relationship with cognition, no study has shown a direct relationship between food intake and cognitive function among centenarians. They speculated that inflammatory reactions occurring along with aging might lead to a low nutritional status and low cognitive function in very old age. In the future, there is a

need for a comprehensive study focusing on the associations between food intake, nutrition level in the blood serum, and cognitive function among centenarians.

## Psychosocial Factors

In addition to the factors mentioned above, recent gerontology studies have started considering psychosocial factors as pathways to maintenance of cognitive function in old age. Specifically, studies examined the effect of life antecedents, such as education, work, and leisure activities, on late-life cognition and the risk of dementia. Studies addressing the complexity of work engaged throughout their main lifetime reported that highly demanding work was associated with a low risk of cognitive impairment in younger older age. A review paper showed the positive effects of high control and work complexity on cognition in late life (Then et al. 2014). Moreover, many findings support the notion that physical activities, social engagements, and intellectual stimulation in leisure activities could promote cognitive function in old age (Hertzog et al. 2008). There is a need to examine whether complexity of work in midlife and engagement in leisure in old age could affect cognitive function among centenarians.

A prospective study is recommended for such research topics; however, it is not feasible in centenarian studies. In one centenarian study, centenarians and their proxies were interviewed, with their lifelong engagements in cognitive activities retrospectively evaluated (Kliegel et al. 2004a). The study demonstrated that higher education and the number of intellectual activities engaged in predicted higher cognitive function in centenarians. Moreover, the number of intellectual activities that adults engaged in mediated the association between childhood education and cognitive function in centenarians. A prior active lifestyle might be an important predictor of cognitive ability, even in centenarians. Further retrospective studies assessing the activities performed during their 80s and 90s, in order to link these to the cognitive

performance when reaching centenarian status, are necessary to enable a better understanding of healthy cognitive aging in very old age.

## Summary and Future Directions

This entry has summarized findings on the prevalence of dementia among centenarians, the cognitive function levels in non-dementia centenarians, as well as risk and protective factors of cognitive function in very late life. Findings suggest that dementia prevalence among centenarians was substantially higher than that among younger older individuals and that women tended to have higher prevalence rates than men did. However, large differences in dementia prevalence rates across different studies have also been observed. A large representative database and similar protocols are needed to clarify the inconsistent results previously obtained. Furthermore, researchers should examine the influence of genetic, biomedical, and environmental factors on cognitive function and dementia among centenarians. As protective factors, nutrition in the serum and an active lifestyle across the lifespan might maintain cognitive function until very old age; however, few studies relating to this have been conducted. In addition to the abovementioned issues, the following topics will also be important in clarifying the nature of cognitive aging among centenarians.

## Gene–Environment Interaction

More recently, the role of gene–environment interactions in older adults' cognitive function has gained interest. Wang et al. (2012) reported that higher education might modify the effect of the *APOE*  $\epsilon 4$  on the risk of dementia among participants aged  $\geq 65$  years. In the study, among the  $\epsilon 4$  allele carriers, if they had more than 7 years of education levels, the risk of dementia was reduced by half, compared to those with less than 8 years of education levels. Environmental factors must be controlled for, to enable

clarification of the effect of genetic factors on cognitive function even in very old age.

## Neuropathology in the Brain and Cognition

Autopsy studies in very old age suggest that there is some level of dissociation between the neuropathological change of the brain and cognitive performance. The prevalence of neuropathology associated with AD ranged from about 20% to about 40% when individuals met at least several criteria for AD-related neuropathology (Price et al. 2009). The result suggests that some people in very old age might be in the pre-stage of AD, although they had not yet exhibited clinical expression.

The Sydney Centenarian Study was designed to relate cognitive function with neuropathological parameters assessed via magnetic resonance imaging in centenarians (Sachdev et al. 2013). Future findings might indicate the uniqueness of the relationship between neuropathology and cognitive function in very old age. Gondo and Poon (2007) proposed the following four phenotypes in centenarians, based on the level of cognitive function and pathological condition: supernormal (i.e., no symptoms of brain pathology and higher cognitive status), cognitive reserve, late-onset dementia, and early-onset dementia. Considering neurological and cognitive aspects simultaneously may provide a useful model of cognitive aging in very old age.

## Micro-longitudinal Studies

Longitudinal assessment and neuropathological examination of the brain are recommended, in order to improve our understanding of centenarians' cognitive status. For instance, the Iowa Centenarian Study examined mental performance status and changes therein over time, using Pfeiffer's Short Portable Mental Status Questionnaire. The study examined the individual level of change and found four patterns of short-term longitudinal performance, including stability,

enhancement, decrement, and variability in scores across the 8-month testing period (Margrett et al. 2012). Examining intraindividual changes or patterns of cognitive changes would be recommended because it might prove more sensitive to cognitive impairments than would a one-shot assessment of cognitive performance.

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## Cognitive and Brain Plasticity in Old Age

Franka Thurm<sup>1</sup> and Shu-Chen Li<sup>1,2</sup>

<sup>1</sup>Department of Psychology Chair of Lifespan Developmental Neuroscience, TU Dresden, Dresden, Germany

<sup>2</sup>Center for Lifespan Psychology, Max Planck Institute for Human Development, Berlin, Germany

*“What seemingly was often overlooked is that the brain itself is a dependent variable, something that is co-shaped by experience and culture, something that does not operate within an environmental vacuum, but that at any moment is subject to environmental constraints and affordances.”*

*Paul B. Baltes, Patricia A. Reuter-Lorenz, & Frank Rösler, 2006*

*(Italics added; Lifespan Development and the Brain, p. 4)*

## Synonyms

Aging; Cognition; Dopamine; Plasticity; Stimulation; Training

## The Challenge of Demographic Change

A recent report from the World Health Organization on world population prospects forecasted an unprecedented demographic shift in human history: the number of people aged 65 or older will outnumber children under the age of 5 before 2020. In most developed countries, the average life expectancy at birth has increased from about 45 years in the 1800s to above 75 years in the twentieth century. This remarkable 30-year gain in physical health is, however, not necessarily accompanied by cognitive fitness and mental well-being into old age. Faced with the rapid growth of aging populations worldwide and an ever-expanding prevalence of dementia and other aging-related neuropathologies, understanding basic mechanisms of the still preserved cognitive and brain plasticity in old age in order to uphold and delay functional declines of the aging mind has become a key challenge for cognitive neuroscience, psychology, and gerontology in the 21st century.

As foreshadowed in the quote from Baltes et al. (2006) above, cognitive interventions and brain plasticity are closely interwoven. This brief review will first introduce theoretical concepts of plasticity that are pertinent for geropsychology, followed by a selected overview about cognitive plasticity in key domains of cognition, focusing specifically on episodic memory, working memory, and executive control. Using memory plasticity as an example, dopaminergic neuromodulation, the frontal–parietal circuitry, and neurogenesis involving the brain-derived neurotrophic factor (BDNF) will be highlighted as intermediate mechanisms that link brain and cognitive plasticity. In the last section, plasticity in populations with aging-related neuropathologies as well as potential noninvasive brain stimulations as additional intervention approaches beyond cognitive and physical fitness interventions will be reviewed.

## Theoretical Propositions of Developmental Plasticity

The concept of plasticity has a long history in psychology and neuroscience. In his classical volume, *The Principles of Psychology*, William James (1980) considered neural mechanisms of the mind to be endowed with substantial potentials to be influenced by experiences and learning. Around the same time, Santiago Ramón y Cajal (1894) in neuroscience also contemplated about the possibilities of mental exercises as means for facilitating the connections between neural networks.

Among modern concepts of plasticity, in our view, the following propositions are particularly relevant from the perspectives of lifespan development and geropsychology. First is the concept of *developmental reserve capacity* in old age (Baltes 1987): notwithstanding declines in their neurocognitive resources, older adults still possess considerable latent reserve capacity, such that if suitable environmental supports or interventions could be provided, their performance could be maintained or even improved. This concept underlies much of the training and intervention research conducted over the past decades, which aims at maintaining or enhancing cognition in old age by cognitive and/or physical fitness training and lifestyle enrichments (see Hertzog et al. 2009 for a review). A second notion is that prolonged mismatches between task demands and supplies of neurocognitive resources can trigger alternations in cognitive and brain processes (Lövdén et al. 2010). Recognizing that the demand–supply balance is an important factor in driving plasticity implicates that programs or methods for enriching older adults' cognitive and physical experiences need to closely adjust the balance between task demands and individual abilities during the course of training for optimal intervention results. A third proposition is that flexible adaptations to declines in neurocognitive resources and increases in task demands can lead to reorganizations of cognitive processes (Li et al. 2004), and brain mechanisms (Park and Reuter-Lorenz 2009) that go beyond effects on the levels of performances or functions. Indeed, the

correlations among sub-facets of intellectual functioning (e.g., perceptual speed, reasoning, memory, and verbal knowledge) or basic cognitive processes (e.g., working memory and episodic memory) are higher in old age than in early adulthood, indicating dedifferentiation in the organization of cognitive processes in old age (Li et al. 2004). At the brain level, extant evidence also indicates that, relative to young adulthood, brain processes of various cognitive functions in old age tend to activate more diffused networks or recruit additional brain regions (see Park and Reuter-Lorenz 2009 for a review).

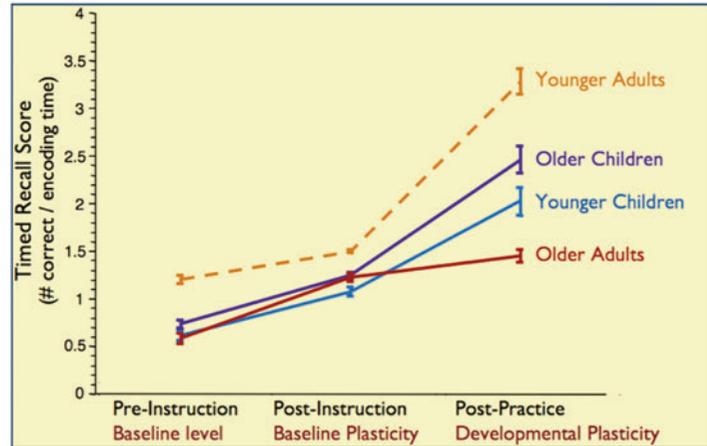
## Cognitive Plasticity

Notwithstanding evidence for developmental reserve capacity in old age, cognitive intervention research over the past decades also revealed that the potential for training gains is more limited in old age relative to other periods of the lifespan. The degree of plasticity limitation, however, varies between cognitive domains. In terms of the extent of training gains in episodic memory, evidence from research that applied mnemonic strategies for training the encoding and retrieval of associative memory revealed substantially reduced plasticity in old age relative to younger adults and children (Brehmer et al. 2007; Shing et al. 2008). Specifically, the so-called baseline plasticity – i.e., the potential to benefit from being instructed with memory strategies (e.g., method of loci or paired associates) – was comparable between different age groups, whereas the plasticity in implementing those respective memory strategies through practice to strengthen associative memory was much more limited in older adults compared to younger adults and children (see Fig. 1; Brehmer et al. 2007). In contrast, the plasticity of working memory and executive control functions seem to be less age dependent. A recent meta-analysis (Karbach and Verhaeghen 2014) revealed comparable effect sizes (around 0.6) of training gains in these two domains of functions in younger and older adults.

Beyond training or practice gains, whether the training benefits would transfer to other untrained

### Cognitive and Brain Plasticity in Old Age,

**Fig. 1** Lifespan age differences in episodic memory plasticity (Data adapted from Brehmer et al. (2007) with permission; copyright American Psychological Association 2007)



tasks is an additional indicator that is of practical relevance when considering interventions for maintaining or improving older adults' daily cognitive competence. Results from a meta-analysis showed that in older adults transfer of training benefits at the level of specific tasks is usually in the range of moderate effect sizes (0.2–0.4) for working memory or episodic memory functions (Karbach and Verhaeghen 2014). Relatedly, a unique extensive cognitive intervention study (Schmiedek et al. 2010, the COGITO study) compared transfer effects of an intensive training on multiple domains of cognitive functions (i.e., over 6 months of 1-h daily practice of perceptual speed, working memory, and episodic memory tests). Of note, in both younger and older adults, transfer effects were not only observed with respect to individual tests but also for cognitive abilities represented as latent factors. This indicates that training benefits can be observed at the level of cognitive abilities, instead of just at the level of specific tests. However, the transfer effects at the level of latent cognitive abilities were more limited in older than in younger adults.

Other than cognitive interventions, aerobic physical fitness trainings have been shown to yield transferrable benefits to cognition, beyond physical functions. Specifically, a recent review of physical intervention research over the last decades (Prakash et al. 2015) points to positive cross-domain transfer effects of enhancing aerobic physical fitness on executive control and memory functions in older adults. Similar to

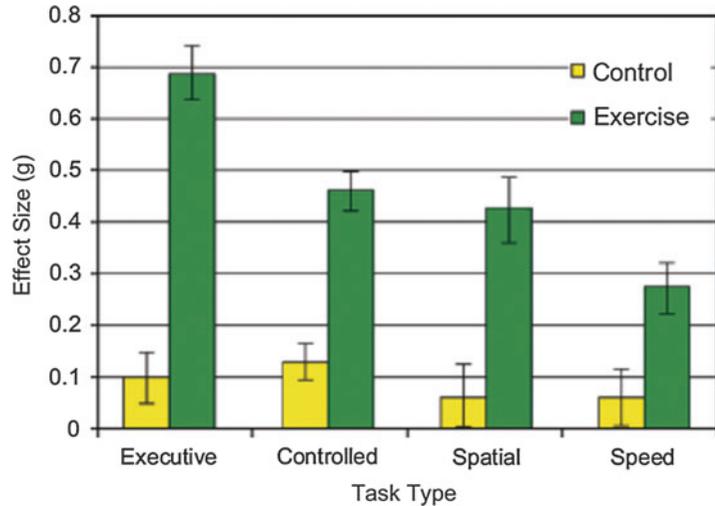
cognitive intervention effects, the effects of physical fitness training on older adults' cognitive performance also differed between domains of functions, with executive control processes (e.g., working memory, inhibition, and multitasking) showing the largest training benefit (Colcombe and Kramer 2003; see Fig. 2).

### Linking Levels of Memory Plasticity: From Brain to Cognitive Plasticity

This section focuses specifically on plasticity of working memory and episodic memory to highlight the multiple levels of mechanisms involved, from neurobiological to behavioral plasticity. A number of relevant neurochemical mechanisms have been identified. Specifically, neurotransmitters such as acetylcholine, norepinephrine, and dopamine are implicated in the modulation of long-term potentiation (LTP), which is an important molecular mechanism of memory (Squire and Kandel 1999). Given that dopamine and other neurotransmitters are involved in affecting synaptic plasticity, lifespan age differences in the efficacy of neuromodulation thus would have direct implications on experience-dependent tuning of synaptic connections. Over the past two decades, studies investigating the impact of aging on the brain's neurochemical processes have yielded the consensus of substantial age-related declines in the efficacy of various neurotransmitter systems. Of particular interest here are aging-related

### Cognitive and Brain Plasticity in Old Age,

**Fig. 2** Effect sizes of aerobic fitness training on cognitive performance in older adults for different types of cognitive tasks. Plotted are mean differences in pre- and post-training cognitive performances of the training and control groups (Data adapted from Colcombe and Kramer (2003) with permission; copyright American Psychological Society 2003)



declines in different components of the dopaminergic system. Estimates based on currently available cross-sectional evidence indicate about 10% decline in dopamine receptor functions per decade starting from the age of early 20s (see Bäckman et al. 2006; Li and Rieckmann 2014 for reviews).

Frontal–striatal dopamine signaling is closely involved in regulating working memory and executive control functions. In healthy young adults, better working memory performance has been associated with higher capacity of striatal and extrastriatal dopamine synthesis (see Li and Rieckmann 2014 for review). Regarding aging, a recent study (Rieckmann et al. 2011) showed that functional connectivity between the prefrontal and parietal cortices, key regions of the network that underlies working memory, was reduced in older compared to younger adults. Importantly, in older adults, interindividual differences in the frontal–parietal connectivity correlated positively with striatal caudate D1 receptor density: those older adults whose D1 receptor availability was higher relative to same-aged peers showed higher frontal–striatal functional connectivity during working memory. These results suggested that age-related losses in striatal DA receptors could contribute to age-related decline in functional brain dynamics of working memory.

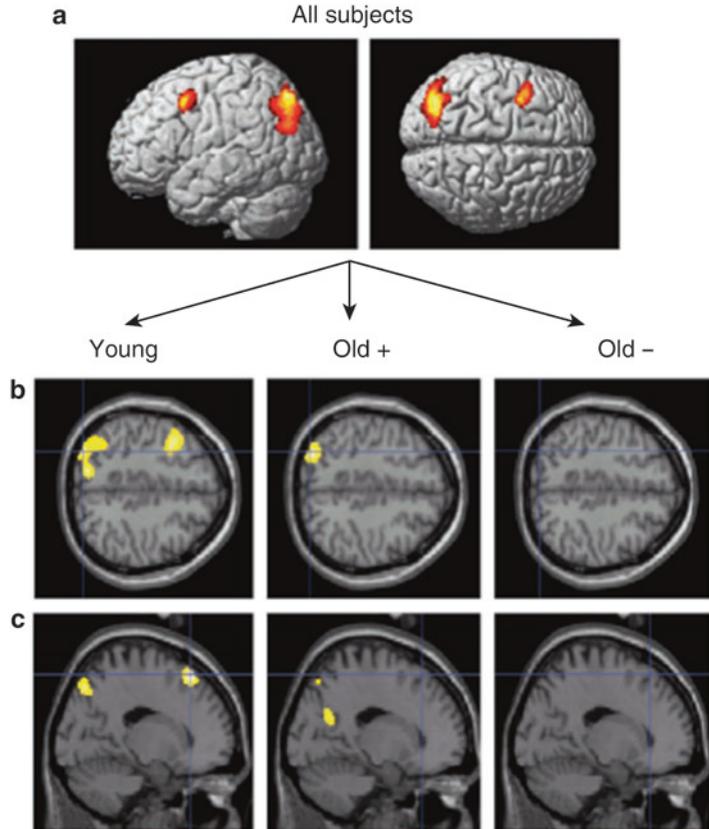
Of particular interest, two recent positron emission tomography (PET) receptor imaging studies established the first empirical links between

memory training and changes in dopamine signaling in various brain regions that are crucial for working memory functions. In younger adults, working memory training over 5 weeks was associated with changes of dopamine D1 receptor binding potential in the prefrontal and parietal cortex (McNab et al. 2009) as well as D2 receptor binding in the striatum (Bäckman et al. 2011). Furthermore, individuals who showed larger performance improvements as a function of working memory training also exhibited a greater training-related change in receptor binding potential (McNab et al. 2009).

The direct effect of aging-related decline in dopaminergic modulation on memory plasticity has thus far not yet been empirically established, but a theoretical link has already been suggested for more than a decade. Modeling aging-related decline in dopaminergic neuromodulation by stochastically attenuating the gain control of the sigmoidal activation function that models presynaptic to postsynaptic input–response transfer, computational stimulations results accounted for the reduced associative memory plasticity and working memory capacity in old age (Li et al. 2001; see also Li and Rieckmann 2014 for a recent review). Although without direct measures of dopamine synthesis or binding, a recent functional brain imaging study showed that reduced striatal activity may contribute to reduced transfer effects of working memory training in

### Cognitive and Brain Plasticity in Old Age,

**Fig. 3** (a) The left dorsal frontal cortex and the left occipitoparietal cortex showed increased activity after the “method of loci” memory training relative to a pretest baseline. (b) Group differences in the comparison of “method of loci” use with pretest. The younger and the improved older adults, but not the unimproved old, activated the left occipitoparietal cortex. (c) Age differences in the comparison of “method of loci” use with pretest. The young but not the old adults activated the left dorsal frontal cortex (Data adapted with permission from Nyberg et al. (2003); copyright the National Academy of Sciences, USA, 2003)

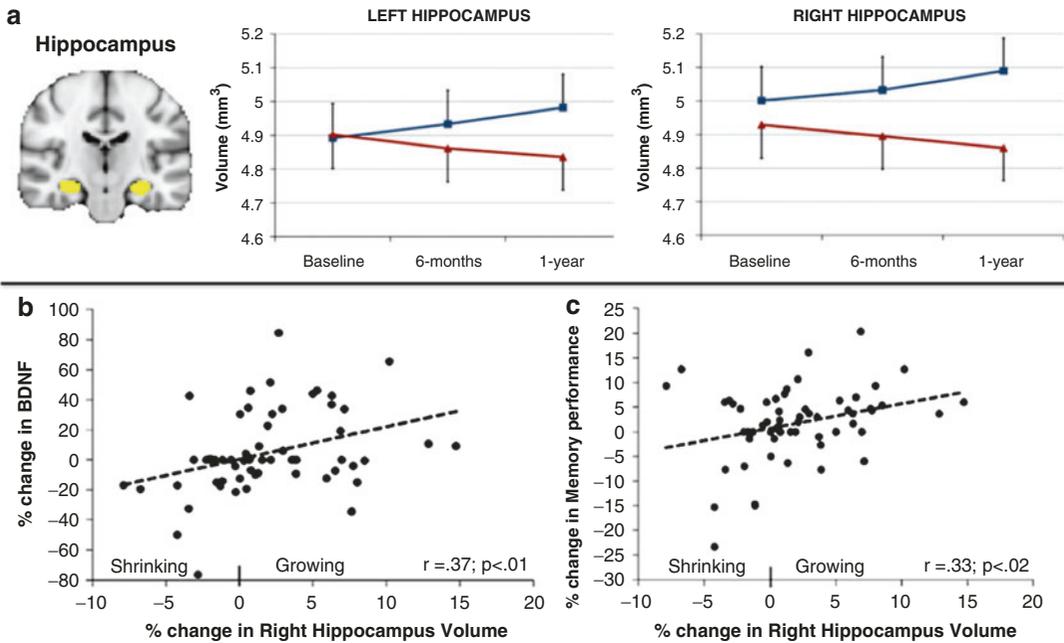


older adults (Dahlin et al. 2008). Given that dopamine pathways extensively innervate the striatum, this finding hints at the possibility that aging-related decline in transfer effects of working memory training may be related to impaired striatal dopaminergic modulation.

Regarding brain correlates of episodic memory plasticity in old age, the plasticity of the frontal–parietal network as a function of memory training has also been investigated (Nyberg et al. 2003). After being instructed to use the method of loci as a mnemonic strategy, increased brain activities in frontal as well as occipitoparietal regions were observed in younger adults. In contrast, accompanying their reduced episodic memory plasticity as indicated by the reduced training gain, older adults did not show training-related increase in frontal activity, and only those older adults who benefited from the memory training showed increased occipitoparietal activity (see Fig. 3). A recent study further investigated

effects of dopaminergic modulation on episodic spatial memory in a crossover pharmaco (ON/OFF)-behavioral design. Using Parkinson's disease as a model disorder which is characterized by severe and progressive degeneration of nigrostriatal dopamine, the authors showed that dopaminergic medication facilitated striatum-dependent spatial learning based on cue-location associations. A positive medication effect on hippocampus-dependent spatial memory relying more on relations between object locations and a local spatial boundary depended on prior experience with the navigation task (Thurm et al. 2016). Given these results, aging-related decline in the dopamine system might differentially affect spatial memory plasticity and transfer effects of navigation trainings might depend upon the task-relevant underlying brain structures.

Turning to effects of aerobic physical fitness training on episodic memory (see Prakash et al. 2015 for a recent review), a study of



**Cognitive and Brain Plasticity in Old Age, Fig. 4** (a) Effects of aerobic fitness training on hippocampal volume in older adults. (b) Positive effects of exercise on increased serum BDNF level are correlated with increased hippocampal volume in older adults. (c) Increased hippocampal

volume is correlated with memory performance improvement in older adults (Data adapted from Erickson et al. (2011) with permission; copyright the National Academy of Sciences, USA, 2011)

particular interest (Erickson et al. 2011) showed that aerobic exercise (3 days/week over 1 year) increased the volume of the hippocampus in older adults by 2%, thus effectively reversed the age-related loss in hippocampal volume by 1 to 2 years (see Fig. 4). Moreover, the increase in hippocampal volume was associated with improved spatial memory performance and with greater serum levels of brain-derived neurotrophic factor (BDNF). The hippocampus is central for episodic and spatial memory and is rich in BDNF, which is a putative mediator of neurogenesis and dendritic expansion. Early animal studies showed that voluntary wheel running enhances BDNF gene expression, neurogenesis, and cell proliferation in the hippocampus of mice and rats (Adlard et al. 2005; Neeper et al. 1995), decreases beta-amyloid plaque load in the brains of transgenic Alzheimer mice, and increases the animals' spatial memory performance (van Praag et al. 1999). Thus, the findings of aerobic fitness training increasing the level of circulating BDNF and

hippocampal volume suggest that cell proliferation or increased dendritic branching might contribute to the training-related increases in hippocampal volume and memory function in older adults (see Erickson et al. 2011 for review).

### Cognitive Plasticity in Aging-Related Neuropathology

A range of neuropathological conditions are age associated. Therefore, this section focuses on cognitive plasticity in populations manifesting aging-related neuropathology. Mild cognitive impairment (MCI) refers to a transitional zone between normal and pathological cognitive aging. Older adults with MCI or caregivers of individuals with MCI usually report subjective memory deficits. Furthermore, cognitive declines in these populations have been objectively confirmed by neuropsychological tests in at least one cognitive domain (Winblad et al. 2004). In general, daily

functioning of older adults with MCI remains intact, and they do not yet fulfill clinical criteria of dementia. However, older adults with MCI have an increased risk of developing Alzheimer's disease (AD). About 10–15% of those seniors with classified MCI convert to AD within 12 months compared to only 1–2% of the general, age-matched population (e.g., Petersen et al. 1999). AD is the most common form of dementia in late life with complex multifactorial pathogenesis. AD leads to progressing memory deterioration and further exacerbates deficits in other cognitive domains, including executive functions and visuo-motoric, visuospatial, and language abilities that impair independent living and quality of life. Idiopathic Parkinson's disease (PD) is another aging-related neurodegenerative disease, which in its initial stages is rather recognized by motor than cognitive deficits. PD is associated with a drastic degeneration of dopaminergic neurons, especially in the substantia nigra pars compacta (SNc) and its terminals in the dorsal striatum (caudate and putamen). With disease progression, the loss of dopamine further affects the ventral tegmental area (VTA) and its terminals in the ventral striatum (nucleus accumbens) as well as the mesolimbocortical dopamine system (Agid et al. 1993).

Many cognitive intervention studies targeting the training of either compensatory cognitive strategies or specific cognitive abilities in older adults with MCI and AD reported performance improvements in the trained tasks but failed to provide relevant long-term transfer effects on other cognitive functions or abilities needed in daily life (e.g., Belleville et al. 2006; Davis et al. 2001). More recent neuroplasticity-based cognitive trainings have yielded promising results in some studies with healthy older adults, but yielded contradicting results in older adults with increased risk of dementia and MCI (e.g., Barnes et al. 2009). Cognitive training and intervention studies with PD patients provide a similar picture with small to moderate improvements mainly in trained fronto-striatal tasks (e.g., Nombela et al. 2011), without transfer to other untrained functions. Taken together, randomized controlled cognitive training or intervention studies in MCI,

AD, and PD are few and inconclusive at the current stage.

## Outlook

In light of aging- and pathology-related decreases in training gains and transfer effects, it is important to investigate other options for improving cognitive and brain plasticity in old age. Repetitive transcranial magnetic stimulation (rTMS) and anodal transcranial direct current stimulation (atDCS) are noninvasive brain stimulation methods that could have transient facilitative effects on cognitive function (see Freitas et al. 2013 for a recent review). Very recently, a few explorative studies have begun to use noninvasive brain stimulations in older adults. Some preliminary successes in terms of ameliorating cognitive aging deficits could be demonstrated. For instance, atDCS applied over the left inferior frontal gyrus improved performance in a semantic word generation task that implicates frontal cognitive control and working memory in old adults. Moreover, atDCS also reduced the nonspecific recruitment of the right prefrontal regions in older adults, thus modified functional brain activity of older adults to more resemble those observed in younger brains (Meinzer et al. 2013). Regarding effects on episodic memory consolidation, atDCS over the right temporoparietal cortex further improved object-location learning and delayed free recall after one week in old adults (Flöel et al. 2012).

Research over the past decade indicates that the facilitating effects of rTMS or atDCS on cognition might not be restricted to healthy young and older adults. Application of rTMS improved face-name association memory in older adults with subjective memory complaints and amnesic MCI (e.g., Turriziani et al. 2012). In AD patients with early to more advanced cognitive deficits, rTMS and atDCS have been shown to improve memory functions (e.g., Cotelli et al. 2014). In PD patients, atDCS stimulation has also been shown to improve working memory (Boggio et al. 2006). These initial progresses notwithstanding, further research is needed to gain better understandings

about the underlying mechanisms of noninvasive brain stimulations, their long-term effects, and potential risks, in order to develop appropriate protocols for gerontological applications.

## Cross-References

- ▶ Alzheimer's Disease, Advances in Clinical Diagnosis and Treatment
- ▶ Berlin Aging Studies (BASE and BASE-II)
- ▶ Cognition
- ▶ Cognitive Neuroscience of Aging
- ▶ Executive Functions
- ▶ Life Span Developmental Psychology
- ▶ Life Span Developmental Psychopathology
- ▶ Learning in Older Adults
- ▶ Memory, Episodic
- ▶ Memory Training Methods and Benefits
- ▶ Mild Cognitive Impairment
- ▶ Neurocognitive Markers of Aging
- ▶ Plasticity of Aging
- ▶ Physical Activity and Aging
- ▶ Working Memory in Older Age

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## Cognitive Behavioural Therapy

Mary E. Dozier<sup>1,3</sup> and Catherine R. Ayers<sup>2,3</sup>

<sup>1</sup>San Diego State University/University of California, San Diego Joint Doctoral Program in Clinical Psychology, San Diego, CA, USA

<sup>2</sup>Department of Psychiatry, University of California, San Diego School of Medicine, San Diego, CA, USA

<sup>3</sup>Research Service, VA San Diego Healthcare System, San Diego, CA, USA

## Synonyms

Evidence-based treatment; Psychotherapy

## Definition

Cognitive behavioral therapy (CBT) refers to a psychotherapeutic framework in which cognitions and behaviors are theorized to be the underlying core factors in the development and maintenance of psychological distress. According to the CBT model, maladaptive cognitions, or schemas, about the world and oneself result in emotional distress and problematic behaviors in the individual. The goal of cognitive behavioral therapy is to alter an individual's maladaptive cognitions and problematic behaviors, which result in the alleviation of psychological distress.

## Introduction

Cognitive behavioral therapy (CBT) is a psychotherapeutic intervention focused on the alteration of maladaptive cognitions and behaviors in the alleviation of psychological distress. CBT blends elements from both behavioral and cognitive therapies into a cohesive intervention in which both behaviors and thoughts are theorized to effect, and to be effected by, an individual's emotional state. CBT is considered an evidence-based treatment for a multitude of mental disorders, including anxiety, depression, bipolar disorder, eating disorders, anger control, insomnia, and substance abuse, and there is growing evidence for the use of CBT with personality disorders and schizophrenia (Sorocco and Lauderdale 2011; Hofmann et al. 2012). In the treatment of depression, CBT has been found to be at least as efficacious as medication alone. A combination approach of medication and CBT has growing support to be considered as the most effective approach for short-term changes in mood, although CBT continues to demonstrate the most enduring results for mid-life samples (Sorocco and Lauderdale 2011). There is growing evidence for the effectiveness of CBT in geriatric samples. Recent studies have demonstrated the efficacy of CBT in treating older adults suffering from depression, anxiety, insomnia, and pain (Sorocco and Lauderdale 2011), although the effects found for insomnia may not be as long lasting in older adults

as in mid-life adults (Hofmann et al. 2012) and there is some debate about the effectiveness of CBT for anxiety disorders when compared to other treatment modalities.

## Outline of CBT

CBT interventions often occur in three main phases: psychoeducation, skills acquisition, and relapse prevention (Sorocco and Lauderdale 2011). Psychoeducation involves teaching the patient about the CBT model for their particular disorder or symptoms and may take place over one or several sessions. Psychoeducation for older adults may take longer than for younger adults due to an increased unfamiliarity with psychosocial interventions (Sorocco and Lauderdale 2011).

Next, therapy moves on to teaching new skills. Skill acquisition involves teaching and demonstrating tools related to both maladaptive cognitions and behaviors (Sorocco and Lauderdale 2011). For example, maladaptive cognitions are altered through the use of cognitive techniques like cognitive restructuring (e.g., replacing maladaptive automatic thoughts with more realistic thoughts) and the downward arrow technique (e.g., asking the individual to describe the meaning of their thoughts until the individual uncovers a core belief about themselves). In the CBT model, an individual's thoughts or interpretation of a situation is theorized as the mediating factor between the situation itself and the individual's subsequent emotional response. The alteration of one's automatic thoughts to the situation allows the person to alter their emotional response as well, thus decreasing distress. The relationship between thoughts, behaviors, and situations is typically monitored through the use of "ABC" worksheets, where "A" represents the "activating event," "B" is the "belief" or automatic thought held by the patient, and "C" represents the "consequence" or emotional reaction to the situation as the result of the automatic thought (Sorocco and Lauderdale 2011). The worksheets used to monitor thoughts may vary based on the patient's symptoms and cognitive ability. Different types of thoughts are captured within the worksheet.

Automatic thoughts are themselves the result of an individual's underlying schemas, or their way of viewing the world. These kinds of thoughts are reflected in the belief portion of the worksheet. Deeper thoughts or themes, known as schemas, develop over the course of an individual's life as the result of an interaction between genetic predispositions and learned responses over time. The therapist and patient can look for common themes in the worksheets to identify schemas.

Maladaptive behavior patterns also develop over time and can exacerbate psychological distress by decreasing the opportunities for individuals to receive positive reinforcement from their environment (Sorocco and Lauderdale 2011). Behavioral problems related to psychological distress are altered through the use of behavioral activation, in the case of depression, and exposure exercises, in the case of obsessive-compulsive spectrum, trauma, and anxiety disorders. Modification of maladaptive behaviors typically starts with activity monitoring worksheets, where the patient monitors his or her activities and mood over the course of a week. This allows the patient and the clinician to assess for patterns related to the patient's behaviors and subsequent mood. Next, the clinician and the patient work together to incorporate pleasurable activities throughout the patient's week. Problem solving and social skills training are also often incorporated into behaviorally based interventions in order to decrease the obstacles faced by patients during this process (Sorocco and Lauderdale 2011). With respect to exposure exercises, patients must face the stimulus that they are repeatedly avoiding. This can be done through imagery or actually engaging with the fear-provoking stimulus. Finally, clinicians and patients work together to create maintenance plans for the patients to decrease the likelihood of their symptoms returning. Relapse prevention in the treatment of older adults is typically done over multiple sessions and possibly includes planning for follow-up sessions either in person or over the phone (Sorocco and Lauderdale 2011).

A case conceptualization process is typically utilized as a necessary component of a CBT model (Sorocco and Lauderdale 2011). The case

conceptualization process starts at intake but is modified repeatedly throughout as new information develops. The conceptualization allows for clinicians to hypothesize about the cognitive, behavioral, and situational factors that may be contributing to an individual's current psychological distress (Sorocco and Lauderdale 2011). Clinicians are able to consider the effect of possible age-related factors, such as cognitive decline and social situation, when creating a treatment plan for geriatric patients.

### **Anxiety and Obsessive-Compulsive Spectrum Disorders**

Up to 27% of older adults may suffer from anxiety-related symptoms and up to 10% of community-dwelling older adults may meet criteria for an anxiety disorder (Petkus et al. 2014). The prevalence of anxiety disorders in late life may be even higher in medical settings (Goncalves and Byrne 2012). Generalized anxiety disorder (GAD) and specific phobia are the two most common anxiety disorders found in late life (Petkus et al. 2014). Older adults suffering from anxiety disorders are likely to prefer psychotherapy to either medication or a combined psychotherapy-medication approach (Goncalves and Byrne 2012). Further, older adults report being more satisfied with a CBT-based protocol than a discussion group intervention (Ayers et al. 2014a).

There is currently a debate in the literature about the most effective treatment for anxiety disorders in older adults, which may be due to a dearth of large treatment trials studying late-life anxiety (Goncalves and Byrne 2012; Gould et al. 2012). While some studies suggest that CBT does not surpass other active treatments of geriatric anxiety, including relaxation training (Hofmann et al. 2012; Petkus et al. 2014), there is also evidence that CBT is equal to or surpasses other treatment modalities, including relaxation therapy, supportive therapy, or psychodynamic therapy (Hofmann et al. 2012). Further, some literature suggests that although CBT may be an effective treatment for late-life GAD, the effect may be less significant than what has been

observed in younger samples (Petkus et al. 2014; Ayers et al. 2014a; Gould et al. 2012). There are multiple reasons why CBT may be less effective in older adults than it is in younger adults. Most notably, older adults with GAD are likely to have maladaptive schemas and behaviors that have been reinforced over several decades, resulting in a psychopathology that is more highly ingrained than in younger adults (Petkus et al. 2014). Further, age-related difficulties with cognitive restructuring may result from increased levels of cognitive dysfunction and reality-based worries (e.g., worries about health and finances) (Petkus et al. 2014). Because CBT requires relatively intact executive functioning in order to be fully engaged in traditional CBT exercises, cognitive dysfunction may serve as a moderator for CBT treatment response in older adults (Ayers et al. 2014a). There may also be additional confounding factors which could have affected the generalizability of the results of many of the major investigation of CBT for late-life anxiety, including self-referral, concurrent unregulated pharmacotherapy, and a lack of control of nonspecific therapeutic effects (e.g., social support) (Gould et al. 2012).

Obsessive-compulsive disorder (OCD) is less frequent in older adults than anxiety-related disorders, only effecting 1.5% of older adults (Ayers and Najmi 2014). The first line of treatment for OCD is Exposure and Response Prevention (ERP), a form of CBT; however, there has been little systematic investigation of the efficacy of ERP in older adults with OCD beyond assorted case studies (Ayers and Najmi 2014). Hoarding disorder, an obsessive-compulsive spectrum disorder with strong ties to anxiety disorders, may be as prevalent as 15% in geriatric samples (Ayers and Najmi 2014). Hoarding disorder has also received poor results when treated with CBT in geriatric samples, with few individuals responding to treatment and no evidence of long-term effects of treatment (Ayers et al. 2014b). Treatment of late-life hoarding is further complicated by low insight, executive functioning problems, and decreased levels of social engagement (Ayers et al. 2014b).

Modified CBT protocols may show more promise than traditional CBT-based interventions for late-life anxiety. Interventions involving

increased problem solving skills and teaching strategies may help to increase long-term outcomes for anxiety disorders (Ayers et al. 2014a). Similar results have been found for hoarding disorder when using a CBT-adapted protocol that focused on compensatory cognitive training and exposure and response prevention (Ayers et al. 2014b). Compensatory cognitive training focuses on skills related to prospective memory and planning, attention and vigilance, learning and memory, and cognitive flexibility, and problem solving. This enables patients with executive functioning problems to work around their deficits when engaging in treatment (Ayers et al. 2014b).

## Mood Disorders

The prevalence of mood disorders in late life rivals that of anxiety disorders: as many as 25% of community-dwelling older adults have reported experiencing symptoms related to depression (Shah et al. 2012). Older adults with a late onset of depression symptoms are more likely to have a poor prognosis and greater disability associated with their symptoms that are individuals with early-onset depression (Sorocco and Lauderdale 2011). The CBT model of depression postulates that depressed mood is a combination of maladaptive cognitions, social isolation, and decreased performance of pleasurable activities (Shah et al. 2012). In the treatment of mood disorders, CBT has been found to be equally effective as other treatment modalities, such as interpersonal therapy and behavioral therapy (Sorocco and Lauderdale 2011; Shah et al. 2012), and may even surpass other treatment models in the maintenance of long-term results (Hofmann et al. 2012). Research suggests that a combined CBT and medication approach in late-life samples does not increase the effectiveness of either approach alone (Hofmann et al. 2012). CBT-based protocols for older adults with depression are often modified to take into consideration age-related changes in cognition and memory, as well as physical limitations (Sorocco and Lauderdale 2011; Shah et al. 2012). Typical modifications include using telephone or

home-based therapy, incorporating breaks within sessions, the simplification of thought records, increased use of handouts, and booster sessions (Sorocco and Lauderdale 2011). The majority of sessions in a typical CBT intervention for geriatric depression are focused on both the identification of maladaptive cognitions and the generation of more helpful alternative thoughts as well as behavioral activation and the introduction of pleasurable or positively reinforcing activities (Sorocco and Lauderdale 2011). Problem solving skills may be introduced in later sessions and can help to increase the mastery felt by geriatric individuals (Sorocco and Lauderdale 2011).

Bipolar disorder, a mood disorder characterized by alternating manic and depressive states, is estimated to be prevalent in 0.1–0.5% of community-dwelling older adults (Sorocco and Lauderdale 2011). CBT is considered the treatment of choice for bipolar disorder, especially in light of the high rates observed for patient noncompliance (40–50%) for pharmacological treatments (Sorocco and Lauderdale 2011). Unfortunately, there is little research on the efficacy of CBT for bipolar disorder in geriatric patients (Sorocco and Lauderdale 2011).

### **Adaptations for Geriatric Samples**

Older adults may be more likely to seek therapy due to external pressures from their medical doctors or children and may be less likely to attend treatment for self-motivating reasons (Sorocco and Lauderdale 2011). Consequently, it is especially important for geriatric mental health professionals to assess motivation for treatment and to engage in motivational interviewing when necessary (Shah et al. 2012). This may be especially important for older adults exhibiting low levels of insight into their symptoms, as is often witnessed in geriatric hoarding disorder (Ayers et al. 2014b). Older adults may also have increased obstacles to treatment, including transportation or financial issues (Sorocco and Lauderdale 2011; Ayers et al. 2014b). Because geriatric patients may be unfamiliar with psychological services, extra time may need to be spent to socialize late-life patients

to the CBT framework (Sorocco and Lauderdale 2011). This includes explaining the purpose and benefits of homework, the organization of treatment sessions, and an overview of the CBT model (Sorocco and Lauderdale 2011). Finally, clinicians working with older adults should be especially mindful of suicide risk and assess for suicidal ideation throughout the therapeutic process, as older adults are more likely to have increased risk factors, such as social isolation (Sorocco and Lauderdale 2011).

As individuals age, their opportunities for positive reinforcement, such as interacting with friends or exercising, may decrease due to changes in available resources and their own physical health (Sorocco and Lauderdale 2011). Cognitive impairment may also decrease the ability of older adults to fully engage in some of the core facets of CBT, such as cognitive restructuring or behavioral activation. When constructing lists of pleasurable activities for geriatric patients to incorporate into their daily lives, clinicians should consider how activities that individuals used to enjoy could be altered to be appropriate for their current levels of functioning (Sorocco and Lauderdale 2011). For example, if an older adult enjoyed kayaking but is no longer able to perform due to a medical illness, they might consider walking in the park to be a suitable alternative to incorporate into their daily routine. Clinicians may want to consult with patients' primary care providers before suggesting any new physical activities be added to patients' daily routines.

Older adults who have difficulty with cognitive restructuring due to possible cognitive impairment may benefit from the use of coping cards, which rely on recognition rather than recall memory (Sorocco and Lauderdale 2011). Patients write down common maladaptive cognitions and alternative thoughts on coping cards and then refer to them as needed, rather than having to generate alternative thoughts spontaneously. Other alterations that may increase the efficacy of CBT for geriatric patients include a lengthened course of therapy, increased structure, and an increased use of examples (Sorocco and Lauderdale 2011). Clinicians should also consider the incorporation of booster sessions every 3–6 months to decrease the

occurrence of re-emerging symptoms (Sorocco and Lauderdale 2011) or reminder calls in between sessions to help increase homework compliance (Ayers et al. 2014a). Because older adults may report feelings of guilt at homework noncompliance (Ayers et al. 2014b), booster calls may also increase the therapeutic alliance between the patient and the clinician. Emphasizing the behavioral aspects of CBT over the cognitive skills may also lead to increased outcomes for older adults (Ayers et al. 2014a). For instance, more time is spent doing behavioral activation and in vivo exposures as opposed to cognitive therapy techniques. In summary, accommodations can be made to address cognitive and physical issues.

## Future Directions

Although depression and anxiety disorders are often comorbid in older adults, little research has been done on the effectiveness of CBT for comorbid late-life anxiety and depression (Ayers et al. 2014a). Some evidence suggests that CBT for anxiety may also decrease depression symptoms (Gould et al. 2012). Depression may also be more effectively treated by CBT than are anxiety disorders, further suggesting the need for increased research into alternative therapies (Gould et al. 2012).

## Cross-References

- ▶ [Anxiety Disorders in Later Life](#)
- ▶ [Behavioral Analysis](#)
- ▶ [Clinical Issues in Working with Older Adults](#)
- ▶ [Depression in Later Life](#)
- ▶ [Interpersonal Psychotherapy](#)
- ▶ [Problem-Solving Therapy](#)
- ▶ [Suicide in Late Life](#)

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## Cognitive Compensation

Allison A. M. Bielak

Department of Human Development and Family Studies, Colorado State University, Fort Collins, CO, USA

## Synonyms

Cognitive plasticity

## Definition

The ability to maintain everyday functioning despite quantifiable age-related decline in

cognitive ability (i.e., memory, attention, executive functioning, speed of processing information). Compensation can be achieved in a number of ways, including reliance on pragmatics or experience, strategy use, task modification, cognitive plasticity or growth, and cognitive reserve (i.e., education, activity engagement).

## Overview

It is well established that as adults age, they experience decline in various cognitive capacities, including certain types of memory, executive functioning, attention, and processing speed (Schaie 1996; Hultsch et al. 1998). Given the size of these deficits, one might expect that older adults must substantially revise how they complete day-to-day tasks, or require considerable assistance carrying out chores such as managing finances, meal preparation, and taking care of grandchildren. However, the changes in cognitive ability do not tend to translate over to noticeable declines in the ability to complete everyday tasks. Rather, older adults continue to go about their daily lives with the same levels of vigor and proficiency as when they were younger. They may even make achievements that they were not capable of when they were younger. For example, the majority of CEOs for Fortune 500 companies are between their late 40s and early 60s (Salhouse 2012). There are no parallel declines in everyday functioning because older adults can compensate for cognitive decline in a number of ways, including reliance on pragmatics or experience, strategy use, task modification, cognitive plasticity or growth, and cognitive reserve (i.e., education, activity engagement).

### Reliance on Pragmatics

There are two general categories of cognition: fluid intelligence and crystallized intelligence (Horn and Cattell 1966). Fluid intelligence uses cognitive abilities that rely on biology and are termed the “mechanics” of cognition. Fluid intelligence involves all of the basic processes needed to complete higher-order cognitive tasks or solve novel problems. It includes domains such as

processing speed, spatial skills, working memory, and reasoning. A person is completing a task based on fluid intelligence when the task requires “adaptation to new situations for which prior education or learning provide little advantage” (Berg and Sternberg 2003, p. 105). On the other hand, crystallized intelligence involves experience, expertise, or “pragmatics” (i.e., practical knowledge). This includes abilities such as general and procedural knowledge, skills, strategies, verbal knowledge, occupational expertise, and the ability to solve real-life problems such as counting change.

To further illustrate this distinction, imagine a bicycle. The mechanical or basic entities of the bicycle would be the wheels, chain, pedals, handlebars, and frame. If there is deterioration in the mechanics of the bicycle, such as if the air in a tire is low, the bike can still function, but it becomes harder to pedal. Similarly, a decline in the basic mechanics of cognition, such as processing speed, would make completing a task that relies on fluid intelligence more challenging. In contrast, if a person is cycling down a hill, their practical knowledge or experience would let them know that they do not have to continue pedaling down the hill but can use their momentum and coast to reach the bottom of the hill. The mechanics of their bicycle, deflated tire or not, would not be at play in this scenario, and the person can rely on their experience in riding the bicycle to efficiently manage the hill.

The distinction between fluid and crystallized intelligence is relevant to cognitive compensation because the two types change differently across the lifespan. Fluid intelligence begins to decline soon after age 30, while crystallized intelligence increases until the mid-40s and remains stable until the 70s (Li et al. 2004). Therefore, even though an individual experiences decline in fluid intelligence with age, they can compensate for this deficit by relying more on their crystallized intelligence (i.e., acquired knowledge, pragmatics, expertise, and experience) to complete tasks.

### Everyday Life is Different from Cognitive Tests

Another key factor related to cognitive compensation is that the tests used in the laboratory to

assess cognitive change are very different from the tasks essential to everyday life. Hess (2005) described laboratory-administered memory tasks as “relatively stripped down in terms of familiarity or meaningfulness” (p. 383), as a person rarely has to memorize a list of unrelated words or discover the pattern among sets of letters in the real world. Because of this, tests have been developed that attempt to assess a person’s proficiency in completing tasks required in their daily life. These measures provide participants with real-life stimuli like nutrition labels, medication labels, or appliance instructions and ask them to complete tasks designed to assess everyday problem solving or cognition (i.e., balancing a checkbook, reading a bus schedule). Tests of everyday ability show moderate correlation with standard cognitive test scores (Allaire and Marsiske 1999), indicating that while there is overlap between successful completion of both types of tasks, the ability to solve everyday problems is distinct from typical cognitive tasks. However, tests of everyday ability still do not provide a precise measure of how well an adult can actually function in the real world.

Salthouse (2012) discussed facets of our everyday lives that may help to explain why there are not greater consequences in real life as a result of age-related cognitive decline. First, successful fulfillment of daily activities only require one’s typical level of functioning, whereas academic cognitive tests assess maximum effort and ability. It may be that cognitive decline with older age is only noticeable when attempting to achieve the upper echelons of human cognitive ability (i.e., on cognitive tests), and the level of cognitive exertion required in our daily lives is not sensitive to detect age-related cognitive deficits. Second, day-to-day tasks are likely only slightly different over time, limiting the amount of novel tasks and situations encountered in daily life and allowing the majority of one’s daily function to be solved by relying on past solutions. Consequently, everyday tasks that rely purely on fluid intelligence, which declines with age, would be an exception rather than the rule and experienced only rarely in daily life.

In addition, Park and Gutchess (2000) described that everyday tasks become automatized and require little cognitive effort to fulfill. While the effortful component of memory declines with age, the processes that rely on automatic cognitive processing that occur without conscious awareness or effort do not (Jacoby et al. 1996). Therefore, age-related declines in processing abilities will only be apparent in situations that need mental effort. It is important to note that the automation of tasks is very specific to an individual, and the same situation that requires little cognitive demand for one older adult may involve effortful processing for another (e.g., driving into a large city can be effortful for a tourist versus being rather automatic for a local) (Park and Gutchess 2000). Overall, although it may appear that older adults are engaging in substantial compensation for cognitive decline, an alternative explanation is that the tasks they complete everyday are fundamentally different than the tasks used in the lab that repeatedly demonstrate age-associated cognitive decline.

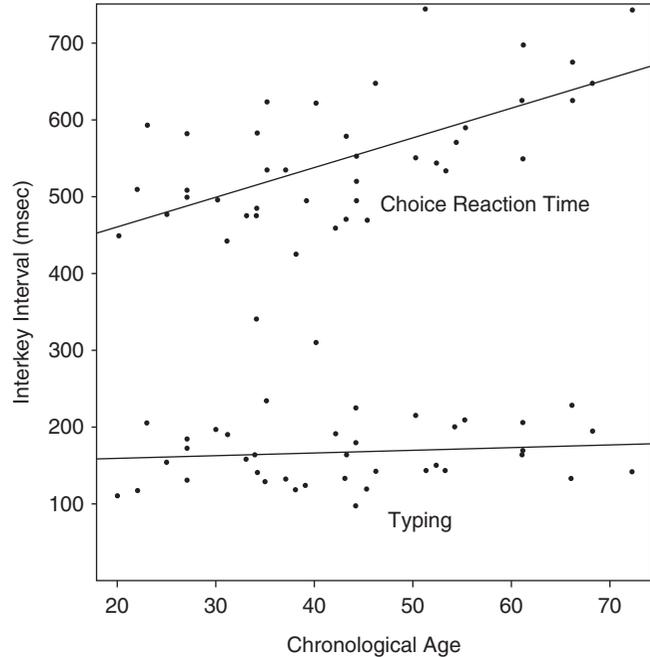
### Strategy Use and Task Modification

If necessary, cognitive compensation can also be achieved through explicit strategy use or modification of the task to accommodate cognitive decline. Possible internal strategies include rote rehearsal (e.g., repeating a name or word multiple times), mental imagery (e.g., recalling ingredients by picturing the finished dish one plans to make), method of loci (i.e., mentally placing items to be recalled in familiar locations, then “walking” through the location to assist in recalling the items), or mental retracing of past steps or events. However, older adults tend to be less likely to spontaneously use such strategies and continue to perform worse than younger adults even when instructed on how to use them (Cavanaugh and Blanchard-Fields 2011). Rather, it is common to rely on external aids such as lists, address books, calendars, notes, or smartphones to aid memory in everyday contexts. A well-known strategy is to use medication organizers or pillboxes to assist with medication adherence, although the efficacy of this aid is inconsistent (Bosworth and Ayotte 2009). Collaborative cognition, where two or

### Cognitive

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**Fig. 1** Interkey interval for choice reaction time and typing tasks across adulthood (Salthouse, TA. Effects of age and skill in typing. *Journal of Experimental Psychology: General*, 113(3), 345–371, 1984. American Psychological Association. Reprinted with permission)



more people work together to complete a cognitive task, can also be an aid in everyday life. This method can be particularly effective when the other person is one's family or friend as they can have a shared past and familiarity with one another that allows them to tailor their reminder cues to their partner (Rauers et al. 2011).

Extensive practice with the task at hand can also benefit older adults. For example, older adults who are given very large numbers of practice trials (i.e., at least 500) on attention-based tasks can perform just as well as younger adults (Cavanaugh and Blanchard-Fields 2011). Older adults may also simply need more time to complete a task, or perform their best when no time limits are imposed.

Individuals may also begin to approach the same cognitive task differently with age, allowing them to compensate for any possible declines in basic processing resources. Salthouse (1984) completed a seminal study demonstrating this phenomenon. Experienced typists between 17 and 72 years of age completed a range of typing-related tasks. As can be seen in Fig. 1, choice reaction time, a test of basic processing speed, was slower with age. However, even though typing presumably involves similar skill,

there was no correlation between age and typing speed. Rather, Salthouse determined that older typists had increased their anticipation span, or were looking farther ahead in the text to be transcribed, and this allowed them to compensate for their slower processing speed.

Similarly, having greater domain-specific knowledge (i.e., crystallized intelligence) for a task or being an expert appears to positively impact performance. Studies have evaluated expertise in a wide range of abilities, including flying, music, chess, bridge, graphic design, and the game of Go. In general, being an expert in a task appears to attenuate but not eliminate age effects on performance and only for tasks specific to the area of expertise (Hess 2005).

### Cognitive Plasticity and Training

Improving our cognitive performance despite age-related cognitive changes is another way cognitive compensation is possible. Cognitive plasticity refers to the idea that cognition can be trained or improved. In other words, our cognitive ability is not set in stone and can be changed or show growth over the lifespan.

Numerous studies have attempted to improve older adult's cognitive performance via intense

training or practice of various cognitive skills. One seminal investigation was the Advanced Cognitive Training for Independent and Vital Elderly (ACTIVE) trial, a multisite intervention that involved 2832 adults aged 65–94 years (Ball et al. 2002). Participants were randomized to receive training in either processing speed, reasoning, or memory ability over ten 60–75 min sessions over 5–6 weeks or were assigned to a control group. All training conditions involved strategy instruction and extensive practice, with tasks becoming more challenging over time. The training conditions involved the following: processing speed training focused on visual search skills, particularly when attention was divided; reasoning training focused on identifying the pattern in various real-life (e.g., travel schedules) and laboratory sequences (e.g., the next letter to appear in a series); and memory training involved recall for word lists, text, and stories, in terms of both real-life (e.g., shopping lists) and laboratory-like (e.g., recall a paragraph) tests. Immediately after the training period, participants who received the training sessions performed better on cognitive tests than the control group, but only in the same domain as the training they received (e.g., the memory training group performed better on memory tasks only). This demonstrated that cognitive ability can be improved in older age, but the training gains were task specific and did not generalize to other types of cognition. Impressively, the training gains were maintained even 10 years later for the speed of processing and reasoning groups (Rebok et al. 2014). Moreover, after 10 years participants in each training group reported less difficulty in completing tasks of everyday living. Therefore cognitive training not only resulted in immediate cognitive compensation but also extended to helping participants be more effective in their daily lives.

Despite the remarkable cognitive gains shown from the ACTIVE trial, the success of interventions that involve extensive practice of tasks or training of particular strategies is not entirely clear. In some studies, improvements are limited to the cognitive domains that were targeted (Ackerman et al. 2010; Owen et al. 2010), whereas other interventions do

find generalized improvement to untrained tasks (Schmiedek et al. 2010; Smith et al. 2009). Few studies evaluate intervention effects on everyday function, and the follow-up time of training studies is relatively short (i.e., mostly immediate posttest or months later), putting the durability of effects into question.

Another way to enhance cognitive performance is with interventions that involve increased activity rather than specific practice in cognitive tasks. For these interventions, stimulation is achieved via an intellectually and socially complex environment or particular activity (Park et al. 2007). Older adults who have been assigned to learn theater performance (Noice et al. 2004), competed in team problem-solving tournaments (Stine-Morrow et al. 2014), or participated in an intense elementary school volunteering program have shown significant gains on various cognitive tests (Carlson et al. 2008). Although the novelty of the activity may be relevant to instituting cognitive growth, it may be critically important as to whether the activity requires the acquisition of new skills or involves productive engagement (Park et al. 2007). This is in contrast to activities that rely only on existing knowledge or receptive engagement. Park and colleagues (2014) demonstrated the importance of this distinction by finding that older adults who learned to design and sew quilts, practice digital photography, or a combination of the two over a 3-month period improved on episodic memory tasks compared to those who were assigned to the two receptive engagement conditions. One condition provided only novelty but not skill acquisition (e.g., field trips), and the other involved traditional mental activities (e.g., completing puzzles).

The longevity of the cognitive changes resulting from engagement-based interventions is unclear, but these interventions have the potential of being more easily integrated into everyday life compared to those assigning cognitive training. However, given the documented cognitive growth from both methods, each method holds potential benefit. It remains to be seen if the two intervention techniques are only additive or if cognitive improvement can be maximized by introducing both techniques.

Finally, it is important to note that there also appear to be limits to the cognitive plasticity available to older adults. Although older adults do show cognitive gains from training and activity engagement, the magnitude of possible improvement is smaller than that for younger individuals (Nyberg 2005) even if this varies by cognitive domain (Schmiedek et al. 2010). Therefore, although one method of cognitive compensation may be to increase cognitive capacity via intensive training or engagement, it is unlikely that this method can completely rescind age-related cognitive declines.

### Cognitive Reserve

Another way cognitive compensation can occur is via cognitive reserve. The concept of cognitive reserve was created because there is not a direct relationship between the severity of neurological insult or disease and a person's level of cognitive functioning. Rather, individuals may continue to perform at a level higher than expected or show no obvious signs of neurological disease despite diagnosed pathology such as Alzheimer's disease. In other words, older adults appear to be compensating for neurological decline. Stern (2002) described cognitive reserve as the ability of the brain to maximize performance by either using neural networks more efficiently or recruiting alternate neural pathways or cognitive strategies. Cognitive reserve is also known as active reserve, in that the brain actively compensates for pathology, compared to passive brain reserve which is determined by brain volume or the number of synapses. Cognitive reserve is believed to be acquired by engagement in lifestyle activities and educational and occupational attainment. Individuals with more of these resources or reserve are consequently better able to tolerate higher levels of brain pathology before showing signs of clinical impairment (Stern 2002). Each of these potential sources of reserve and their link to cognition is briefly described.

It is well established that older adults who engage in more physical, social, and cognitive activities such as jogging, talking with friends, or playing board games perform better on cognitive tests than less active individuals (Hertzog

et al. 2009). Active older adults also have a reduced risk of developing dementia (Wang et al. 2006; Wilson et al. 2002). It is unclear whether lifestyle engagement slows the rate of age-associated cognitive change per se or simply increases cognitive ability level to a higher starting point and that advantage is maintained with age (Salthouse 2006; Bielak et al. 2014). The precise mechanisms for the association with cognitive performance are unclear and vary by activity domain (Bielak 2010).

It is hypothesized that physical exercise may increase blood flow to the brain, positively impact hormone levels, or increase synaptic connections. Moreover, those who frequently exercise are more likely to have other healthy lifestyle behaviors (e.g., adequate sleep and nutrition) and health status (e.g., healthy weight) that can have repercussions for their cognitive health. Social engagement can enhance emotional well-being through decreasing stress and providing opportunities for instrumental and emotional support which can decrease the physical toll on the body and brain. Finally, stimulating cognitive activity may be neurologically beneficial by increasing cerebral blood flow, increasing the number of synapses, or allowing optimal neurochemical compositions. Exposure to cognitive activity may also produce a feedback loop that encourages further engagement in similarly challenging environments and activities. The environmental complexity hypothesis also proposes that exposure to complex environments offer opportunities for intellectual flexibility and practice that in turn enhance cognitive performance (Schooler and Mulatu 2001).

Greater years of formal schooling are also associated with less cognitive decline compared to those who receive fewer years of education, but the relation appears to vary by cognitive domain (Kramer et al. 2004). Low levels of education are a well-established risk factor for Alzheimer's disease, but higher levels do not appear to attenuate the rate of cognitive change (Zahodne et al. 2011; Wilson et al. 2009). Greater exposure to formal education settings would provide high levels of cognitive stimulation, and highly educated individuals are likely more confident completing tasks that challenge their cognitive skills and may seek

out similar environments. Educational attainment is also highly correlated with socioeconomic status, and individuals with greater education are more likely to partake and experience other activities known to be beneficial for cognitive health including good nutrition, holidays to relieve stress, and knowledge of healthy lifestyle behaviors. Consequently, it is unclear to what extent education per se is influencing cognitive reserve versus other related factors.

The complexity of the tasks one completes in their occupation has been linked to cognitive performance. Those who worked in occupations that had greater environmental complexity, or an environment that involved diverse stimuli, having to make many decisions and having to make decisions that had many factors and contingencies showed greater intellectual functioning in older adulthood than those whose paid work was not substantively complex (Schooler et al. 1999). Specifically, it may be greater complexity with people (e.g., mentoring compared to taking instructions or serving) and data (e.g., synthesizing compared to copying or comparing) at work that is associated with better cognitive performance (Andel et al. 2015) and reduced risk of dementia (Andel et al. 2005). Similar to the effects associated with educational attainment, occupation is associated with many other factors that may also indirectly affect cognition (e.g., nutrition, exercise).

Cognitive reserve acts to boost cognitive ability by allowing the brain to be better able to compensate for impending or already existing declines in functioning. However, the various sources of cognitive reserve may not be purely additive. Rather, the potential gains may be modest when multiple other sources of reserve have already been acquired. For example, the benefit of completing complex work was no longer significant to late-life cognition when participation in social activities was also high (Andel et al. 2015).

## Conclusion

Compensation for age-associated cognitive decline is possible in various ways. Some of the

methods involve explicit compensatory techniques or training, while others are achieved indirectly through participation in other activities or passive reliance on other skills. Despite these various sources, older adults do not appear to be able to achieve the same level of performance on cognitive tests as younger adults. However, the relevance of this limitation is negligible given that age-associated cognitive decline does not have a significant negative impact on everyday life for older adults.

## Cross-References

- ▶ [Aging and Strategy Use](#)
- ▶ [Behavior Modification](#)
- ▶ [Cognitive and Brain Plasticity in Old Age](#)
- ▶ [Everyday Cognition](#)
- ▶ [Expertise and Ageing](#)
- ▶ [Memory Training Methods and Benefits](#)
- ▶ [Plasticity of Aging](#)

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## Cognitive Control and Self-Regulation

Hannah Schmitt<sup>1</sup> and Jutta Kray<sup>1,2</sup>

<sup>1</sup>Saarland University, Saarbrücken, Germany

<sup>2</sup>Department of Psychology, Saarland University, Saarbrücken, Saarland, Germany

### Synonyms

Executive control; Self-control

Cognitive control and self-regulation are key determinants of goal-related behavior and known to be highly susceptible to increasing age. This entry provides an overview about new insights into the geropsychology of cognitive control and self-regulation. In two sections, each concept is briefly defined in combination with existing knowledge about their neuronal underpinnings. Then, empirical evidence on age differences in cognitive control and self-regulatory abilities as well as on how these can be improved by cognitive interventions will be summarized.

### Definition of Cognitive Control

The term *cognitive control* refers to a set of higher-order processes that regulate basic sensory, motor, and cognitive operations for planning, guiding, and coordinating goal-directed behavior in everyday life (Miller and Wallis 2009). As these higher-order cognitive processes are assumed to

allow pursuing internal goals and flexibly adapting to external changes, cognitive control is regarded as being critical to intelligent behavior.

Evidence from cognitive neuroscientific studies suggests that the mechanism of cognitive control can be attributed to a distributed brain network with the prefrontal cortex (PFC) taking a critical role. Due to its extensive connectivity, the PFC seems to be strongly activated whenever multimodal information from sensory and motor systems and subcortical structures needs to be integrated and maintained in a highly accessible state (Miller and Wallis 2009). Specifically, this PFC activation ensures the maintenance of goal-related information against distraction and serves the top-down guidance of neuronal activation in other brain areas required for the execution of controlled behavior. Advancing age is characterized by a marked neuronal deterioration particularly affecting the integrity of the PFC (Raz 2005). This neuronal alteration in the healthy aging brain has been linked to a pronounced decline of performance in tasks assessing cognitive control processes.

### Age Differences in Components of Cognitive Control

Researchers suggested three key components of cognitive control that are assumed to be interrelated but separable abilities: (1) the updating and monitoring of working memory (WM) representations, (2) the inhibition of predominant response tendencies, and (3) the flexible switching between cognitive tasks (Buitenweg et al. 2012). At the theoretical level, aging researchers investigating cognitive control aimed at determining whether age differences in these abilities reflect process-specific limitations or whether they can be explained by age differences in one single general factor reflecting age-related changes in speed of cognitive processing (Kray and Eppinger 2010). At the applied level, aging researchers become more and more interested in assessing the extent to which these abilities can be improved by cognitive interventions (Kray and Ferdinand 2014).

In the following, evidence on both levels will be reviewed for each of the three key components of cognitive control.

**Working Memory.** There is now ample empirical evidence that WM is a crucial determinant of age differences in cognitive control. In its traditional conceptualization, WM includes domain-specific buffers for short-term storage of visuospatial and verbal information along with central executive processes that monitor and manipulate the storage contents in the service of controlled, goal-directed operations (Hale et al. 2007). The large number of existing WM tasks distinguishes tasks that measure storage capacity, generally termed simple-span tasks (Reuter-Lorenz and Jonides 2007), from tasks that assess both storage capacity and central executive processing, generally termed complex-span tasks. For instance, digit-span tasks can be classified as simple-span tasks. They are assumed to assess the individuals' ability to actively store a number of visually or auditorily presented items and to recall them in the correct order. In contrast, complex-span tasks assess not only storage processing but also the manipulation of the stored information or the processing of a secondary task (Reuter-Lorenz and Jonides 2007). For instance, reading-span tasks require the processing of a sequence of sentences and deciding for each sentence whether it is meaningful or not. At the same time, individuals have to encode the final word of each sentence and to remember these until the end of the task (Reuter-Lorenz and Jonides 2007).

Researchers investigating age differences in simple-span tasks found a differential decline in the performance on visuospatial and verbal WM tasks in older relative to younger adults, indicating larger deficits in visuospatial relative to verbal WM tasks (Hale et al. 2007). Other studies show that age differences are even more pronounced in complex-span tasks, tapping both storage and executive processes, than age differences in storage measures per se. While some researchers tried to separately investigate storage and executive processes of WM in order to identify process-specific limitations in old age, others argued that this separation is artificial, as even storage tasks

might require executive control processes, particularly in older adults (Reuter-Lorenz and Jonides 2007). Evidence for this view comes from studies using functional magnetic brain imaging (fMRI) data. Older adults recruit regions of the PFC associated with cognitive control even in simple storage tasks, while these brain regions are not significantly activated in younger adults. These findings suggest that the recruitment of the PFC serves as a compensatory mechanism to maintain good performance in older adults, as assumed by the *Compensation-Related Utilization of Neural Circuits Hypothesis* (CRUNCH) (Reuter-Lorenz and Jonides 2007). However, as task complexity increases, and thereby the demands on executive control, older adults perform poor on WM tasks because their control processes are already taken up by lower storage demands (Reuter-Lorenz and Jonides 2007).

It is now well known that age differences in WM tasks are particularly pronounced with increased cognitive control demands. A critical question from an applied perspective is whether WM can be improved by cognitive interventions even in elderly individuals. In the last decade, a variety of training studies aimed at improving WM performance by means of computerized training programs (Klingberg 2010). These programs often used adaptive training schedules to optimally adjust training demands to individuals' performance levels. Results of these studies indicate that a variable amount of training on visuospatial and verbal WM tasks results in considerable training gains not only in the trained task but also in closely related but untrained WM tasks (Buitenweg et al. 2012; Klingberg 2010). Less consistent evidence is reported on the extent to which these training gains can be maintained over a longer period of time and can be generalized to other cognitive tasks (Buitenweg et al. 2012; Klingberg 2010). These inconsistencies might be due to differences in the duration of the training interventions as well as in the type of training. For instance, it has been shown that practice of explicit memory strategies leads to WM improvements in older adults, but these strategies are not easily transferred to other memory tasks. In contrast, adaptive, process-oriented WM training sometimes also leads

to performance gains in other cognitive tasks (Buitenweg et al. 2012).

**Inhibition.** Pronounced age differences have also been demonstrated in cognitive control tasks requiring the ability to inhibit irrelevant responses and predominant actions (Buitenweg et al. 2012). One frequently used task to measure the efficiency of inhibition processes is the Stroop task (Kray and Eppinger 2010). This task consists of color words either printed in a compatible color (i.e., “red” printed in red ink) or in an incompatible color (i.e., “red” printed in blue ink) (Kray and Eppinger 2010). Subjects are usually instructed to perform the less-practiced color naming and to inhibit the more-automatized reading of the word meaning. Results typically show longer reaction times and larger error rates in cases in which the word reading interferes with the color naming, that is, on incompatible stimuli relative to compatible ones. This so-called Stroop interference effect is usually larger in elderly adults than in younger adults. Results from a meta-analysis suggest that the larger Stroop interference effect in older adults can be fully explained by age differences in general speed of processing as a general underlying factor (Kray and Eppinger 2010) and not by specific limitation in inhibitory processing. However, when the demands on controlled processing are increased, for instance, by manipulating the frequency of trials on which subjects have to inhibit automatic responses, older adults tend to show larger deficits in inhibitory control than younger adults. The greater need to flexibly recruit cognitive control on less frequent conflict trials, inducing higher demands on cognitive control, lead to pronounced impairments in inhibition tasks in the elderly, similar to the reported findings on age differences in WM tasks (Kray and Eppinger 2010).

Despite the existing age-related decline in measures of inhibition, studies that aim to enhance inhibitory control in old age are lacking (Buitenweg et al. 2012), although there is some evidence for practice-related improvement in the Stroop tasks in older adults. Whether these training gains also transfer to other inhibitory control tasks or even to improvements in other measures of cognitive control remains to be examined (Buitenweg et al. 2012). It has also been

suggested that older adults show better inhibitory control in the morning than in the evening, based on circadian arousal patterns for inhibitory processes that predominantly peak in the morning in the elderly (Hasher et al. 2007). In addition, there are some first results indicating that physical fitness is linked to better inhibitory control that is explained by increased prefrontal oxygenation. In this regard, it has been shown that 8 weeks of moderate aerobic training can improve performance on an inhibition task in older adults (Berryman et al. 2014).

**Task Switching.** Age differences in cognitive control are also obtainable in tasks assessing the flexible switching between task rule representations. In these types of tasks, subjects are required to alternate between two or more simple categorization tasks such as deciding whether a stimulus belongs to the category of fruits or vegetables (picture task) or whether it is gray or colored (color task). Results of a meta-analysis on age differences in task switching show larger general (or global) switching costs in older than younger adults when two tasks are performed in an alternating order on a task-switching block relative to performance on a single task block (also termed mixing costs) (Kray and Ferdinand 2014). These age-related deficits seem to map on age differences in WM as a key determinant of cognitive control, as age differences in the implementation of a task switch within a task-switching block, termed specific (or local) switching costs, are less pronounced than age differences in general switching costs (Kray and Ferdinand 2014). Importantly, age effects in these costs remain reliable after controlling for age differences in processing speed, suggesting process-specific limitations in the ability to maintain and select task sets.

Further evidence for this view comes from aging studies measuring the neuronal activity during task preparation and response selection by means of fMRI and event-related potential (ERP) data. For instance, if the upcoming task in a task-switching paradigm is announced by a preceding task cue, changes in neuronal activity suggest that older relative to younger adults tend to update the appropriate task representations in

WM after task-cue presentation all the time, even if not required, i.e., when the response rules are exactly repeated compared to the previous task. Moreover, older adults seem to recruit a larger proportion of the PFC than younger adults even in single task blocks in which no task switching is required. Similar to age differences in WM, this finding may reflect that older adults tend to compensate for difficulties in maintaining task rule representations by activating a larger network of prefrontal brain areas (Kray and Ferdinand 2014). Together, the results of task-switching studies favor process-specific limitations, as behavioral and psychophysiological measures suggest age differences in the representation and selection of task goals in WM that cannot be attributed to processing speed as a single underlying factor. In contrast, the switching process itself seems to be relatively preserved in old age (Kray and Ferdinand 2014).

Despite these age-related limitations, recent intervention studies revealed substantial plasticity in task-switching abilities among older adults (Buitenweg et al. 2012; Kray and Ferdinand 2014). Strategy-based interventions, for instance, employed labeling strategies such as verbalizing the next task to promote the planning and preparation of the upcoming task switch and thus to facilitate goal-directed behavior. Results on these kinds of interventions show a substantial benefit of verbal self-instructions on switching costs particularly in older adults, indicating language processes to offer a promising approach to support action control in old age (Kray and Ferdinand 2014). Process-based interventions aim to enhance cognitive control by the practice of the underlying cognitive control processes involved in task switching. Recent studies reported a considerable reduction in switching costs for younger as well as older adults, indicating substantial potentials to improve switching ability (Buitenweg et al. 2012). Both age groups also showed larger performance gains in an untrained but structurally similar switching task, and these gains were even more pronounced in the older than in the younger age group. Importantly, training gains also generalized to untrained cognitive

control task (e.g., inhibition, WM (Kray and Ferdinand 2014)), suggesting the training of cognitive control processes, and in particular, the training of maintaining and selecting (biasing) of tasks as required in dual-task-like situations is a promising approach to induce broader transfer to other cognitive domains (Buitenweg et al. 2012; Kray and Ferdinand 2014).

### **A Theoretical Framework for Explaining Age Differences in Cognitive Control**

In sum, age-related differences in cognitive control have been shown in WM, inhibition, and switching tasks. Recently, the dual mechanisms of control (DMC; Braver et al. 2007) theory proposes that age differences in all of these tasks can be explained by age differences in one common mechanism, namely, the ability to process context information. Context information is described as the internal representation of task-relevant information such as rules, goals, or instructions within WM that is maintained and updated to serve controlled, goal-related behavior. Within this framework, context processing relies on the interaction between the dorsolateral PFC (DL-PFC) and the midbrain dopamine (DA) system. More precisely, sustained neuronal activity of the DL-PFC provides the online maintenance of context information in order to bias the activity in posterior and subcortical brain regions responsible for goal-related behavior in accordance with the current context representation. At the same time, phasic DA projections toward the DL-PFC in response to new, salient, or reward-predicting context cues are proposed to act as a gating mechanism, i.e., ensuring the appropriate updating of context information in the DL-PFC (Braver et al. 2007). Hence, sustained activity within the DL-PFC ensures the stability of goal-directed behavior against distraction, whereas the DA-guided gating mechanism simultaneously allows for the flexible adaptation to changing task demands. Given the well-known age-related neurobiological changes observed in the PFC and the midbrain DA system, deficits are expected in both the active maintenance and the

gating of new context information that in turn impairs performance on a variety of cognitive control tasks. For instance, the active maintenance of task-relevant context information serves to protect information against interference, and disturbances therein particularly affect WM capacity. In a similar vein, deficits in actively maintaining context representations may also impair the ability to inhibit predominant response tendencies, as the maintenance of a contemporary task rule is thought to enable the activation of a weaker, task-relevant response against a stronger but task-irrelevant response. Finally, phasic DA responses to the DL-PFC indicating the need for updating context representations are particularly important in task switching. Therein, context information represents the currently relevant task rule, and deficits in the gating mechanism might impair the updating and flexible attention shifting between cognitive tasks. These examples outline that instead of separating age differences in cognitive control into a decline of subprocesses such as WM, inhibition, and attention shifting, the DMC theory considers age differences in the neurobiological basis of context processing to be fundamental to account for age deficits in subcomponents of cognitive control (Braver et al. 2007).

Recent behavioral and neuroscientific studies on testing the assumptions of the DMC theory show that changes in the interplay between the PFC and the DA system inherent to healthy aging predominantly affect the time course of updating context information. Younger adults exhibit an early, proactive manner of context updating by the time context information is presented and hence update context information to prepare for an upcoming task in advance. In contrast, older adults show a late, reactive manner of context updating, only when needed such as when interference is detected in a reactive fashion (Braver 2012). While the temporal shift of context updating in a pro- versus reactive manner with increasing age has been supported on the basis of fMRI and ERP data (Braver 2012; Schmitt et al. 2014), age differences in maintaining context information have revealed mixed results and seem to occur only under specific task conditions. However, the DMC theory is promising as

temporal differences in context updating seem to account for age differences in inhibition, WM, and task shifting that are often regarded as separable components of cognitive control (Braver et al. 2007).

Age-related differences in context updating have been shown to be susceptible to different training regimes. In two training studies, the AX continuous performance task (AX-CPT, Braver 2012) was applied in order to measure an individual's ability to process context cue information required for correct responding to a subsequent probe stimulus. It has been demonstrated that both extended practice and directed strategy training toward the use of cue-based, proactive control in the AX-CPT reduced context processing deficits in older adults, indicating process- and strategy-based interventions to benefit context updating in old age. Moreover, the behavioral improvements in the AX-CPT in older adults were accompanied by increased PFC activation to the presentation of contextual information (Braver 2012). These results correspond to a recent training study showing training-related alterations in PFC activity to underlie the transfer of training gains to untrained cognitive control tasks (Bamidis et al. 2014). In this study, older adults performed an adaptive multitasking video game training offering a large stimulus variability and continuous feedback. The multitasking approach in particular encompassed the need for resolving task interference in the dual-task situation. Training gains were larger after multitask training than after training both tasks in isolation, transferred to other untrained cognitive control tasks such as WM and attention, and remained stable at a follow-up measurement 6 months after the training. Moreover, robust correlations between multitasking ability and changes in activation patterns of the PFC predicted the transfer gains to the untrained cognitive control tasks. Hence, process-based training interventions, such as multitasking training, that aim at improving cognitive control can result in alterations of the neuronal recruitment of the PFC in elderly individuals that may also generalize to other cognitive tasks relying on cognitive control networks (Bamidis et al. 2014).

## Definition of Self-Regulation

The concept of *self-regulation* refers to the individual control of own actions, thoughts, and emotions toward the achievement of desired outcomes and intentions (Bauer and Baumeister 2011). It is very loosely defined and considered as a conglomeration of abilities, consisting among others the capability to override automatic habits, basic affects, and impulses, to control and monitor performance, to achieve distal aims, and to resist short-term temptations to the benefit of long-time goals. Accordingly, failures of self-regulatory ability affect both flexible behavior and social adaptation that can be observed in a broad range of psychological phenomena such as gambling, addiction, eating disorders, underachievement, prejudice, aggression, and so on (Bauer and Baumeister 2011).

In general, self-regulatory processing is considered as a system of feedback loops in which individuals concurrently monitor the discrepancy between the actual behavioral outcomes and feedback and the individuals' goal and intentions (Bauer and Baumeister 2011). Whenever there is a discrepancy, individuals automatically or consciously engage in self-regulatory abilities to minimize the discrepancy until the goal is achieved. Hence, similar to the concept of cognitive control, self-regulation is highly important to adaptive, goal-directed behavior (Bauer and Baumeister 2011). For instance, it has been shown that individuals with better cognitive control ability, such as higher WM capacity, also tend to show better self-regulatory skills, such as less mind-wandering or more resistance toward the temptation of eating candy (Hofmann et al. 2011).

## Neuronal Underpinnings

Recent research has also identified subprocesses of cognitive control to play an important role in the mechanisms of self-regulation (Wagner and Heatherton 2011), in particular the self-control aspects of self-regulation. This view is supported by evidence that akin to the mechanisms of cognitive control, a broader range of self-regulatory

abilities depend on a network of specialized prefrontal brain regions, including the lateral PFC (L-PFC), the ventromedial PFC (VM-PFC), and the anterior cingulate cortex (ACC) (Wagner and Heatherton 2011). The L-PFC is highly related to other prefrontal regions, especially to motor cortices, the VM-PFC, and the ACC, and is assumed to contribute to the mere self-control processes involved in self-regulation, such as inhibiting inappropriate behaviors, maintaining multiple goals in WM and flexibly selecting between them, dealing with distraction, and carefully planning the sequence of goal-directed actions (Wagner and Heatherton 2011). In contrast, the VM-PFC is highly connected to subcortical structures involved in affective processing (e.g., the amygdala, the hypothalamus, the insula, and the ventral striatum). Therefore, the VM-PFC is seen to be particularly important for regulating affective and appetitive processes and adapting to social norms (Wagner and Heatherton 2011). This assumption has been supported by case reports showing patients with damage to the VM-PFC to exhibit drastic personality changes such as aggressive, socially inhibited behavior and a particular inability to respect social norms (Wagner and Heatherton 2011). Despite their functional differences, both the L-PFC and the VM-PFC are interconnected with the ACC that shares many connections with subcortical (e.g., the ventral striatum) and motor regions. Patient studies show that due to its close connection to motor cortices and subcortical structures involved in reward processing, damage to the ACC may result in general apathy, loss of motivation or interest, and an inability to generate behavior (Wagner and Heatherton 2011). Moreover, given its anatomically strategic position, neuroscientific research regards the ACC as a neuronal correlate of a conflict detection mechanism, signaling the need for increased control toward the L-PFC whenever performance errors are detected. This role closely reflects the conceptualization of self-regulation as a system of feedback loops (Wagner and Heatherton 2011).

The strong anatomical and functional overlap between control processes (e.g., inhibition of temptations and automatic behaviors) attributable

to both the concepts of cognitive control and self-regulation has led to systematic investigations of their interaction. In the *Strength Model of Control and Depletion* (Bauer and Baumeister 2011), it has been argued that these control processes depend on a limited, domain-general physiological resource that – once depleted – results in impaired performance on task relying on this resource. Dieters, for example, whose resource for self-regulatory control on eating behavior was stressed by inhibiting temptation from nearby food, showed impaired performance not only in a subsequent task on self-regulation (i.e., eating ice cream) but also on a cognitive control task (i.e., WM) relative to non-dieters and dieters whose self-regulation was not additionally depleted by tempting foods (Bauer and Baumeister 2011). Likewise, participants who were required to take part in a difficult cognitive control task (i.e., attentional control) showed impaired self-regulatory control (i.e., emotion regulation) compared to control participants who did not complete the cognitive control task (Wagner and Heatherton 2011).

### Age Differences in Self-Regulation

Age-related deficits in self-regulation have been strongly associated with impairments in cognitive control and in particular with impairments in inhibitory control (Von Hippel and Henry 2011). On the one hand, due to a failure to inhibit and control automatically activated thoughts and temptations, older adults seem to express more social stereotypes (i.e., race-related prejudices), exhibit more socially inappropriate behavior (i.e., talking about private issues in public and generating gratuitous comments), and engage more in risky gambling (i.e., larger perseverance in the absence of reward) than younger adults (Von Hippel and Henry 2011). Interestingly, individual differences in inhibitory deficits (as measured with standard cognitive control tasks) seem to directly mediate the extent of self-regulatory failure in older adults (Von Hippel and Henry 2011). Moreover, these inhibitory deficits have been shown to be sensitive to circadian

rhythms, with smaller deficits obtained in the morning than afternoon based on biological changes in the underlying neuronal resource. Therefore, older adults showed more risky gambling and socially inappropriate behavior when they were tested in the afternoon relative to when the experiment took place in the morning (Von Hippel and Henry 2011). On the other hand, evidence exists that older adults are able to manage self-regulatory deficits and inhibit expressing stereotypes or inappropriate behaviors when they are aware of it. For instance, if older adults are forewarned about an upcoming, irrelevant stereotypical situation or if they know beforehand that they have to suppress a socially inappropriate action later on (Von Hippel and Henry 2011), they do not differ in the appropriateness of their behavior relative to younger adults. This suggests that older adults may prepare for potential inhibitory control deficits, and hence, can exert conscious control over their self-regulatory abilities.

Furthermore, there are also findings suggesting *increased* self-regulatory skills in older adults than in younger adults (Von Hippel and Henry 2011). For instance, in the domain of emotion regulation, it has been shown that older adults focus more on positive than negative or neutral information in order to voluntarily enhance their emotional well-being. This phenomenon, known as the *age-related positivity effect* (Mather 2006), has been explained in the framework of the *socio-emotional selectivity theory* (Mather 2006). This theory posits that personal goals have to be regarded within future time constraints. In the case that individuals value future time horizons as enduring, they will focus on goals related to the future, such as gaining knowledge. In contrast, if individuals recognize future time as restricted, just as it occurs in older age, they will focus on immediate, meaningful goals, such as emotional regulation and gratification (Mather 2006). Accordingly, relative to younger adults, older adults expressed higher emotional stability and skills of emotion regulation, showed more effective social problem-solving, focused more strongly on positive relationships with others, and reported less self-conscious negative emotions (Mather 2006). Similar to the controlled

compensation of inhibitory deficits, the age-related positivity effect seems to be more pronounced when older adults are forewarned and for older adults with better cognitive control ability. In contrast, when cognitive load is increased or cognitive control abilities are impaired as in pathological aging, older adults are less able to invest in controlled processing of emotional information and the positivity effect vanishes (Mather 2006).

Apart from the stable or even improved ability of emotion regulation in the elderly, there are only a few studies that have investigated whether self-regulatory skills can be improved by cognitive interventions. These studies show that already a limited amount of practice in self-regulatory control, for instance, by controlling eaten food or engaging in regular physical exercises, is able to translate into improvements in key aspects of self-control in laboratory tasks and also transfers to self-regulatory skills in everyday life (e.g., decreased consumption of cigarettes, alcohol, and unhealthy food) (Bauer and Baumeister 2011). So far these studies have mainly been conducted in younger or middle-aged individuals and largely neglected the effect of self-regulatory practice in older adults (Hofman et al. 2012). However, given existing evidence for self-regulatory failures in old age (e.g., problematic gambling), it might be especially important to create successful self-control trainings and to investigate any potential transfer to measures of self-regulation in this age group. In this respect, it is also interesting to note that improvements in self-control have been demonstrated via training of cognitive control functions. In a study on middle-aged problem drinkers, WM training transferred to self-regulatory improvements, i.e., reduced alcohol consumption for more than 1 month after training (Hofman et al. 2012). Given the functional relationship between cognitive control and self-regulation, these improvements may draw back on the underlying neuronal process resource common to cognitive control and self-regulation. Thus, as cognitive interventions have already demonstrated significant potential to improve different facets of cognitive control in old age (see previous section on

cognitive control), future research studies in older adults might investigate whether and to what extent these interventions are able to transfer to self-regulatory skills. Finally, these studies might also turn to training-related changes in the underlying brain network of self-regulation and cognitive control.

## Summary

There is now accumulated evidence for age-related limitations in cognitive and self-regulatory control that are associated with alterations in different underlying neuronal networks. Age differences in cognitive control occur in tasks requiring high demands on WM, inhibitory control, and task switching that can be explained by a recent neurobiological theory on context processing. Age differences in self-regulation primarily concern self-control, while emotion regulation is relatively preserved. Intervention studies have revealed considerable plasticity in cognitive control in elderly individuals, while the potential benefit of training in self-regulation is not known yet. Given that cognitive control and self-regulation partly rely on similar neuronal networks, it will be an important challenge for future research to determine whether training in either of these abilities will lead to improvements in the corresponding other one.

## Cross-References

- ▶ [Age-Related Positivity Effect and Its Implications for Social and Health Gerontology](#)
- ▶ [Executive Functions](#)

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## Cognitive Dissonance and Aging

Joel Cooper and Yaritza D. Perez-Hooks  
Princeton University, Princeton, NJ, USA

### Synonyms

Inconsistency; Inconsistency resolution

### Definition

In its original definition, cognitive dissonance is a state of arousal caused by having co-occurring cognitions such that one follows from the obverse of the other. Dissonance is experienced as an unpleasant tension-like state and needs to be reduced. A cognition is an individual piece of knowledge about the world or about one's internal states.

## Cognitive Dissonance

Cognitive dissonance is a ubiquitous aspect of human social life. Introduced into the scientific literature by Leon Festinger (1957), the concept was defined as a state of arousal caused by inconsistency among a person's cognitions. In Festinger's view, people abhor inconsistency. When faced with discrepancy among cognitions, people experience a motivation akin to hunger or thirst. It is an uncomfortable drive-like state that we are motivated to reduce. We resolve our inconsistencies in myriad possible ways that are designed to alleviate the tension state and restore equanimity.

Festinger (1957) offered a set of hypothetical examples that helped to describe some of the circumstances that might lead to the arousal of dissonance. Among those circumstances are choosing to smoke when you know that smoking is damaging to your health, making a statement contrary to your true opinions, choosing one commodity or action from a set of attractive alternatives, holding an opinion that is inconsistent with more general values or opinions, or observing events that are inconsistent with past experience.

Despite our preference for consistency, there are numerous times in our daily lives in which we are confronted with a set of inconsistent cognitions. Because the perception of inconsistency leads to an uncomfortable state of arousal, we have developed ways to reduce the inconsistency. We may respond to inconsistency by changing a cognition to make it fit with other cognitions we hold. We can also change the importance of a cognition or act to avoid noticing the inconsistency altogether.

Aging may affect the dissonance process. At the very least, the cognitions that people find to be important change with age. Young children may be invested in the toy they are allowed to choose; young adults may be profoundly affected by the cost of attending university; older adults may be most interested in the types of leisure activities they can choose or the age of retirement from their careers. More profoundly, changes in memory and emotional processes may also affect the quality and magnitude of dissonance arousal, and

changes in mental and physical health status may also affect the way that dissonance is experienced in people's lives.

The plan of this entry is to describe the basic tenets of cognitive dissonance theory and the focal areas that have received the preponderance of research attention. Alternative formulations of dissonance will be examined as will the accompanying evidence for those alternatives. Changes in mental processes and brain activities that characterize passage into older age will be presented along with a discussion of the ways that such changes affect the arousal and reduction of cognitive dissonance.

### Cognitive Dissonance as Function of Choice

Our lives are replete with choices. We choose a breakfast cereal to begin the morning, we choose the clothes we put on, and, possibly, we choose the means of transportation we use to shop or go to work. If we have been fortunate in our lives, we have chosen the job we currently have or the school that we attended. What is little noted in all of these choices is the fact that choices create the conditions for the arousal of cognitive dissonance. Imagine a couple that has recently retired and decided to change their living accommodations from a private home to a retirement community. They have narrowed their choice to two facilities that they view as highly attractive. One community offers excellent recreational activities but comes at a steep cost. Another may have a dearth of recreational facilities but has excellent food and costs appreciably less. The choice is an important one for it has implications for future lifestyle and happiness.

Cognitive dissonance theory predicts that these retirees will experience cognitive dissonance as soon as they decide which facility to join. Prior to the choice, the many facets of the decision were examined carefully and objectively. In the pre-decision period, people try to make the very best decision possible and consider their options without bias. However, once the decision is made, then every attractive feature of the unchosen alternative stands in contradiction to the choice that was made. So, too, does every unattractive feature of the chosen alternative. For example, if the

retirees decide to join the facility that had the best recreational activities, they will be comforted by the fact that recreation – as well as all other positive features of this choice – fit with their decision. They can envision hours on the treadmill, or the golf course. On the other hand, the cost of the facility will make it less feasible for them to travel for holidays or family visits. Moreover, by choosing the facility with the better recreational activities, the couple will not be able to savor the excellent meals at the second facility.

Cognitive dissonance theory predicts that, once having made a choice, all of the consequences of that choice that are inconsistent with the selected alternative become grist for the dissonance process. The perception of inconsistency – for example, foregoing the excellent food at the rejected community and paying the steep price at the chosen community – creates the aversive feeling state of cognitive dissonance. In order to reduce the aversive state of dissonance, the couple is motivated to reevaluate the components of their decision in order to support the conclusion they came to. They can decide that they did not really want to be saddled with the burden of having to go to the rejected community's elaborate dinners and that traveling is not a highly prized activity after all. They might also engage in selective memory by recalling all of the consequences consistent with their choice while forgetting those that are inconsistent. In the end, dissonance theory predicts that the couple will become more satisfied with their choice than they were when they made their selection. In brief, the inconsistency created by making a difficult choice between alternatives arouses the uncomfortable tension state of dissonance. In order to reduce dissonance, the chosen alternative is seen as more attractive and the rejected alternative becomes less attractive. This is known as the "spreading of alternatives," one of the signature predictions of cognitive dissonance theory.

Numerous laboratory studies have supported this prediction (Cooper 2007). In the first empirical investigation of the consequences of free choice, Brehm (1956) asked adult consumers to rank a number of appliances in terms of how attractive they would be to own. The consumers were

then given an opportunity to select one of two highly attractive items. The choice was a difficult one because the items had been ranked similarly in attractiveness. Brehm found that, following the choice, the participants came to feel that the item they had chosen was even more attractive than it had been prior to the choice and the item they had rejected was rated as less attractive. The spreading of alternatives following a choice has been replicated with children and adult participants and is robust across cultures (Cooper 2007).

### **Cognitive Dissonance and Induced Compliance**

Induced compliance is the name given to the social situation in which someone is induced to argue for a position that is contrary to the person's own beliefs. In the first experiment of its type, Festinger and Carlsmith (1959) asked participants to engage in a performance task in the laboratory that was designed to engender a negative attitude. It was tedious, boring, and apparently without purpose. Participants were then induced to lie to a person who was waiting to take part in the experiment. They were asked to convince the alleged next person that the performance task was fun, engaging, and enjoyable. Because the statement was clearly contradictory to the participants' attitudes, it aroused cognitive dissonance. In order to reduce the arousal of the unpleasant tension state, participants changed their attitudes to make them more consistent with their behavior – that is, they came to agree that the task was interesting.

Dissonance has a magnitude (Festinger 1957). People who hold cognitions that are incompatible can experience dissonance to different degrees. Some of the variance is due to individual differences in tolerance for inconsistency (Cialdini et al. 1995). Most of the research on the magnitude of dissonance, however, has focused on situational differences in the inducement for counterattitudinal behavior. For example, asking people to make a counterattitudinal statement for a small, or no, incentive creates more dissonance than making the same request for a substantial incentive. Festinger and Carlsmith predicted and found that making attitude-discrepant speeches in

return for a small incentive (\$1) created more attitude change than making attitude-discrepant speeches for a large incentive (\$20).

The situation that Festinger and Carlsmith employed in their research was well controlled but somewhat artificial. Enjoyment of a specific laboratory task is not a concern in most people's lives. Nonetheless, there are instances in people's lives in which they may find themselves advocating positions that they do not fully endorse and these may lead to the arousal of cognitive dissonance. Imagine that a special interest group hires a retiree to advocate for privatization of a pension or retirement system. Although the retiree does not endorse privatization, he consents to advocate on behalf of this plan. Consistent with dissonance theory predictions, the retiree is likely to change his attitude in favor of privatization. The less he is paid for his advocacy, the greater the dissonance and the greater the attitude change in favor of the privatization plan.

Empirical research has supported the prediction that people change their attitudes toward important issues that affect their lives. People have been induced to change their attitudes about banning controversial speakers, students have changed their attitudes toward raising tuition, and taxpayers have changed their attitudes about raising taxes after being induced to make statements contrary to their attitudes. And, as in the laboratory, the less the incentive, the greater the dissonance and the more the attitude change (Cooper 2007).

An additional feature of the induced compliance situation critical for the maximization of dissonance is that the attitude-discrepant behavior must lead to an unwanted consequence. If a retiree makes a statement advocating privatization of pension plans, the statement will lead to dissonance if there is a consequence to his behavior. The likelihood that someone will be convinced by the counterattitudinal statement facilitates maximal cognitive dissonance and will lead to attitude change.

### Effort Justification

People often engage in effortful activities in order to achieve a goal. In the literature on effort

justification (Aronson and Mills 1959), effort is considered to be any activity that is difficult and unpleasant or would otherwise not be engaged in. Imagine that a person hopes to join a book discussion club at a neighborhood senior citizen center. Imagine, too, that the group has requirements that could be considered onerous. In order to join, members have to pay a deposit as a precaution against damages, must read and write reports on several books so that their reading and intellectual abilities can be assessed, and agree to lead more than their share of group discussions. Assuming that the deposit, the extra reading, and reports are unpleasant or effortful, then engaging in them arouses cognitive dissonance. If they were engaged in for the purpose of joining the club, then the club ought to be a very good one in order to justify the amount of effort expended. Suppose that objectively it is only mediocre. In that case, the effort expended to join the group is inconsistent with the group's quality. This increases the amount of dissonance. The unpleasant arousal state can be reduced by distorting the perception of the quality of the group. Rather than viewing the book club as mediocre, people can alter their attitude to believe that the group is wonderful, thereby justifying the effort and expense they paid to join.

### Alternative Models of Dissonance

*The New Look Model.* Cooper and Fazio (1984) proposed an alternate model for the basis of cognitive dissonance. They outlined a theory in which dissonance is caused by assuming responsibility for a behavior that results in a potentially unwanted consequence. In the New Look model, dissonance is not aroused by inconsistent cognitions per se but is rather a coping strategy to deal with one's responsibility for bringing about aversive events.

The New Look model raises an important issue that affects many people as they age. Any number of unwanted consequences may occur as a function of growing older. People may need to retire because of failing health or because of arbitrary age restrictions. Home environments may need to be modified or people may need to move to special care facilities. These consequences of aging

are often unwanted and aversive, which seem suited to evoking the arousal of dissonance. Dissonance often works to the advantage of people who must make difficult decisions about retirement or health because it typically serves to make them feel more positively about the decisions they have made. The critical factor that determines whether the unwanted consequences of aging lead to dissonance is whether people feel personally responsible for the occurrence of the aversive events. In principle, if dissonance is aroused, it will lead to cognitive activity designed to reduce the dissonance. If moving to a senior facility leads to something objectively unwanted, people will experience dissonance and take action to reduce it. It would be reasonable to predict that people will be motivated to like their new living facilities as a way to reduce dissonance – but only to the extent that they feel personal responsibility for their choices. If they feel retirement has been forced on them or they had no role in a decision to move to a new facility, then dissonance will not occur and there will be no motivation to raise their evaluations.

*The Action-Based Model.* Harmon-Jones (1999) proposed a functional approach to the motivation for cognitive dissonance. The action-based model suggests that people are motivated to reduce inconsistency because the negative arousal interferes with people's distal motivation to prepare for unequivocal action. Because inconsistent cognitions imply inconsistent actions, the discrepancy needs to be resolved.

*Self-Esteem Approaches.* Aronson's self-esteem model (Aronson 1968) and Steele's self-affirmation theory (Steele 1988) suggest that the central motivation for dissonance arousal and reduction is to maintain a high sense of self-esteem. Acting inconsistently threatens people's self-worth. Therefore, restoring consistency is at the service of reestablishing a self-worth and global self-esteem.

*Self-Standards Model and the Role of Self-Esteem in Aging.* Stone and Cooper (2001) proposed a resolution of the role of self-esteem in dissonance. They showed that the effect of the self in the arousal of dissonance is moderated by the standards that are used to evaluate the

consequences of behavior. When people behave, they assess the valence of the consequences by comparing them to a particular standard of judgment. Stone and Cooper's self-standards model proposes that the choice of standards of judgment moderates the role of the self in the dissonance process. When people are motivated by situational or dispositional factors to assess their behavior against normative standards of judgment, such as "How would most people assess this behavior?", then self-esteem does not factor into the dissonance process. However, when people evaluate their behavior by using a personal standard of judgment, then self-esteem is very much a part of the dissonance process. As a general rule, the higher the self-esteem, the greater is the dissonance.

What can we expect about the role of self-esteem in the aging process? To the extent that dissonance is based on personal standards of judgment, an aging population will experience more or less dissonance depending on changes in their self-esteem over the life span. Research concerning the self-esteem of the elderly leans toward the conclusion that older adults have a lower sense of self-esteem than younger adults (Robins et al. 2002), which would suggest that dissonance may be less acute with an aging population. On the other hand, self-esteem of older adults tends to be related not only to chronological age but also with their ability to assimilate into their social environment and to manage difficult life events (Alaphilippe 2008). Self-esteem of the elderly also shows fewer fluctuations than the self-esteem of younger adults. Empirical research has not yet addressed the role of aging as a moderator of the role of self-esteem in the dissonance process but it is likely that self-esteem is a complex factor of chronological age and social circumstances.

**Neuropsychology of Dissonance.** Dissonance is accompanied by the psychological experience of discomfort (Elliot and Devine 1994) and by autonomic physiological arousal as assessed by elevated skin conductance responses (SCR) (Croyle and Cooper 1983; Losch and Cacioppo 1990). In the brain, research has associated cognitive dissonance with increased neural activity in

the right inferior frontal gyrus, the medial frontoparietal regions, and the ventral striatum and decreased activity in the anterior insula (Jarcho et al. 2011). Such processes are found to engage quickly at the moment of decision without extensive deliberation. Van Veen et al. (2009) found that attitude change associated with cognitive dissonance engages the dorsal anterior cingulate cortex and the anterior insula. More broadly, greater left frontal activity appears to be activated in the dissonance process, linking it to other negative, approach-oriented motivations such as anger (Harmon-Jones 2004).

### Dissonance in the Aging Process

Numerous changes occur during aging that affect dissonance. The magnitude of dissonance is influenced by factors that undergo change during the life span. For example, when making a choice between alternatives, a person's age may determine the importance of the choice and therefore the magnitude of dissonance. More fundamentally, increased age brings with it changes in psychological functioning and neurological integrity. These changes are likely to affect cognitive dissonance in fundamental ways.

Older adults experience deteriorations in neural areas important for executive functioning. The prefrontal cortex is one of the areas most affected by aging. With increasing age, the prefrontal cortex responds more slowly than, for example, the limbic system, when processing emotional stimuli (Gross 2013). The vmPFC shows marked structural decline after the age of 60 (Asp et al. 2012). Neuronal density in the frontal gyrus is measurably different when people enter their 70's. Yet, despite the atrophy in structure, activation in areas associated with dissonance and decision making remain strong in older age. Activations in the dorsolateral prefrontal cortex and the ventral medial frontal cortex remain strong, as do the parietal areas.

There are decreases in explicit memory with age, but the decreases are not associated with diminished ability to process or respond to dissonant information. Explicit memory does not

appear to be necessary for dissonance reduction. Lieberman and colleagues (2001) tested amnesiacs whose explicit memory was impaired and compared them to normal adults in a free-choice dissonance situation. In the experiment, amnesiacs and normals were asked to make a selection between attractive alternatives. Lieberman et al. found that amnesiacs engaged in choice-supportive reevaluation of the alternatives despite their having no explicit recollection of the initial choice. Consistent with dissonance theory, and similar to the responses of normal participants, amnesiacs spread the attractiveness of the choice alternatives to support the initial decision they had made.

Older adults are more averse to negative affect than are younger adults. For example, they are more likely to rate highly arousing negative stimuli as more negative than do younger adults and are vigilant to minimize the occurrence of negative experiences. Older adults concentrate on avoiding regret and boosting contentment (Carstensen and Hartel 2006). When asked to report their emotional experiences, older adults report as many positive emotional experiences as younger adults but report fewer negative experiences (Carstensen et al. 2000). In general, older adults spend more time and resources regulating emotional experiences, both in laboratory research tasks and in daily life tasks, and do so with a bias that leads to emotional satisfaction (Scheibe and Carstensen 2010).

As people age, they become more proficient at knowing the emotional effects of future events and have the enhanced ability of tailoring their emotion-regulatory strategies to meet contextual demands (Scheibe and Carstensen 2010). Thus, the future emotional implications of decisions may be weighted heavily by older adults, suggesting that because the elderly are concerned with their view of self, decisions and actions that go against their attitudes and views may intensify their experience of dissonance. This effect in the elderly can be further understood through the life-span theory of control (Heckhausen & Schulz 1995), which suggests that people's capability to regulate their environments and attain their growth-related goals declines in older adulthood. Therefore, older

adults increasingly use secondary control tools, such as emotion regulation, which is aimed at changing the self to be able to adjust to a given situation, instead of relying on primary control strategies that change the situation itself.

The increase need for emotion regulation combined with diminished structural integrity of frontal brain activity suggest that older adults devote more of their cognitive resources to regulating emotion, with particular emphasis on avoidance of negative states. Because cognitive dissonance is experienced as a specifically negative emotional state, older adults are motivated to engage in dissonance reduction, consistent with their orientation to avoid negative emotional states. Mather and Johnson (2000) examined people's recollections of the positive and negative features of choice alternatives in a free-choice (Brehm 1956) situation. Older adults (64–83) and younger adults (18–26) were given the option to choose an alternative in a set of two-choice options. Choices included selections of which of two houses they would prefer or about which of two candidates they would select for a job. Several positive and negative attributes of each alternative were described. Following their choice, participants were asked to recall as many of the attributes as they could remember. The older participants showed more choice-supportive memory than the younger adults. Older adults remembered more positive attributes and fewer negative attributes of the alternatives they selected. They also recalled more negative and fewer positive aspects of the alternatives they rejected. Older participants also misattributed attributes of the alternatives in a choice-supportive manner. When given the opportunity to attribute positive and negative features to the alternatives that had not been mentioned in the original list, they made errors of memory in the same choice-supportive fashion.

In order to assess the crucial role played by emotion regulation, participants were either asked to remember the facts or remember how they felt when making their decisions. Younger adults did not show choice-supportive memory when asked for a factual review. They manifested the choice-supportive memory effect only when asked how they felt. Older adults showed the

choice-supportive memory effect regardless of condition, indicating that they used selective and distorted memory as ways to adjust negative feelings that were aroused by dissonance.

In Mather and Johnson's research, participants were also administered a neuropsychological test battery to measure frontal brain region pathology. The results showed poorer overall memory among people identified with neuropathological disorders but found even greater ratios of choice-supportive memory in this subpopulation. This is consistent with the notion that the weakening of cognitive executive function causes people to put more of their available resources toward the goal of regulating emotion by becoming more emotionally satisfied with the choices they made (Mather and Johnson 2000).

Further research (Mather and Johnson 2000) confirmed that the distortions of memory are consistent with dissonance theory predictions. Participants either chose one of the alternatives or were assigned one of them. Results confirmed that choice-supportive memory distortions occurred only in the free-choice conditions known to produce cognitive dissonance (Brehm 1956) but not in conditions in which the alternatives were merely assigned.

## Conclusion

Cognitive dissonance is a state of aversive arousal that occurs when people perceive inconsistency among their cognitions. Although dissonance was not theorized to be age related, empirical work on dissonance had been primarily focused on convenience samples of young adults. Recent research suggests that, to the extent that gerontological factors influence the course of cognitive dissonance, older adults may be particularly sensitive to dissonance effects. With increasing age, changes in psychological functioning imply different needs, goals, and abilities. Although regions of the brain associated with memory and executive function show structural and functional decline with age, regions associated with cognitive dissonance show no consistent pattern of decline. Instead, research in emotion regulation suggests that the need to achieve positive emotional states increases with age along

with the concomitant sensitivity to potential negative threats. Cognitive dissonance is a potential threat. Reducing it in a choice-supportive manner appears to be an increasing priority of the aging process.

## Cross-References

- ▶ [Positive Emotion Processing, Theoretical Perspectives](#)
- ▶ [Social Cognition and Aging](#)
- ▶ [Strength and Vulnerability Integration](#)

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## Cognitive Neuroscience of Aging

Laura E. Paige and Angela H. Gutchess  
Brandeis University, Waltham, MA, USA

### Synonyms

Aging; Cognition; Neural differences; Structural changes

### Definition

While physical changes are obvious with age, cognitive neuroscience sheds light on the structural and functional changes that occur in the brain throughout the lifespan. Using behavioral and neural measures, cognitive neuroscience suggests that with increasing age, there are not only cognitive deficits, but also the potential for reorganization and stability of these underlying cognitive processes.

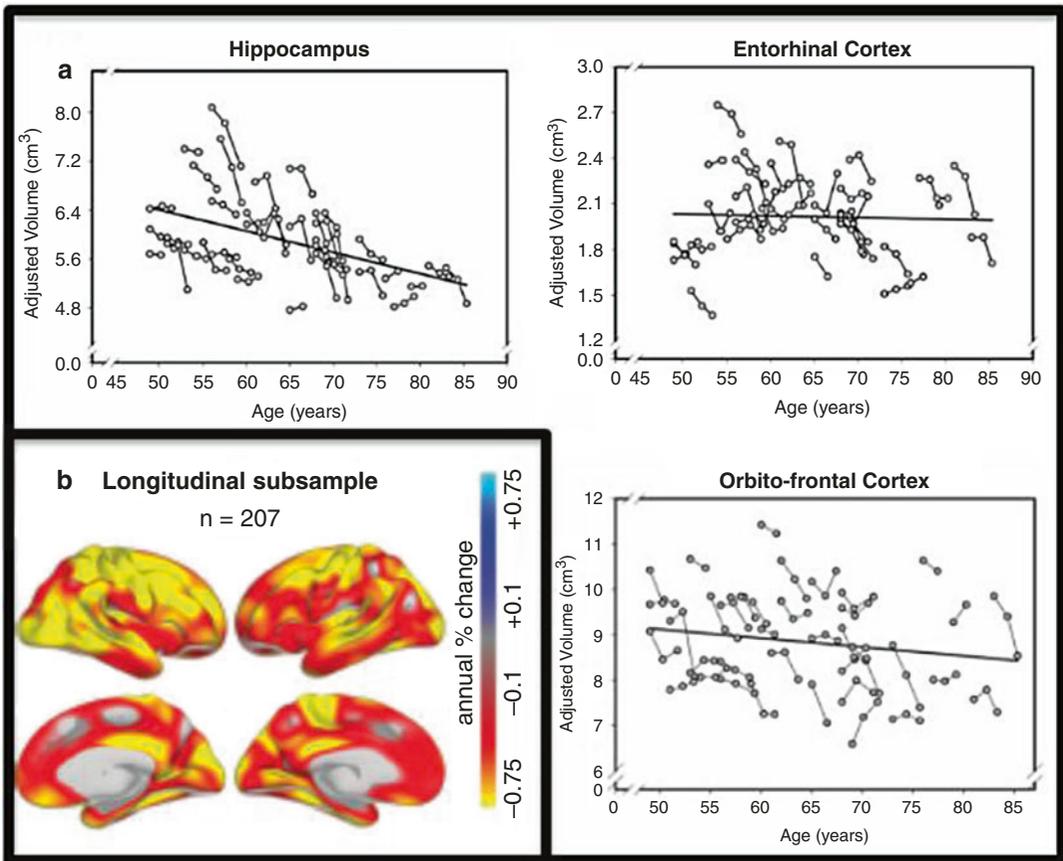
### Introduction

Much of the previous behavioral research has focused on losses with age – the senses become less sharp, performance worsens on tasks, and it is easier to become distracted and forgetful. While aging brings readily apparent changes to areas such as physical appearance, health, and stamina, it also brings significant changes to the brain. Cognitive neuroscience has greatly impacted the way in which aging is understood by probing these internal changes. New methods have shown that aging leads to alterations in multiple aspects of the brain, including structure, integrity, and active engagement of neural regions. The physical anatomy of the brain changes in terms of both gray matter (as assessed with methods such as magnetic resonance imaging, MRI) and white matter (as assessed with method such as diffusion tensor imaging, DTI). Determining *functional* activation in the brain, such as how different regions are engaged during demanding

cognitive tasks, is accomplished via methods such as functional magnetic resonance imaging (fMRI). These are just some of the many methods used in cognitive neuroscience research, but these are the methods that will be predominantly discussed in this entry. Studies employing these methods begin to uncover how age-related changes to the brain impact behavior, including not only how neural regions support cognitive function with age but also the overall efficiency in engaging processes. Importantly, the application of cognitive neuroscience methods has shown that aging is not simply deterioration of the brain, but it also reveals evidence for reorganization and compensation underlying cognitive processes. For example, some research illustrates how an older brain is able to adapt to physiological changes to perform a task comparably well as a younger brain, albeit not as efficiently. Much of the literature argues that older adults recruit additional activation in brain areas that were not activated in younger adults performing the same task. While the function of these activation changes is still greatly debated in the field, it indicates, at the very least, flexibility in the brain recruitment of older adults. Cognitive neuroscience has helped progress the field by seeking to understand the behavioral impairments on a neural level and how brain plasticity attempts to compensate for these changes.

### Structural Changes in Aging

With aging, the brain typically undergoes widespread cortical thinning. The gaps (sulci) between the cortex widen, while the volume of the folds of the cortex (gyri) decreases, as evidenced with methods such as MRI. However, certain regions are more prone to atrophy than others, and individuals vary widely in their extent of change. For example, the hippocampus, orbitofrontal cortex, and entorhinal cortex have all been shown to decrease in volume over time, whereas regions like the primary visual cortex, putamen, and pons remain relatively intact (see Fig. 1a; Raz et al. 2010). Longitudinal studies of cortical thickness have also shown that regions such as the



**Cognitive Neuroscience of Aging, Fig. 1** Atrophy in the aging brain is exhibited by overall cortical thinning of the cortex. **(a)** Volume was measured twice, 15 months apart, in individuals aged 49 and older. This is depicted by two measurements, connected by a line for each individual. Most individuals show decreases in volume, even in this short time frame, with the vast majority of lines connecting the two points showing a downward trend. The overall trend line reflects that the volume of the region tends to decline after age 49. **(b)** Annual percentage change in cortical thickness was measured in a longitudinal sample

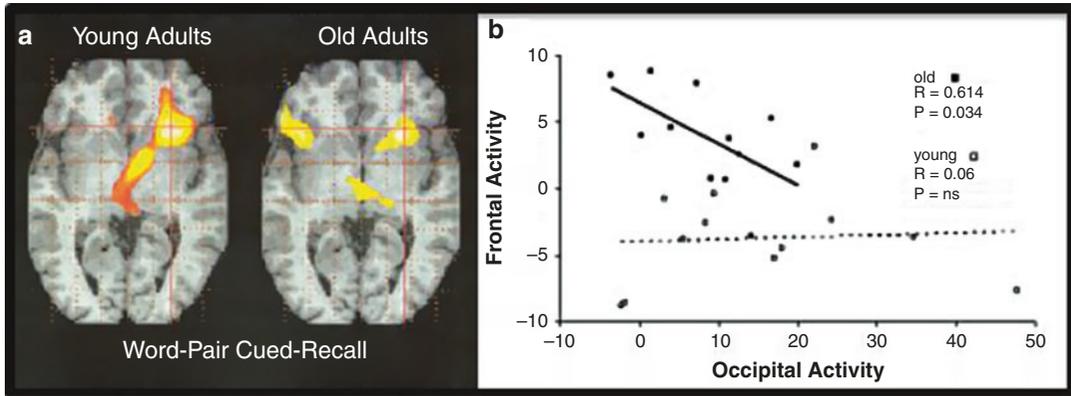
aged 60–93. This is represented by a color-coded brain map where percent decrease in cortical thickness is represented by *yellow* and *red*, appearing as lighter and darker *gray* in the grayscale version. The longitudinal sample showed a mean annual change of  $-0.59\%$  across the cortical surface. This reduction was especially seen in regions such as the lateral frontal, temporoparietal, and lateral occipital cortices (Source: **(a)** adapted from Raz et al. (2010) with permission; **(b)** adapted from Fjell et al. (2014) with permission)

lateral frontal, temporoparietal, and lateral occipital cortices all exhibit an increased mean annual percent change with age (see Fig. 1b; (Fjell et al. 2014)).

Although there is much interest in linking structural measures of the brain with performance on cognitive tasks, there is not always a straightforward link between these measures. However, relationships have emerged for some regions, such as the entorhinal cortex. The cortical thickness of this region is associated with memory

performance and shows substantial atrophy both in Alzheimer's disease and in normal aging (Fjell et al. 2014). A role for entorhinal cortex in memory is consistent with its location in the medial temporal lobes near the hippocampus, an important structure for memory.

Classically, atrophy in the brain has been studied by examining gray matter, which is the tissue that contains the cell bodies and dendrites of neurons. However, cognitive neuroscience has revealed that it is also important to study the



**Cognitive Neuroscience of Aging, Fig. 2** Changing brain activation patterns with aging. (a) Support for the HAROLD model reveals that prefrontal cortex activation during a cued-recall task (e.g., studied *parents-piano*, presented with *parents-???* at test) was right lateralized in younger adults but bilateral in older adults. Activation appears as a *yellow/orange* blob, *gray* in the grayscale version. Concurrent with HAROLD and reductions in hemisphere asymmetry, older adults recruited two hemispheres to complete a task that only required recruitment of one hemisphere for younger adults. (b) Correlations

between occipital and frontal activations in younger (depicted as *circles*) and older (depicted as *squares*) adults. Consistent with the PASA model, older adults (relative to younger adults) showed less occipital activity concomitantly with increased frontal activity. This suggests age-related deficits in sensory processing that require recruitment of regions involved in organization and reconstruction of information (Source: (a) adapted from Cabeza (2002) with permission; (b) adapted from Davis et al. (Davis et al. 2008) with permission)

connections between regions of the brain formed by white matter, the tissue that contains the axons of neurons and that is necessary for communication and coordination between regions (Gunning-Dixon et al. 2009). One metric used in DTI is fractional anisotropy (FA), which characterizes the presence of white matter fiber tracts by studying how much water diffuses in one direction. Intact fibers restrict the flow of water, increasing the measure of FA. Research using this method has shown that aging causes deterioration of tissue microstructure, decreasing FA (Gunning-Dixon et al. 2009). As a result, there is no longer an exclusive focus on just gray matter. White matter changes with aging can be profound and may explain much of age-related cognitive decline (Gunning-Dixon et al. 2009).

### Age-Related Differences in Neural Activity

While structural measures of gray and white matter largely reveal a pattern of decline, research with functional measures can reveal different

patterns. For many tasks, older adults can activate more brain regions than younger adults (Park and Reuter-Lorenz 2009). This includes patterns of bilaterally recruiting the same region in both the left and right hemispheres and shifting from activating regions largely in the back of the brain to those in the front (Cabeza 2002; Davis et al. 2008). Several models have sought to understand the causes and functions of these age-related changes in activation.

The *Hemispheric Asymmetry Reduction in Older Adults (HAROLD)* model looks at how younger adults activate a region in one hemisphere when performing a task, whereas older adults have a tendency to activate the same region in both hemispheres (see Fig. 2a; Cabeza 2002). This pattern of bilateral activity, or reducing the asymmetry of hemispheric activations, can sometimes be linked to better cognitive performance, suggesting that additional bilateral recruitment may support older adults' performance to be on par with that of younger adults.

While HAROLD considers patterns of activation across hemispheres, the *posterior-anterior shift in aging (PASA)* model studies a different

pattern with aging – changes in activation from the back of the brain to front. Specifically, decreases in occipital lobe activation occur concomitantly with increases in frontal lobe activity (see Fig. 2b; Davis et al. 2008). The occipital lobe is involved in sensory-related processes that become deficient with age (e.g., difficulty organizing sensory input of a previously seen image). PASA suggests that older adults try to offset sensory deficits and underrecruitment in these areas by overrecruiting in frontal regions. This change may reflect greater reliance on high-order cognitive processes responsible for directing sensory input or reconstructing poor signals coming from sensory cortices, also known as top-down processing (Davis et al. 2008).

Like HAROLD, another pattern of activity known as *dedifferentiation* illustrates a decrease in the specialization of regions with age (Park et al. 2004). In contrast to HAROLD or PASA, which emphasize the location of the brain areas recruited differently with age, dedifferentiation usually emphasizes the specialization of the process. For example, parts of the brain that respond specifically to seeing faces in younger adults may respond less distinctly to faces but also respond to other images, such as places or words, for older adults (Park et al. 2004). This loss of specialization in activity can occur even in brain regions that do not show atrophy with aging, such as the ventral visual cortex (Park et al. 2004).

Within the literature, there is much debate over whether these increased patterns of activation are actually compensatory, helping to improve older adults' performance. If this is the case, older adults could be bringing "online" additional cognitive resources in response to task demands. One theory has focused on how changing task demands (e.g., increasing or decreasing difficulty of task) can alter activation in older adults. The *compensation-related utilization of neural circuits (CRUNCH)* hypothesis suggests that making a task more difficult should proportionally increase neural activity for older adults at levels of difficulty that would not be considered strenuous for younger adults (Cappell et al. 2010). Building off of that theory, the *scaffolding theory*

*of aging and cognition (STAC)* shows older adults compensate with task difficulty by recruiting additional regions, creating new connections, and enhancing neural systems to improve cognitive performance (Park and Reuter-Lorenz 2009). Cognitive neuroscience methods have helped develop important theories like STAC to advance our understanding of aging. Unlike other theories, STAC actually accounts for both cognitive decline as well as the ability to utilize additional resources to improve performance with age. STAC incorporates the possibility that while cognitive declines may be inevitable with age, interventions such as cognitive training or physical exercise could help subside some of the age-related challenges to cognition.

## Theories of Cognitive Aging

Thus far, this chapter has reviewed ways in which cognitive neuroscience has led to new ways of thinking about aging. However, data using these methods have also substantiated or enriched classical theories of cognitive aging originally based on behavioral data.

**Speed of processing.** Slowing in older adults is true both physically and mentally, as our ability to process information slows with age. Known as speed of processing, this ability is assessed by how many judgments can be made in a short period of time (Salthouse 1991). Performance declines with age because older adults are slow to complete initial cognitive tasks and processes within a trial, and this prevents them from completing later stages of tasks (Salthouse 1991). Underlying neural regions involved in executive function, such as the prefrontal cortex, have been shown to decrease with age leading to increased response time and inaccuracy in tasks specifically measuring speed and efficiency (Rypma et al. 1999). As previously mentioned, cognitive neuroscience helped establish the importance of studying white matter pathways. It has now been shown that damage to connections between the prefrontal cortex and other regions formed by white matter tracts can largely account for such cognitive slowing (Gunning-Dixon et al. 2009).

**Memory.** There are two major subtypes of memory, both of which are affected by aging. Working memory manipulates and stores information “online,” such that it can be stored, retrieved, or transformed at the same time (Craik and Byrd 1982). Looking up a phone number, keeping it active in mind, and dialing it a few minutes later would be an example of this. The ability to manipulate information decreases with age. Research suggests older adults require additional cognitive resources to maintain information in mind as task demands increase (e.g., remembering a string that is three numbers vs. nine numbers long). In line with the PASA model, older adults try to counteract deficits in underrecruited sensory regions by recruiting higher-order cognitive processes mediated by frontal regions (Cabeza and Dennis 2012). This leads to a pattern of prefrontal overactivation in older adults as additional resources are needed. Interestingly, a similar pattern of activation happens for younger adults too, but not until they reach seemingly higher memory loads (Cappell et al. 2010). This suggests that older adults are using compensatory processes but require them at lower levels of task difficulty than younger adults.

Aging also affects long-term memory or lasting storage of information. As previously mentioned, structural deficits to regions involved in memory processes have been shown to occur with age and accelerate in Alzheimer’s disease (Fjell et al. 2014). One consideration within this type of memory is true versus false recollection of items. True recollection, or correctly remembering an event in enough detail to feel as if it were being reexperienced (rather than feeling only generally familiar), is associated with age-related decreases in occipital activation and increases in prefrontal cortex activation (Dennis et al. 2014). Despite recruitment of different neural regions, older and younger adults have similar behavioral rates of true recollection. This pattern of activation therefore suggests an age-related inability to retrieve perceptual details and a greater reliance on familiarity and gist (e.g., general meaning that lacks distinct features) for older adults to complete the task (Dennis et al. 2014). On the other hand, false recollection

is associated with age-related decreases in prefrontal cortex activity, parahippocampal gyrus, and occipitoparietal cortex (Dennis et al. 2014). Unlike the comparable memory performance for true recollection, older adults have higher rates of false recollection. The resulting activation then suggests a reduced ability to reconstruct perceptual details leading to increased false memories (Dennis et al. 2014).

**Inhibition.** Older adults’ difficulty with speed of processing and memory could be largely connected to breakdowns in inhibition with age. Inhibition, or the ability to focus on important target information and inhibit attention to irrelevant information, becomes increasingly difficult with age (Hasher et al. 1991). Successful versus unsuccessful “ignore” trials have revealed differences in brain activation. When told to ignore certain words, younger adults activated rostral prefrontal cortex and inferior parietal cortex more than older adults, and activity in these regions was negatively correlated with priming for distracting words (Campbell et al. 2012). Younger adults remembered fewer of the “ignore” words than older adults. Besides activating the rostral prefrontal cortex less during to-be-ignored trials, older adults also had reduced functional connectivity within the frontoparietal network. These results suggested that increased distractibility could be due to decreased engagement of this cognitive control network and impairment in how this network works together with other networks involved in ignoring information (Campbell et al. 2012).

## Socioemotional Information and Aging

This chapter has shown that aging brings changes to structural integrity of the brain and the cognitive processes necessary to carry out various tasks. Aging can also impact the ways in which one interacts with the environment. The application of cognitive neuroscience methods to social psychology has allowed researchers to understand the neural changes involved in social domains and emotional responses. Importantly, the inclusion of aging into social and affective neuroscience

research highlights how age-related differences in social cognition, similar to cognitive function, are not just about loss.

**Changes in social cognition.** Social neuroscience research has revealed a variety of activation patterns. Some patterns are consistent with the cognitive literature, showing that age-related declines in cognitive processes may also contribute to social domains. Other patterns, however, suggest that social domains may be more preserved with age. One ability that seems to be largely preserved with aging is self-referencing. In these tasks, participants must reference words or items to oneself or to another person, and this process can enhance the memorability of information. When comparing activation between younger and older adults, it was found that both groups engage the medial prefrontal cortex similarly (Gutchess et al. 2007). This finding was interpreted as evidence for preserved social functioning, and corresponding neural activity, with age.

Other research, however, suggests that patterns of activation in social cognition are consistent with the functional deteriorations seen in the cognitive literature. Processes like inhibition and speed of processing which decline in age may contribute to changes in social cognition by way of their contribution to executive function. For example, executive functions are necessary for regulation of bias, specifically toward stigmatized individuals (e.g., individuals with facial deformities, homeless people). It has been shown that high-functioning older adults, who had relatively preserved levels of executive function, activated areas of lateral prefrontal cortex more than younger adults and low-functioning older adults (Krendl et al. 2009). On the other hand, younger adults had greater activity in medial prefrontal cortex than older adults in response to stigmatized individuals that were considered less negative (Krendl et al. 2009). Because high-functioning older adults and younger adults showed similar attitudes toward stigmatized targets, the differences in the groups' neural activity suggest high-functioning older adults and younger adults rely on different underlying processes (Krendl et al. 2009). High-functioning older adults may have exerted greater cognitive effort,

relying on executive function, to achieve the same behavioral results.

**Changes in emotion.** In contrast to the other abilities reviewed thus far, emotion regulation, or the ability to control reactivity to valenced stimuli, seems to improve with age. Unlike other areas of the brain that undergo large amounts of atrophy, the amygdala is relatively preserved with age (Nashiro et al. 2012). Further, aging seems to affect the way in which valenced information is processed in which older adults show a positivity effect, whereby they spend more time viewing positive items and less time viewing negative items. As a result, older adults remember relatively less negative information and more positive information (Mather and Carstensen 2005). Behavioral theories suggest that the positivity effect seen with aging is due to a greater focus on regulating emotions and required cognitive processes (Mather and Carstensen 2005). This cognitive control theory predicts that prefrontal emotion regulation processes diminish amygdala responses to negative but not positive stimuli (Nashiro et al. 2012).

Using cognitive neuroscience methods, one can examine the ways in which different regions in a network operate together to contribute to this shift in emotional processing with age. Research suggests that emotional processing differences are the result of age-related changes in encoding processes when viewing positive stimuli only. In these instances, the connectivity between the ventromedial prefrontal cortex, amygdala, and hippocampus was stronger during encoding of positive trials only (Addis et al. 2010). There were no changes in connectivity between regions during encoding of negative trials (Addis et al. 2010). This suggests that aging may not weaken emotional network connections (as in the negative stimuli) but rather strengthen them (in relation to the positive stimuli), allowing for increased attention and memory for positive information.

## Conclusion

The growth of cognitive neuroscience has changed the way aging is studied and understood. Brain volume and cortical thickness decrease, and

important connections between regions lose integrity as white matter tracts deteriorate. In aging there are also general brain activation patterns that change, such as reduced hemispheric asymmetry and overrecruitment of frontal regions. Importantly, cognitive neuroscience has shown that aging is not just a downward spiral of loss but can include compensation by bringing additional regions “online” and reorganizing neural circuits. Despite the increased appreciation for malleability in neural circuits with age, changes in the brain do affect cognition, causing older adults to process information slower, demonstrate short- and long-term memory problems, and experience difficulty attending to important information while ignoring irrelevant information. In regard to social cognition, research is split on whether social domains may be preserved in aging. Some aspects appear to be affected by underlying cognitive processes that are known to deteriorate, whereas other abilities seem to be unaffected. Age-related differences are also seen in emotional processing, with older adults exhibiting a positive bias when viewing and remembering information. Research has shown this change could be the result of a greater focus on emotion regulation with aging or altered connections between neural regions, allowing for the emphasis on positive information over negative. Ultimately, developments in cognitive neuroscience have shown that aging is not as clear-cut as previously thought – there are both age-related deficits and alterations that reveal the ability of the aging brain to adapt to change through compensation. Advances in cognitive neuroscience methods seek to better understand the physiological changes that occur through aging and how these neural changes ultimately influence behavior.

## Cross-References

- ▶ [Aging and Attention](#)
- ▶ [Aging and Inhibition](#)
- ▶ [Cognition](#)
- ▶ [Cognitive and Brain Plasticity in Old Age](#)
- ▶ [Cognitive Compensation](#)
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- ▶ [Positive Emotion Processing, Theoretical Perspectives](#)
- ▶ [Psychological Theories of Successful Aging](#)
- ▶ [Social Cognition and Aging](#)

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## Cognitive Rehabilitation

Nicholas T. Bott<sup>1,2</sup> and Abigail Kramer<sup>1,3</sup>

<sup>1</sup>Sierra Pacific Mental Illness Research, Education, and Clinical Centers (MIRECC), VA Palo Alto Health Care System, Palo Alto, CA, USA

<sup>2</sup>Pacific Graduate School of Psychology–Stanford PsyD Consortium, Stanford, CA, USA

<sup>3</sup>Pacific Graduate School of Psychology, Palo Alto University, Palo Alto, CA, USA

## Synonyms

Adaptation; Cognitive strategies; Cognitive training; Compensation

## Definition

Cognitive rehabilitation refers to therapy designed to restore, substitute, or compensate for cognitive abilities lost due to injury or illness. Cognitive rehabilitation typically refers to training targeting improvement of skill by regaining (reestablishing or strengthening) abilities that were intact prior to the loss. The other focus of cognitive rehabilitation is developing compensatory strategies for lost abilities when they cannot be regained. In contrast, the term cognitive intervention refers to targeted training of a particular cognitive skill or domain for the purpose of enhancement regardless of the baseline state of cognitive abilities. As such, many cognitive interventions target healthy functioning individuals. Distinct from rehabilitation and intervention, cognitive stimulation therapy refers to a brief psychological intervention used to provide general stimulation of cognitive abilities in individuals with mild to moderate dementia.

The techniques used in cognitive rehabilitation can be applied to any individual who experiences cognitive loss due to an injury or illness. Most commonly, cognitive rehabilitation is used with stroke victims and traumatic brain injury patients. Additionally, while less common, cognitive rehabilitation techniques and programs have been designed for elders with cognitive decline due to normal aging, mild cognitive impairment (MCI), or neurodegenerative disease (Attix and Welsh-Bohmer 2006; Camp 2010).

## History of Cognitive Rehabilitation in Old Age

As the name suggests, cognitive rehabilitation represents a diverse set of therapeutic interventions aimed at restoring, substituting, or compensating for cognitive abilities impacted by injury or illness through the use of specific strategies or adaptations. These interventions are nonpharmacological and nonsurgical and are aimed at remediating the cognitive capacities (Prigatano 2005). Historically, cognitive rehabilitation has focused on specific kinds of acquired brain injury

such as traumatic brain injury (TBI) and stroke (Parente and Stapleton 1996). While injury severity necessarily limits the extent to which cognitive rehabilitation can be effectively utilized, age is also a significant factor contributing to the efficiency (e.g., time, cost) of cognitive rehabilitation for acquired brain injury (Flanagan et al. 2005) as well as later-life cognitive impairment and dementia.

To combat the effects of cognitive decline in older adults, cognitive rehabilitation was born out of plasticity research in the 1970s, which conceptualized the cognitive aging process as both multidimensional and multidirectional (Verhaeghen 2000). At that time, the “performance-potential” divide associated with cognitive aging spurred the search for modifiability, which would later be described as plasticity. Baltes and Willis (1982) defined plasticity as “the range of intellectual aging under conditions not normally existent in either the living ecology of older persons or in the standard assessment situation provided by classical test of psychometric intelligence.” While early experiments focused on the enhancement of performance on tests of intelligence, plasticity research with elders quickly branched out into the domain of episodic memory function and has since expanded to include nonspecific cognitive stimulation targeting a variety of cognitive domains (Smith et al. 2009). As the construct of brain plasticity has matured, it has come to stand alongside, if not over shadow, cognitive rehabilitation training programs focused on strategy use. This is in part due to the lack of generalized gains from direct strategy instruction outside of the specific cognitive tasks related to the training. Additionally, it can be difficult for older adults to continue learning new approaches to cognitive processing, as use of specific strategies require.

One of the dominant theories underlying current understanding of neuroplasticity in cognitive aging is known as the scaffolding theory of aging and cognition (STAC; Goh and Park 2009). STAC posits that the aging brain responds to neural insults (e.g., volume reduction, white matter degradation) through the recruitment of additional brain regions to achieve adequate function. Barulli and Stern (2013) identify STAC as a

more generalized theory of neural compensation within which the concept of cognitive reserve remains an important factor associated with better neural compensation. Such additional brain recruitment has been observed in both structural and functional imaging studies. For example, Ilg and colleagues (2010) investigated practice-induced neural activation associated with mirror reading and found that short-term gray matter signal increase was associated with task-specific processing. Similarly, Steffener and colleagues (2009) investigated age-related changes in working memory using an fMRI paradigm. They found that while decreased regional volume in the primary neural network was associated with increased secondary network utilization independent of age, only older adults demonstrated increased activation in the secondary neural network as working memory load increased. Whether this recruitment represents neural compensation in the facilitation of task completion remains debated (Park and Reuter-Lorenz 2009).

## Preventative Cognitive Training

Increasingly, however, targeting healthy older adults before symptoms of impairment develop has been a focus of research. Shatenstein and Berberger-Gateau (2015) have recently posited four categories of modifiable cognitive risk or protective factors for older adults: (1) collective societal factors, (2) individual psychosocial factors, (3) lifestyle factors, and (4) cardiometabolic factors. Within these four categories, seven individual modifiable factors account for 28% of the risk of developing Alzheimer’s disease: diabetes, obesity or hypertension in middle age, low physical activity, depression, smoking, and low educational level. Within this model, Shatenstein and Berberger-Gateau identify primary prevention as reduction of the occurrence of specific risk factors, with secondary prevention aimed at early prevention of disease by identification of clinical or biological markers that could lead to early detection and treatment of at-risk individuals.

Historically, cognitive interventions have been used to remediate intellectual decline in normal

older adults. In a longitudinal study conducted by Schaie and Willis (1986), their findings suggest that decline is associated with the disuse of cognitive abilities overtime. With the implementation of cognitive training, two thirds of the participants were able to improve their intellectual functioning. Specifically, 40% of the participants that had shown significant decline over a 14-year period were able to return to their pre-decline performance (Schaie and Willis 1986). Furthermore, the outcomes of this cognitive training were shown to be long-lasting, with the benefits persisting 7 years after training in comparison to controls (Schaie et al. 1994).

The potential benefits of targeting healthy older adults have been rigorously demonstrated in the recent Advanced Cognitive Training for Independent and Vital Elderly (ACTIVE) study. The ACTIVE study was a randomized, controlled single-blind trial ( $n = 2832$ ) with three intervention groups and a no-contact control group to determine the effects of cognitive training on cognitive abilities and everyday function over a 10-year period. Each of the three intervention groups targeted a specific cognitive domain: memory, reasoning, and speed-of-processing. The intervention consisted of an initial ten-session training (60–70 min per session) for one of the three cognitive domains, with some participants receiving a four-session booster training at 11 and at 35 months after training. Outcome measures included both objective measures of memory, reasoning, and processing speed and functional measures of IADLs.

At the conclusion of the study, all groups showed declines from their baseline tests across cognitive domains. Interestingly, individuals who received training in reasoning and processing speed evidenced fewer declines than those in the memory and control groups. Results of the cognitive tests after 10 years reported by Rebok and colleagues (2014) demonstrated that nearly three quarters of those individuals that received reasoning training were still performing reasoning tasks above their pretrial baseline level. In contrast, only 62% percent of control participants showed above pretrial performance. Similarly, 71% of those receiving the processing speed intervention

were performing comparable or better than their baseline level compared to 49% of controls. Memory performance was comparable between the intervention and control groups after 10 years. With respect to IADLs, individuals across all three intervention groups endorsed less subjective difficulty with IADLs than control participants; however, performance on objective measures of functional abilities was comparable across intervention and control groups.

In summary, ACTIVE was the first multisite clinical trial to test the effects of cognitive training interventions on cognitive abilities and daily function in healthy functioning older adults. The relative success of the ACTIVE trial provides support for preventative cognitive interventions in this population and has significant economic implications given the aging of the US population. Interventions that reliably extend healthy cognitive aging trajectories could significantly reduce the economic burden associated with cognitive impairment and dementia.

### **Cognitive Rehabilitation for Mild Cognitive Impairment**

MCI is often described an intermediate stage between cognitive decline due to normal aging and dementia (Huckans et al. 2013). Criteria for MCI diagnosis are (a) evidence of modest cognitive decline from a previous level of performance in one or more cognitive domains including memory, language, attention, visuospatial functioning, and executive functioning, or as documented by standardized neuropsychological testing, (b) cognitive deficits do not interfere with capacity for independence in everyday activity, (c) cognitive deficits do not occur exclusively in the context of a delirium, and (d) it is not better explained by another mental disorder and does not meet criteria for dementia (American Psychiatric Association 2013). Although many people with MCI live independently, declines in subjective and objective memory and cognition impact quality and degree of independence in daily life. Deficits may impact scheduling, transportation, or financial management. Functional impact may be

greater for those struggling with multiple domain MCI rather than in a single domain (Huckans et al. 2013). Within the older adult population, the prevalence rate of MCI is estimated to range from 3% to 42% (Ward et al. 2012). However, it is estimated that 14–40% of people with MCI return to normal cognitive functioning (Ganguli et al. 2004) and others maintain MCI functioning without progressing to dementia (Manly et al. 2008). The use of cognitive rehabilitation in this population may have particularly beneficial outcomes (Huckans et al. 2013), as gains will not be obscured by progressive decline.

A large proportion of patients (35–85%) with MCI have additional psychiatric comorbidities, such as depression, anxiety, irritability, apathy, disinhibition, and sleep disorder (Monastero et al. 2009). Therefore, effective management of MCI will not only focus on cognitive decline but also incorporate strategies to address neuropsychiatric symptoms and lifestyle.

Although many cognitive rehabilitation programs exist to treat MCI, there are several strategies and interventions that are consistent across programs. The first and most directive approach to address cognitive impairment is restorative cognitive training. The aim of this technique is to enhance or restore cognitive abilities through neuroplasticity mechanisms. This is most commonly done through the utilization of structured and repeated practice of specific cognitive tasks and mental exercises (Huckans et al. 2013). These tasks are tailored to the individual's ability level and in the domain that is impaired, such as memory or attention. The exercises have the potential to improve or maintain functioning in these cognitive domains with the goal to improve performance that will generalize beyond the immediate training task. However, the impact and the duration of task repetition remain unclear (O'Sullivan et al. 2015). Belleville and colleagues (2006) demonstrated that instruction in episodic memory strategies is effective in improving memory performance in individuals with MCI. More recently, Gagnon and Belleville (2012) reported that individuals with a single-domain executive function deficit benefit from an attentional control cognitive intervention.

A different approach is to train cognition through the development of new processing approaches. Here, cognitive training draws on internal strategies to work around the deficit when the impairment cannot be improved through repetition. Examples of such cognitive training strategies include visual imagery, chunking information, storytelling, and creating acronyms to remediate memory difficulties. Other strategies such as structured problem solving and planning methods can be used to address specific executive deficits (Huckans et al. 2013). Teaching mindfulness to double check and develop habits and routines may also be helpful for some individuals (O'Sullivan et al. 2015). Compensatory techniques can also involve external aids such as day planners, calendars, and personal notebooks (Kurz et al. 2009). Navigation devices can be helpful for those with visuospatial compromises. Additionally, environmental strategies may be used, such as setting up a quiet workspace in order to avoid distracting visual and auditory stimuli (Huckans et al. 2013). Quinn and colleagues (2015) recently reviewed three self-management interventions for individuals with MCI that focused on information, communication, social support, and skills training. They concluded that continued study of this intervention is necessary to test the efficacy of self-management techniques in an MCI population.

Treatment benefit will likely be maximized if additional treatment modifiers, such as mood and lifestyle factors, are also addressed (Attix and Welsch-Bohmer 2006). Education about MCI as a risk state, rather than prognostic indicator, can be quite helpful. Information about lifestyle practices that involve protective factors (e.g., diet, exercise, and cognitively stimulating activities) and risk factors (e.g., smoking, heavy substance use) is also relevant. This can be done through direct behavioral engagement or through the use of motivational interviewing with patients (Huckans et al. 2013; Kurz et al. 2009). Lastly, psychotherapeutic interventions are utilized to treat the neuropsychiatric symptoms that frequently accompany MCI. For example, relaxation exercises and deep breathing can be taught to reduce anxiety, and cognitive-behavioral

interventions can be utilized to address negative thoughts and feelings related to MCI (Kurz et al. 2009; O'Sullivan et al. 2015; Huckans et al. 2013). While not every patient will need cognitive retraining, compensatory strategies, modification of lifestyle interventions, and psychotherapy, these interventions are each part of a comprehensive treatment model to improve overall quality of life in patients with MCI.

## Cognitive Rehabilitation in Dementia

Due to the progressive nature of neurodegenerative diseases, many do not believe that cognitive rehabilitation is a suitable treatment for people with progressive dementias such as Alzheimer's disease, progressive vascular disease, and Lewy body disease. However, when the goal is to improve quality of life rather than return to premorbid cognitive ability, cognitive intervention can be a proactive approach to improve overall functioning (Marshall 2005). Dementia is a relatively common condition in older adults aged 65 and older, affecting approximately 5% of the population (Jolley 2005). Alzheimer's dementia (AD) has an insidious onset and progressive cognitive decline, predominately in the domain of episodic memory, and is most evident in the ability to register and retain new information. However, people with AD tend to maintain the ability to recall stories from early in their lives, as well as habits and skills performed over decades (Jolley 2005) until late stages of the disease. Cognitive intervention is primarily used in individuals with dementia to help them utilize their remaining memory functioning most effectively, learn how to compensate for difficulties, and create environmental adjustments to reduce the need for memory (Mountain 2005). In other words, cognitive intervention aims to assist patients and families discover new ways to handle problems that arise due to cognitive decline and help the individual maintain the ability to engage in pleasurable activities and interact with loved ones for as long as possible (Clare 2005). The treatment should be client-centered, recognize the changing role identities of the patient, and facilitate coping and

effectiveness. Attix and Welsh-Bohmer (2006) detail the importance of the initial clinical evaluation in maximizing the effectiveness of cognitive interventions through careful incorporation of relevant patient data. These variables include goals, motivation, neuropsychological evaluation, insight, affective status, unique patient and environmental factors, and current compensatory methods and activities.

Cognitive rehabilitation techniques for people with more significant deficits in dementia include reminiscence therapy, reality orientation, and validation therapy, among others. Reminiscence therapy encourages individuals to recall past events and life experiences through stimuli that evoke memories, such as photos, objects, music, and videos. These sessions typically take place in a group setting in order to stimulate conversation about common subjects (Mountain 2005). Reality orientation is a technique that presents orientation information such as time, place, and person-related. The goal of providing information about the surroundings is to improve the quality of life in confused individuals by increasing their sense of control. Bianchetti and Trabucchi (2001) found that this therapy was able to delay entry into extended-care facilities and slow cognitive decline when administered over an extended period of time to people in early- to middle-stage dementia. In contrast, validation therapy provides a way to communicate with older individuals with dementia in a way that is opposite to reality orientation. Instead of helping the individual understand the truth of their surroundings, this communication style validates rather than corrects the individual's erroneous sense of reality (Neal and Briggs 2003). The purpose of these three therapeutic orientations aims to compensate for decline rather than attempt to reverse it. This approach can ultimately lead to greater acceptance and increased quality of life for people with dementia (Mountain 2005). Importantly, however, this therapeutic approach has received criticism with respect to its underlying evidence base. Moreover, in their 2003 review of the effects of validation therapy, Neal and Barton concluded that there is insufficient evidence from rigorous studies (e.g., randomized control trials) to

substantiate claims of efficacy for people with dementia or cognitive impairment.

Alternatives to compensatory orientations include self-management interventions, which equip people to manage the symptoms and lifestyle changes present over the course of chronic health conditions. Self-management interventions for individuals with dementia focus on psychoeducation, social support, and specific skills training. Quinn and colleagues (2016) recently reported modest effects of a randomized controlled trial of a self-management intervention for individuals with early-stage dementia and their caregivers.

Adaptations to existing methods of developmental learning have also been successfully employed in individuals with dementia. For example, Camp and colleagues developed Montessori Programming for Dementia (MPD), which provides a framework for the translation of Montessori principles into meaningful activities for individuals with dementia (Camp 2010). MPD has been used effectively within long-term care settings as well as in intergenerational care programs where programming is administered to older adults and preschool-aged children in a shared location (Camp and Lee 2011; Camp et al. 2002).

## Future Directions

While interventions on individual modifiable risk factors associated with cognitive decline will continue to be investigated, multidomain approaches for the prevention of cognitive decline are strategic. This is, in part, due to the multifactorial nature of late-life dementia (Richard et al. 2012). Additionally, the majority of preventative studies to date have focused on the prevention of dementia, rather than less severe forms of cognitive impairment. The recent results of the Finnish FINGER study (Ngandu et al. 2015) provide proof-of-concept for the efficacy of multidomain interventions targeting modifiable vascular and lifestyle-related risk factors associated with mild cognitive deficits. Several other randomized clinical trials are employing multidomain approaches,

including the US ENLIGHTEN trial, the Prevention of Dementia by Intensive Vascular Care (preDIVA) study, and the Healthy Aging through Internet Counseling in Elderly (HATICE) program, which focuses on the management of modifiable risk factors in older people using an Internet-based platform (Shatenstein et al. 2015).

## Conclusions

While cognitive rehabilitation interventions will continue to be developed and used in older adult populations with acquired brain injury (e.g., TBI, MCI), MCI, and dementia, preventative interventions to extend healthy aging cognitive trajectories are well positioned to be more widely disseminated. Efforts to build cognitive reserve and thereby extend the course of healthy cognitive aging trajectories have significant economic implications. For example, total annual per-person payments for Medicare beneficiaries with dementia are more than three times greater than payments for those without dementia (Unpublished tabulations based on data from the Medicare Current Beneficiary Survey for 2008. Prepared under contract by Julie Bynum, November 2011). Total payments in health care, long-term care, and hospice for individuals with neurodegenerative disease are currently estimated at \$214 billion, and over the next 25 years, the cumulative cost of care for individuals suffering from neurodegenerative diseases such as Alzheimer's disease has been estimated at over \$1 trillion (Alzheimer's 2014). These costs underscore the economic benefits associated with the prolongation of healthy cognitive aging trajectories even over relatively short amounts of time.

## Cross-References

- ▶ [Cognitive and Brain Plasticity in Old Age](#)
- ▶ [Cognitive Compensation](#)
- ▶ [Frailty and Cognition](#)
- ▶ [Healthy Aging](#)
- ▶ [Mild Cognitive Impairment](#)
- ▶ [Neurocognitive Markers of Aging](#)

- ▶ Psychological Theories of Successful Aging
- ▶ Resilience and Aging

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## Cohort Effects

Robert F. Kennison<sup>1</sup>, David Situ<sup>1</sup>, Nancy Reyes<sup>1</sup> and Kozma Ahacic<sup>2,3</sup>

<sup>1</sup>Department of Psychology, California State University, Los Angeles, CA, USA

<sup>2</sup>Centre for Epidemiology and Community Medicine, Health Care Services, Stockholm County Council, Stockholm, Sweden

<sup>3</sup>Department of Public Health Sciences, Karolinska Institutet, Stockholm, Sweden

## Synonyms

Birth cohort; Cohort effect; Generation (e.g., Baby boomers); Generational shift

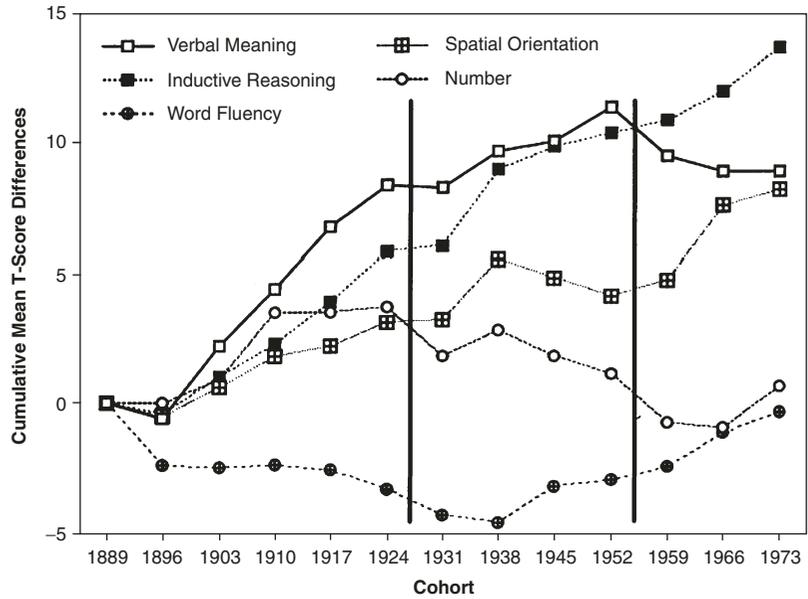
## Definition

The term *cohort* refers to a group of people born at about the same time.

In geropsychology, the term *cohort* refers to a group of people born at about the same time. While it has long been considered a nuisance variable for age-based developmental studies, cohort is an important variable for many researchers in the social and health sciences because it provides evidence of secular changes. Studies of cohort effects on intelligence, reasoning, memory, and other cognitive abilities have garnered recent attention in both the academic and lay communities (Schaie et al. 2005; Williams 2013). A cogent example is the *Flynn effect* (Flynn 1987), which is the observation that generation by generation, people are becoming smarter with respect to intelligence test scores.

### Cohort Effects,

**Fig. 1** Cumulative cohort differences for the primary mental abilities in the Seattle Longitudinal Study. Excerpted from Schaie (2005) (Reprinted with permission from Oxford University Press.)



This entry will focus on cohort effects on cognitive performance primarily in adulthood and older age. After reviewing some of the methodological issues that affect the measurement of cohort and age effects, several important findings on cohort differences in cognitive performance including the Flynn effect will be reviewed. Finally, the issue of whether cohort differences continue into later life will be discussed.

### Methodological Issues

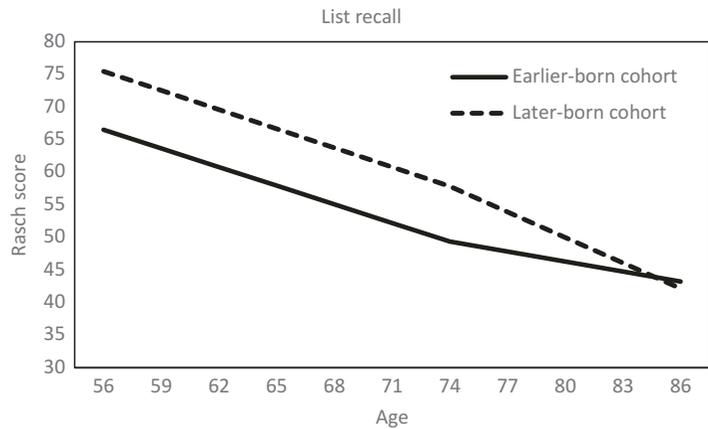
Cohort is often contextualized in the metric of years, decades, or generations. Decisions about defining an appropriate time metric to assess cohort effects are important because the gap between cohorts needs to be large enough to detect statistical differences, yet not too large as to miss meaningful changes or turning points. Decisions about the range of birth years to be included in a sample are best made before initiating a study but are often constrained to the parameters of previously collected data in studies that were not specifically designed with the measurement of cohort in mind (Schaie et al. 2005).

Cohort-sequential longitudinal studies and time-lag studies have been used to assess the

effects of cohort for a variety of measures and for a variety of research questions (Schaie and Hofer 2001). *Cohort-sequential studies* (AKA panel studies), which include two or more longitudinal panels of participants derived from different birth cohorts, are able to assess cohort effects in two important ways. First, they can be used to measure changes in cognitive performance over birth cohort. As shown in Fig. 1, Schaie and collaborators (Schaie et al. 2005) have often used this approach to examine cohort changes in performance for psychometric measures of cognition. The figure shows that psychometric performance can be mapped over birth cohorts yielding evidence of cohort trends. For example, one can see from Fig. 1 that there have been marked increases in inductive reasoning performance in more recent birth cohorts. Second, cohort-sequential studies can be used to assess cohort differences in time-based or age-based analyses of measures of cognitive performance. As shown in Fig. 2, Zelinski and Kennison (2007) demonstrated this approach when they assessed cohort differences in mean level functioning and in age-related changes of performance in a list recall task. The cohort difference observed from ages 56 to 74 weakens from ages 74 to 86.

**Cohort Effects,**

**Fig. 2** Estimated longitudinal changes for list recall for earlier-born (*solid line*) and later-born (*dashed line*) cohorts. The chart was created from the parameters reported in Table 5 of Zelinski and Kennison (2007)



A classic example of a cohort-sequential study is the Seattle Longitudinal Study (SLS), which includes multiple longitudinal sequences (panels) initiated approximately 7 years apart currently providing the potential for 7, 14, 21, 28, 35, 42, and 49 year cohort comparisons (Schaie et al. 2005). Some of the other studies that have used this approach are the Victoria Longitudinal Study (Dixon and de Frias 2004) and the Long Beach Longitudinal Study (Zelinski and Kennison 2007).

An alternative method used to assess cohort effects in longitudinal studies is the practice of replacing lost subjects with new ones who are matched on baseline age but born to a later cohort. An example of this approach can be found in the Health and Retirement Study (2015), which replaces participants lost to attrition. In addition, as the HRS has progressed, it has included panels that represent different cohort groups.

The other approach that is often used to study cohort effects is the *time-lag design* (Twenge 2010). In time-lag studies, groups of participants are tested at about the same age but at different points in time. The participants used in the different data collections are not the same, so the approach is not longitudinal. Like cross-sectional studies, time-lag studies are less expensive and easier to conduct than longitudinal studies. However, time effects are confounded with cohort effects making it difficult to uniquely attribute causality; possible causes are either specific

historical events or the accumulation of life experiences nested within a broader historical period (Twenge 2010; Salthouse 2015).

The important design features of a valid cohort study have been debated. Jensen in a personal communication sent to and reported by Flynn (1987) identified four elements needed to conduct a reasonably valid cohort study. He stated:

- (a) The possibility of sample bias should be eliminated by comprehensive samples, such as mass testing of draft registrants; (b) tests should remain unaltered from one generation to another and estimates of trends should be based on raw score differences; (c) particular emphasis should be placed on culturally reduced tests like the Ravens Progressive Matrices Test, as distinct from tests with items that might easily be learned from one generation to another; and (d) particular emphasis should be placed on using mature subjects, subjects who have reached the peak of their raw score performance.

While these criteria are generally desirable, aspects of each have been challenged. On the first criterion (a), the best methods for selecting subjects such as random sampling from a well-defined population are difficult and costly to achieve. Many of the most consequential longitudinal studies that have reported on cohort effects have used convenience samples including the Victoria Longitudinal Study, Seattle Longitudinal Study, and Long Beach Longitudinal Study (1, 5, and 7, respectively). Even the use of representative sampling is flawed because samples are likely to become less representative as subject

attrition occurs over time and testings (Schaie et al. 2005). Criterion (b), while it was originally one of the central tenants of longitudinal methods, has become somewhat less important with the development of item response theory methods (Embretson 1996), which allow tests and measures to be equated. Criterion (d) states that subjects should have reached maturity before inclusion into the study, however, this does not allow for the assessment of cohort differences in the age at which maturity is reached (Schaie et al. 2005).

In recent years, many of the existing and retired longitudinal studies have archived their data for use by other investigators. According to the Maelstrom Research webpage (Fortier and Ferretti 2015) there are currently 115 active or completed cohort-based studies worldwide and most of those studies include one or more measures of cognitive performance. Many of the databases can be found on the Maelstrom website ([www.maelstrom-research.org](http://www.maelstrom-research.org)) or on other websites such as the National Archive of Computerized Data on Aging (NACDA) in the USA.

### Cohort as a Nuisance Variable

In the developmental sciences, research studies are not able to achieve pure measures of age, cohort, or time-of-measurement (AKA period effects), which are likely to be the primary measures of interest. That is, the experimental designs that are currently available are problematic such that two of three time-varying measures, age, cohort, and time, are always confounded with one another, and the so-called “ACT problem” is intractable (Horn and Donaldson 1976). However, as statistical modeling methods continue to advance, there is the likelihood that the magnitude of the three effects can be estimated and that these estimates can be confirmed within and across studies. If reliable estimates can be determined then they can be statistically controlled for.

In *cross-sectional studies*, which are the most popular type of study used to examine cognitive performance (Salthouse 2015), age is the variable of interest but cohort confounds its measurement

(Horn and Donaldson 1976). In such studies, the performance of different age groups is compared to determine whether age differences exist among those groups. However, compared to a younger age group, an older age group’s participants are not only older but they are also born into an earlier birth cohort, and thus any conclusions about observed age differences are potentially confounded by cohort differences. Depending on the nature of the cohort effect, age group differences in performance can either be inflated, which is the norm, or reduced (Schaie et al. 2005; Zelinski and Kennison 2007). Yet, even when the direction of a cohort effect is not clear or is inconsequential, additional cohort-related noise is likely to be introduced into cross-sectional data, which may affect estimates of variability.

While many cross-sectional studies are performed in the highly controlled environment of a research laboratory, the potential for birth cohort contamination is not directly knowable from the data collected. The implicit assumption of many researchers has been that cohort effects are small and that they have only trivial effects on conclusions about age differences (Salthouse 2015). However, such assumptions are not always well founded and are contradicted by findings from the cohort-based results of cohort-sequential longitudinal studies, which have shown that many of the most studied measures of cognitive performance are indeed affected by birth cohort differences (Schaie et al. 2005; Zelinski and Kennison 2007). Matched sampling, in which the younger and older aged participants are matched on variables such as education or health can be used to reduce potential cohort effects, but such matching strategies are not likely to be entirely effective because such variables do not fully account for observed cohort effects (Williams 2013; Flynn 1987). While it is the case that cohort contamination is usually acknowledged as a limitation of cross-sectional study designs, cohort effects are scarcely considered in discussion sections.

As shown in Figure 1, positive cohort trends, whereby later-born cohorts outperform earlier-born cohorts, have been observed for measures of inductive reasoning, episodic memory, spatial

reasoning, and vocabulary (Schaie et al. 2005). Such findings suggest the likely existence of cohort contamination in cross-sectional studies of age-related cognitive performance, and they indicate that conclusions about age differences are likely to be overstated. Findings of cohort differences have been mixed for some measures such as verbal fluency and numerical ability, and so the potential for cohort contamination is less clear but not necessarily inconsequential (Schaie et al. 2005).

Salthouse (2015) in an intriguing study investigated the validity of longitudinal and cross-sectional results in light of the Flynn effect. The Flynn effect, the observation that more recently born cohorts score higher on IQ measures compared to earlier-born cohorts, has largely been confirmed with time-lag studies, in which both time-of-measurement and cohort effects are measured together and therefore confounded. If the Flynn effect is at least partially a product of historical changes, then longitudinal results may be contaminated by the Flynn effect. Salthouse studied Flynn effect biases in both cross-sectional and longitudinal comparisons and concluded that "...there were similar time-of-measurement increases in cognitive scores at different ages, which were accompanied by nearly constant cross-sectional age differences, but positively inflated estimates of longitudinal age differences." Thus, he showed that longitudinal studies are not immune to secular changes in performance and in some cases may be more biased in the measurement of age effects than cross-sectional studies. Others have shown that cohort effects can alter both cross-sectional and longitudinal results (Zelinski et al. 2009).

### Research Findings on Birth Cohort and Cognitive Function

*Gains in intelligence.* The so-called *Flynn effect* is the observation that there has been a strong, positive trend of increasing intelligence scores from one generation to the next for nearly a century (Flynn 1987). Rundquist in 1936 (Rundquist 1936) and Tuddenham in 1948 (Tuddenham

1948) were among the first researchers to document the phenomenon in the early to mid-twentieth century in American samples. Tuddenham (1948), for example, observed gains over an 11 year gap from 1932 to 1943 in an American sample, and he attributed the gains to advances in health, nutrition, education, and test-taking abilities. It was not until the 1980s, however, that the phenomenon gained its current traction and a name, when it was reported by Richard Lynn in 1982 and James R. Flynn in 1984 (Lynn 2013). It was Flynn's detailed investigation and description that led to the phenomenon being labeled the "Flynn effect" (Lynn 2013). Although this is the term popularly used, some refer to it as the Flynn-Lynn effect to recognize Lynn's 1982 contribution, whose publication preceded Flynn's and who like Flynn has published extensively on the topic (Lynn 2013).

In the United States, intelligence scores have risen by about three IQ points per decade from 1932 to 2002 on various versions of the Stanford-Binet and Wechsler IQ tests (Flynn and Weiss 2007). Similar strong gains have been recorded in countries all across the globe, including developed (Flynn 1987; Flynn and Weiss 2007) and developing nations (Williams 2013). These gains have been observed in both verbally based IQ measures as well as for Raven's Matrices and other matrix reasoning tests, which are believed to be less affected by cultural and educational influences (Flynn 1987).

A recent meta-analysis evaluated average IQ gains from 1909 to 2013 for a combined sample created from 271 individual samples representing 31 countries of over four million participants. They reported IQ gains of 4.1 points per decade for measures of fluid abilities (Pietschnig and Voracek 2015). Somewhat more modest gains were observed for spatial abilities (IQ gain = 3.0 points/decade), full scale IQ (IQ gain = 2.8 points/decade), and crystallized abilities (IQ gain = 2.2 points/decade). While IQ gains have been observed across most of the twentieth century, there is a growing body of evidence that these gains have slowed or even reversed around the turn of the twenty-first century for some countries. Teasdale and Owen (2008), for example,

found losses of 1.5 IQ points over a 5 year period from 1998 to 2003 in a Danish sample.

The magnitude of gains has been observed to be larger in people with lower IQ scores, but this finding is not universal (Williams 2013). Observed gains have also been larger for urbanites than for rural samples (Williams 2013).

The largest gains have usually been found for fluid ability measures such as inductive reasoning, word recall, and spatial reasoning (Schaie et al. 2005; Zelinski and Kennison 2007). Somewhat smaller gains have been observed for crystallized abilities such as vocabulary (Schaie et al. 2005; Zelinski and Kennison 2007), and in some cases no gains have been observed (Lynn 2013). The observed increases in fluid abilities have sometimes been taken as evidence that the gains represent real gains in intelligence as opposed to gains in knowledge. Yet, the inconsistent correlation in the rise of IQ scores around the globe and the small fluctuations in reports of gifted individuals have led Flynn (1987) to conclude that IQ tests have a weak but not inconsequential relationship to the construct of intelligence.

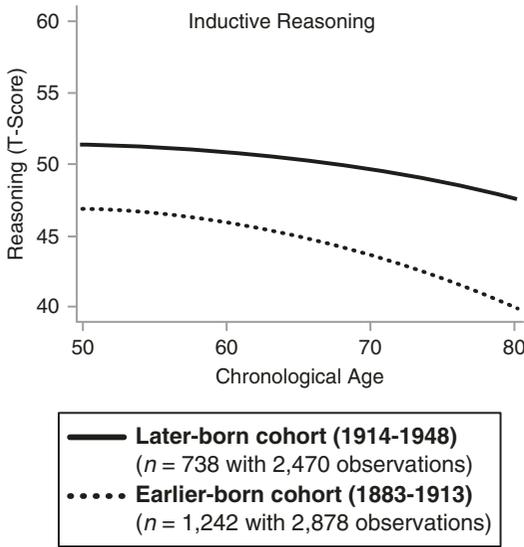
So what explains the rather extraordinary gains in IQ performance observed over the past century? Several non-mutually exclusive explanations have been proposed and at least partially supported, including increases in educational quality and attainment (Alwin and McCammon 2001), exposure to technology and media (Williams 2013), the benefits of better health and healthcare (Williams 2013; Gerstorf et al. 2011), and reductions in poverty and malnutrition (Flynn, 2008), among others (Lynn 2013). However, none of these explanations individually or in combination fully explain the observed gains. In addition, Lynn (2013) has demonstrated that cohort-based IQ gains have been found in infants, which brings into question explanations that are likely to occur in later development, including education-based explanations. Thus, the question of cause remains open and the search for a comprehensive explanation continues to remain elusive.

*Cohort effects in older adult samples.* It is well established that there are large age-related declines in many aspects of cognitive performance.

For example, declines in fluid intelligence abilities (e.g., inductive reasoning, memory, and word fluency) have been observed to begin soon after human maturity is reached, around age 30, with increasingly large age-related declines thereafter as confirmed in both cross-sectional and longitudinal analyses (Schaie and Hofer 2001). Given these persistent declines and the expanding size of the older adult population relative to other age groups, questions about whether cohort-based positive gains in intellectual abilities will offset or partially mitigate anticipated declines in present and future generations are well worth considering (Zelinski and Kennison 2007).

Most studies that have examined cohort effects in psychometric measures have done so by examining mean level differences in cognitive performance, whereby participants from different cohorts are matched on age and their average performance is compared to determine whether cohort differences exist (Schaie et al. 2005). Such comparisons have usually indicated that a later-born cohort outperforms an earlier-born cohort (Schaie et al. 2005; Williams 2013). Fewer studies have examined cohort differences in the rate of age-related changes (Schaie et al. 2005; Zelinski and Kennison 2007; Gerstorf et al. 2011). Such studies typically employ growth modeling, whereby a model is “fit” to the data. At least two results are typically reported: (1) cohort differences in mean level performance (intercept) and (2) cohort differences in the rate of change (slope).

Zelinski and Kennison (2007) examined cohort differences in the Long Beach Longitudinal Study from ages 56 to 86 for two cohorts born 16 years apart on five measures of cognition including inductive reasoning, list recall, text recall, spatial reasoning, and vocabulary. Piecewise growth models consisting of two linear slopes – one for young-old age (ages 56–74) and the other for old-old age (ages 74–86) – were fit to each measure of cognition. The results indicated that mean level cohort differences favoring the later-born cohort were found for all measures except vocabulary. No differences in the rates of decline were found for inductive reasoning or spatial reasoning. However, for the two memory measures, list and text recall, the rate of decline for

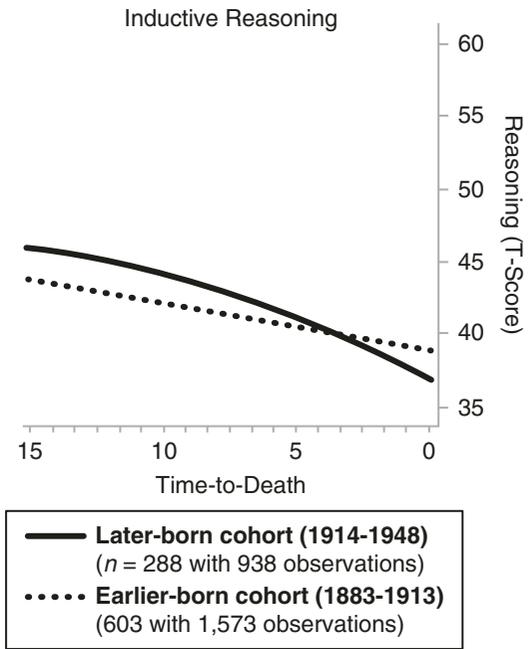


**Cohort Effects, Fig. 3** Cohort differences in inductive reasoning from age 50 to age 80. Later-born cohorts (*solid lines*) outperformed earlier-born cohorts (*dashed lines*) at age 70 and also showed shallower rates of cognitive decline. Excerpted from Gerstorf et al. (2011) (Reprinted with permission from the American Psychological Association)

the old-old age slope (age 74–86) interacted with cohort such that the advantage of the later-born cohort disintegrated with advancing age. This result can be seen in Fig. 2 for list recall.

Similar findings have been reported by Gerstorf et al. (2011), who examined age-related performance on five cognitive measures from the Seattle Longitudinal Study including inductive reasoning, spatial reasoning, word fluency, numerical ability, and vocabulary. Separate growth models were fit for age-related changes and for time-to-death changes. The five age-related change models each showed that a later-born cohort outperformed an earlier-born cohort and that the gap increased from 50 to 80 years of age. Figure 3 demonstrates this finding for inductive reasoning. Yet, the time-to-death models showed that the cohort advantage enjoyed by the earlier-born cohort receded as death approached. Figure 4 shows the collapse of the advantage in performance of the later-born cohort compared to the earlier-born cohort as death nears.

Possible explanations for the reduction of cohort effects in very old age include: (1) greater selectivity



**Cohort Effects, Fig. 4** Cohort differences in terminal decline for inductive reasoning. Mortality-related models suggest no evidence for positive secular trends in inductive reasoning. Later-born cohorts (*solid lines*) showed steeper mortality-related declines than earlier-born cohorts (*dashed lines*). Excerpted from Gerstorf et al. (2011) (Reprinted with permission from the American Psychological Association)

in the oldest segment of the sample or (2) that the protective effects of cohort recede at the upper reaches of the lifespan. While greater selectivity is a possibility in the results reported by Kennison and Zelinski (2007), the Gerstorf et al. (2011) time-to-death results reduces selectivity as a possible explanation for their results because all of their participants were followed to their deaths. They concluded that “[the] results are in line with the idea that mortality-related mechanisms and the progressive processes leading toward death (e.g., deteriorating health) are so pervasive that they override historical, cohort-related effects that were apparent earlier in life.” Thus, these results suggest that cohort effects, while quite robust, may not persist across the entire lifespan, especially at the upper reaches of the lifespan.

Still there is considerable evidence that birth cohort differences favoring the later-born cohort exist in older samples, and this suggests that the

effects of early developmental experiences are likely to be long lasting, even into old age. There is also growing and compelling evidence that cognitive, social, and physical engagement among adults enhances level of cognitive functioning (Hertzog et al. 2008). These findings combined with findings that later-born cohorts are more likely to engage in such positive health behaviors (Baltes et al. 2006) suggests that the level of age-related declines that are seen in today's older adults are likely to be smaller for future generations (Skirbekk et al. 2013).

## Conclusion

The cohort-based findings reviewed in this entry have far reaching societal and institutional implications as they have been linked to secular changes in education, technology, health, health care, etc. Yet, a comprehensive explanation of the observed positive cohort trends remains a work in progress. While methodological constraints persist, much progress has been made towards understanding age, cohort, and time effects and their interactions by employing a variety of different study designs, sampling frames, and statistical techniques. The cognitive performance advantages enjoyed by later-born cohorts are likely to persist into old age, however, as death approaches, these advantages may recede. Finally, the findings reviewed here give hope that the typical cognitive declines seen in older adults today are likely to be smaller and less intrusive in future generations of older adults.

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## Common Cause Theory in Aging

Kim M. Kiely and Kaarin J. Anstey  
Centre for Research on Ageing Health and Wellbeing, Research School of Population Health, The Australian National University, Canberra, ACT, Australia

### Synonyms

Common cause hypothesis; Common cause factor; Dedifferentiation; Shared age-related variance; Shared influence models

### Definition

The common cause theory of cognitive aging hypothesizes that age-related declines in cognitive, sensory, and sensorimotor functioning can primarily be attributed to a domain-general neurobiological mechanism. It predicts an increasing association between cognition and sensory acuity with advancing age and was originally proposed as a broad third variable explanation to account for shared variance between age, cognitive, and noncognitive variables.

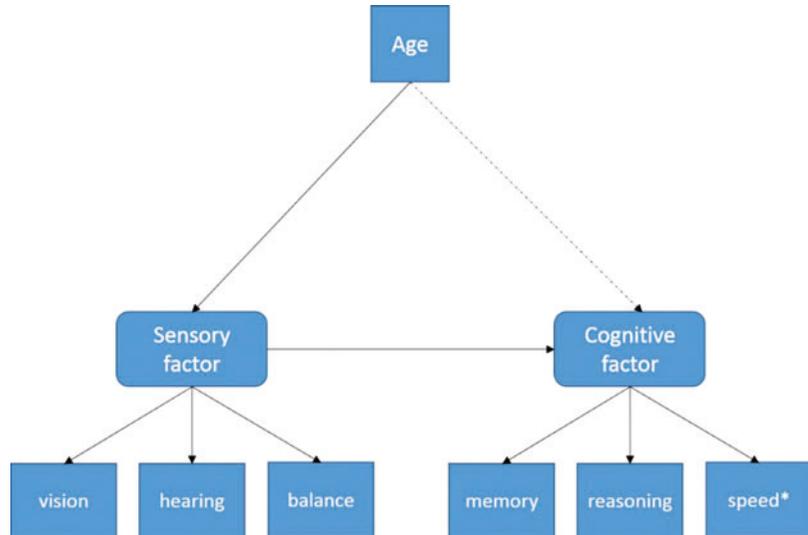
## Historical Context and Background to the Common Cause Hypothesis

Since Galton's early work in the late 1800s (Galton 1883), psychologists have long attempted to draw conceptual and empirical links between sensory discrimination and intelligence, particularly those adopting an individual differences perspective (Deary 1994). For example, sensorimotor abilities have been identified as important structural components in hierarchical models of human intelligence (Carroll 1993). In more recent times cognitive scientists, guided by an information processing framework, have recognized that cognition and sensation do not operate in isolation, but constitute an integrated system in which top-down and bottom-up processes are intrinsically intertwined. Of interest to geropsychology is the way in which the coupling between these two domains changes with age. While there is no evidence to suggest that sensory functioning is strongly linked to cognitive performance in early life or mid-life, a small number of studies conducted sporadically during the latter half of the 1900s consistently demonstrated an association between cognition and sensory functioning (particularly hearing ability) in older age-groups (Schaie et al. 1964; Anstey et al. 1993; Rabbitt 1990a; Granick et al. 1976). These cross-domain interassociations were important from the viewpoint of life-span developmental psychology as they appeared to emerge during later life and therefore provided an example of discontinuity in life-span development (Lindenberger and Baltes 1994). They also indicated that dedifferentiation may extend beyond the cognitive domain (Anstey et al. 2003a) and were relevant to theoretical debates concerning the extent to which age-related changes in a variety of domains could be accounted for by a broad and general mechanism, rather than a number of unrelated domain-specific factors (Salthouse and Czaja 2000).

Despite the significance of these findings for theories of cognitive aging, it was not until the mid-1990s that there was a concerted research program seeking to understand why cognitive and noncognitive variables are increasingly

### Common Cause Theory in Aging,

**Fig. 1** Schematic of mediation model analogous to those tested by Lindenberger and Baltes (1994) and Anstey (Anstey and Smith 1999; Anstey et al. 2001). \*Sensory functioning is generally found to be a stronger predictor of age-related individual differences in cognition than processing speed



related at older ages. At the start of the decade, Rabbitt (1990b) strongly argued that cognitive scientists with an interest in late-life phenomena should indeed be interested in lower-level sensory systems. Critically, this period coincided with a greater appreciation of the underlying role that degeneration of the central nervous system plays in driving age-related declines in sensory acuity (Baltes and Lindenberger 1997). That is, age-related sensory decline could be attributed to neuronal deterioration beyond the level of the end organ. It was therefore timely for geropsychologists to consider joint contribution of “brain aging” to cognitive and sensory decline (and more broadly to motor functions), and this culminated with a proposal by Lindenberger and Baltes for a “common cause hypothesis” (Lindenberger and Baltes 1994).

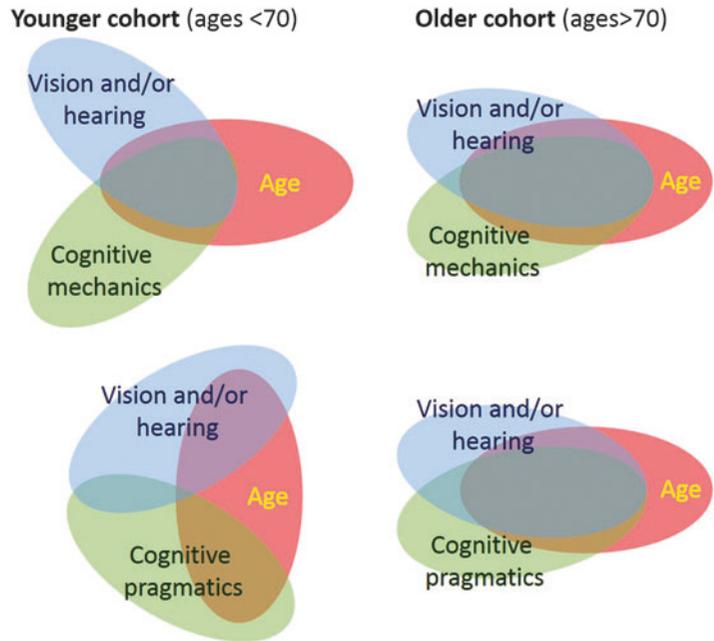
### Shared Age-Related Variance

Motivated by previous empirical findings and their potential implications for cognitive aging theory, Lindenberger and Baltes (Lindenberger and Baltes 1994; Baltes and Lindenberger 1997) conducted two studies using baseline data from the Berlin Aging Study to investigate the roles of vision and hearing in explaining age differences in

intellectual (or cognitive) abilities. In the first study (Lindenberger and Baltes 1994), visual acuity and auditory pure-tone thresholds explained 49% of the total variance and 93% of the age-related variance in a second-order general intelligence factor comprising perceptual speed, reasoning, memory, verbal fluency, and knowledge. In addition, vision and hearing fully mediated the effects of age on intelligence – that is, after adjusting for sensory functioning, there were no direct effects of age on intelligence (see Fig. 1). Importantly, excluding participants with suspected dementia or severe sensory impairment did not alter the pattern of results. The explanatory power of sensory functioning was then compared to that of processing speed, which had been identified as a potential broad mechanism underpinning cognitive aging. These analyses indicated that vision and hearing were at least as powerful as processing speed in predicting age-related individual differences in an intelligence factor defined by reasoning, memory, verbal fluency, and knowledge (i.e., excluding speed). Moreover, while sensory functioning subsumed all the age-related variance in processing speed, processing speed was unable to account for 15% of the age-related variance in vision and 9% of the variance in hearing. This finding was later supported by comparable analyses of other datasets (Anstey

### Common Cause Theory in Aging, Fig. 2

Venn diagrams depicting cohort differences in shared variance patterns among age, sensory functioning (visual acuity and pure-tone audiometry), fluid cognitive mechanics (speed, reasoning, and memory), and crystallized cognitive pragmatics (knowledge and fluency). Overlapping areas reflecting proportions of shared variance are approximated from results reported in Baltes and Lindenberger (1997) and Anstey (Anstey and Smith 1999); however, the schematic is illustrative only and not based on actual data



et al. 2001). Lindenberger and Baltes (1994) argued that of the two, sensory functioning was the more powerful predictor of general intellectual abilities. Their conclusion was significant because speed of information processing was considered an important cognitive primitive and central to resource-based accounts of cognitive aging. Such theories included the generalized slowing and processing speed hypotheses, which had been proposed in various forms by Birren, Cerella, and Salthouse (for review see Hartley 2006).

The link between intellectual abilities and sensory acuity was later reexamined in a larger composite sample that augmented the baseline sample of participants from the Berlin Aging Study with newly recruited younger participants (Baltes and Lindenberger 1997). Rather than modeling the indirect effects of age on a second-order general intelligence factor, each cognitive ability was examined individually. Vision and hearing were more strongly associated with individual differences in the five cognitive abilities within the older cohort (ages 70–103), relative to the younger cohort (ages 25–69). But there remained a significant proportion of shared age-related

variance among the younger participants, thus replicating their previous findings across a broader age range. A more nuanced pattern of results emerged when the cognitive abilities were classified according to a dual-process model of intellectual functioning. (Dual process models of intellectual development across the life-span make a distinction between cognitive mechanics (also referred to as fluid intelligence) and cognitive pragmatics (referred to as crystallized intelligence). Cognitive mechanics are content poor, have a strong neurophysiological basis, and typically undergo age-related declines throughout adulthood. Cognitive pragmatics reflect knowledge acquired through experience, are culturally shaped, and increase with age.) There were no cohort differences in the proportion of age-related variance shared by vision or hearing and variables reflecting fluid cognitive mechanics (speed, reasoning, and memory). In contrast, while sensory functioning predicted age-related variance among variables reflecting crystallized cognitive pragmatics (fluency and knowledge) within the older cohort, this was not the case within the younger cohort (see Fig. 2).

## The Common Cause Hypothesis and Alternative Explanations

Overall, the key findings from these studies were that (a) there was considerable shared variance between age, general intelligence (primarily in fluid abilities), and sensory acuity and (b) sensory functioning fully mediated age-cognition associations. Lindenberger and Baltes offered etiological and functional explanations to account for age-related covariation between cognitive and sensory functioning. These included the neurological *common cause* hypothesis, *sensory deprivation* hypothesis, and *cognitive load on sensory performance* hypothesis. A brief description of each of these hypotheses is provided below, but interested readers may like to refer to Schneider and Pichora-Fuller (2000) who provide a thorough overview of these hypotheses and additional explanations.

The *common cause hypothesis* maintains that a domain-general mechanism is responsible for a substantial amount of the age-related decline in cognitive, sensory, and sensorimotor functions. It was argued that the emergent association between sensory and cognitive function in late life reflected “an expression of the physiological architecture, or the mechanics, of the [aging] brain” (Lindenberger and Baltes 1994, p. 339). Clearly the original intention of the hypothesis identified the underlying etiology as being neurological in nature. Though often construed as a single determinant, it was recognized that as a third variable explanation, the common cause factor could reflect an ensemble of senescent processes affecting brain structure, physiology, and function. In addition, other third variables such as “bodily functions” were not discounted (Baltes and Lindenberger 1997). The common cause hypothesis was consistent with contemporaneous views offered by researchers interested in operationalizing functional biomarkers as an index of primary aging. For example, after reporting that a bioage factor (a latent variable reflecting biological age; Anstey 2008) comprising measures of sensory acuity and physical functioning mediated the relationship between age and fluid intelligence (Gf), Anstey and colleagues

(1993) concluded that sensorimotor functioning was an important indicator of intellectual decline, and this “may be interpreted as evidence for a decline in Gf related to biological changes in the brain, central nervous system, and motor systems” (Anstey et al. 1993, p. 568). Such broad explanatory mechanisms implied by common cause factors are attractive to cognitive aging theorists because they are parsimonious and reduce the search for potential mechanisms to a single or small number of underlying causes.

Whereas the common cause theory hypothesizes an underlying etiology, other explanations propose more functional and directional causal pathways between cognitive and sensory aging. The *sensory deprivation* hypothesis identifies reduced sensory functioning as a long-term antecedent of cognitive decline, linking the two via social engagement. Specifically, declining sensory acuity creates communication and mobility difficulties, increasing the likelihood of social withdrawal and disengagement from intellectually stimulating activities, which over an extended period (spanning years to decades) will eventually result in the lowering of levels of general cognitive ability. Thus, according to this view, age-related sensory impairment initiates an upward cascade of effects that ultimately impact on central cognitive functioning. Such explanations had previously been described by Sekular and Blake who referred to the process as “protracted sensory underload” (1987; cited in Lindenberger and Baltes 1994) and Rabbitt (1990b) who noted that sensory loss in late life can inhibit “social interaction, employment, enjoyment of life, learning new skills, and cognitive engagement” (p. 231) and have secondary “knock-on” effects on everyday memory and comprehension. These accounts therefore invoke the notions of brain reserve or cognitive reserve, which posit that novel and mentally stimulating activities are important for maintaining cognitive ability levels (or at least attenuating rates of cognitive decline) by promoting neuroplasticity which creates a buffer against the impacts of accumulating neuropathology.

Alternative upward cascade models have also been proposed. The *perceptual degradation*

and *cognitive permeation* hypotheses place age-related sensory decline as a driver of poor cognitive performance, but over a more immediate time frame (Schneider and Pichora-Fuller 2000; Valentijn et al. 2005). According to the perceptual degradation explanation, encoding errors of degraded sensory inputs impinge on higher-level cognitive processing. Similarly, the cognitive permeation hypothesis maintains that greater attentional, executive, and working memory resources must be allocated to processing of low-fidelity sensory inputs, thus compromising cognitive functioning by diverting cognitive resources away from higher-order processes (Lindenberger and Ghisletta 2009). A key prediction of such explanations is that correcting for sensory loss should moderate the association between sensory and cognitive function. A popular approach to testing this hypothesis has been to examine the effect of cataract surgery on cognitive function. While some studies have been argued to demonstrate that cataract surgery is associated with lower levels of cognitive impairment after surgery, these investigations have been limited by small sample size, lack of appropriate control groups, failure to assess baseline cognitive function, or inadequate control for confounding factors (Hall et al. 2005). Studies employing more rigorous research designs have failed to show that removal of cataracts improves cognitive function (Hall et al. 2005; Anstey et al. 2006).

The *cognitive load on sensory performance* suggests that deterioration of cognitive abilities such as attention and processing speed adversely affect the control and execution of simple sensory tasks. For example, deficits in sustained attention may diminish an individual's capacity to detect auditory or visual stimuli. It is important to note that these explanations are not mutually exclusive, but are related and likely to operate interdependently in a cycle of cumulative and reciprocal effects. For example, if cognitive resources become more limited and sensory acuity declines due to "brain aging," this may increase the cognitive load for basic processing of sensory information. This increases the likelihood of social withdrawal and reduced participation in mentally stimulating activities, which

limits opportunities to moderate the adverse impacts of brain aging.

As the original analyses of the Berlin Aging Study employed observational and cross-sectional research designs, it was not possible to rule out any of the proposed explanations. Baltes and Lindenberger (1997) also acknowledged that each of the hypothesized causal pathways was potentially related. Nevertheless, they argued that a common cause explanation was most consistent with their results for the following reasons. Firstly, sensory functioning had weaker associations with experientially based cognitive abilities, whose development was considered to be more reliant on an enriched social environment. Secondly, it was expected the impacts of protracted sensory underload would be more pronounced among individuals with greater levels of sensory impairment, yet there was no evidence of a curvilinear relationship between sensory and cognitive functioning. Finally, sensory measures were thought to mediate age-cognition relations because they were assumed to provide a more reliable and direct measurement of brain aging (Lindenberger and Baltes 1994). Similar arguments were made by those who adopted a biomarker mediation model of cognitive aging, whereby sensorimotor variables were conceptualized as functional biomarkers that indexed primary (normative) aging processes with greater reliability than chronological age (Anstey et al. 1993; Anstey and Smith 1999).

### **Evidence for Common and Domain-Specific Factors**

Even though these studies arose from opportune circumstance and were framed as being exploratory (Lindenberger and Baltes 1994; Baltes and Lindenberger 1997), their clear rationale and robust findings meant they quickly became a catalyst for rigorous conceptual, methodological, and empirical examination of the interassociations between age, cognition, sensory perception, and other indicators of physical ability. Because of the emphasis placed on a common cause interpretation, this theory became the main focus of subsequent

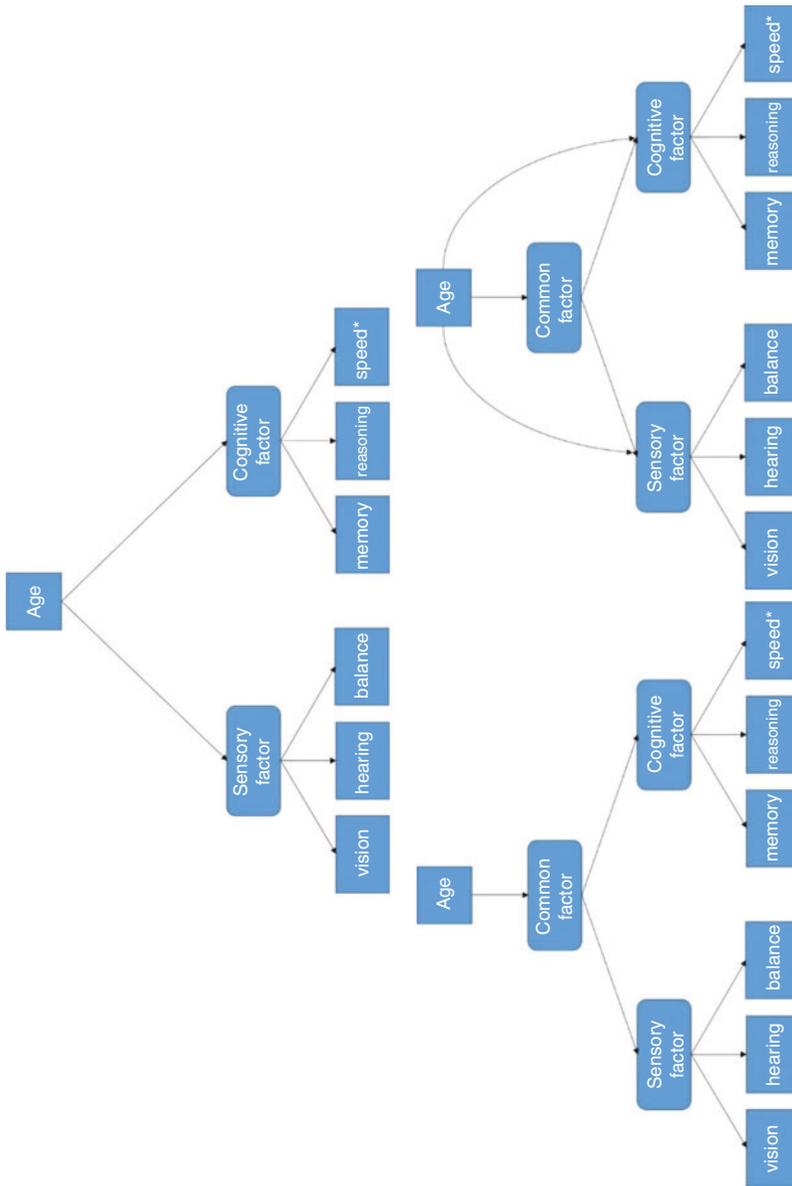
investigations. In particular, debate centered on quantifying the degree of interdependency across a variety of functional domains and whether it was reasonable to infer that a common cause was primarily responsible for age-related declines.

The common cause theory was originally concerned with cognitive and sensory domains, with a focus on visual acuity and pure-tone audiometry; subsequent investigations broadened the explanatory scope of the theory to include other functional domains that also exhibit declines in performance with age. Studies have examined age-related associations with cognition for a range of sensory variables such as contrast sensitivity, central auditory processing, proprioception, vibration sense, and balance. The general finding has also been extended to motor and physiological functions including grip strength, lower limb strength, walking ability and gait, lung function, and blood pressure (Schneider and Pichora-Fuller 2000; Anstey and Smith 1999; Li and Lindenberger 2002; Clouston et al. 2013; Krall et al. 2014), though blood pressure has not always been shown to load onto a common factor (Christensen et al. 2001). All such cross-sectional studies have typically reported moderate to large interassociations with age. However, it has been suggested that the magnitude of the age-related associations between different pairs of cognitive and sensorimotor variables may vary. For example, data from the Australian Longitudinal Study of Aging indicates that vision and hearing are more strongly linked to episodic memory than other general cognitive abilities (Anstey et al. 2001).

It was not unusual for cross-sectional evidence of shared age-related variance to be interpreted as suggestive of a broad explanatory mechanism (Salthouse and Czaja 2000). Early studies employing structural equation modeling or hierarchical regression analyses generally identified sensory functioning as the mediator of age-cognition associations as depicted in Fig. 1. In these cases, a common cause interpretation relied on the assumption that sensorimotor functioning was a more direct indicator of the integrity of the central nervous system. A more formal approach to assessing common cause factors is to define latent variable that reflects shared

variance across cognitive and noncognitive variables and regress age onto the common factor as well as each of the individual domains or indicators. This approach, when applied to multifactorial data, is depicted in Fig. 3 and typically involves the comparison of (at least) three nested conceptual models, namely, (i) an independent factor model (no common cause factor) which only includes direct effects of age on each domain, (ii) a hierarchical common factor model with indirect age effects mediated by a common cause, and (iii) a hierarchical common factor model with both direct and indirect age effects (see Allen et al. (2001) for a detailed description of each of these conceptual models and some additional variations). An alternative depiction of these shared variance models is presented in Fig. 4.

When studies were designed to test common cause factor models following procedures outlined in Fig. 3, it quickly became apparent that there were both direct and indirect effects of age on cognitive and sensorimotor variables (Salthouse and Czaja 2000; Anstey et al. 2001; Christensen et al. 2001; Salthouse et al. 1998; Salthouse and Ferrer-Caja 2003). Thus, these analyses demonstrated that there were shared and unique portions of age-related variance among cognitive and noncognitive variables. Sensorimotor variables have also been reported to correlate with cognitive variables independent of age (particularly variables reflecting crystallized cognitive pragmatics) (Anstey and Smith 1999). Consequently by 2003, there was a broad consensus that age-related declines in cognitive and sensorimotor functioning could be attributed to both a broad common cause factor and separate domain-specific mechanisms, tempering the earlier emphasis placed on common cause interpretations. In an important appraisal of the common factor methods used to support broad mechanisms, Allen and colleagues (Allen et al. 2001) argued that many analyses failed to adequately assess the comparative fit of all competing models. They demonstrated that hierarchical common factor models did not always fit the data better than independent factor models, particularly when independent factors were allowed to have correlated disturbance terms.

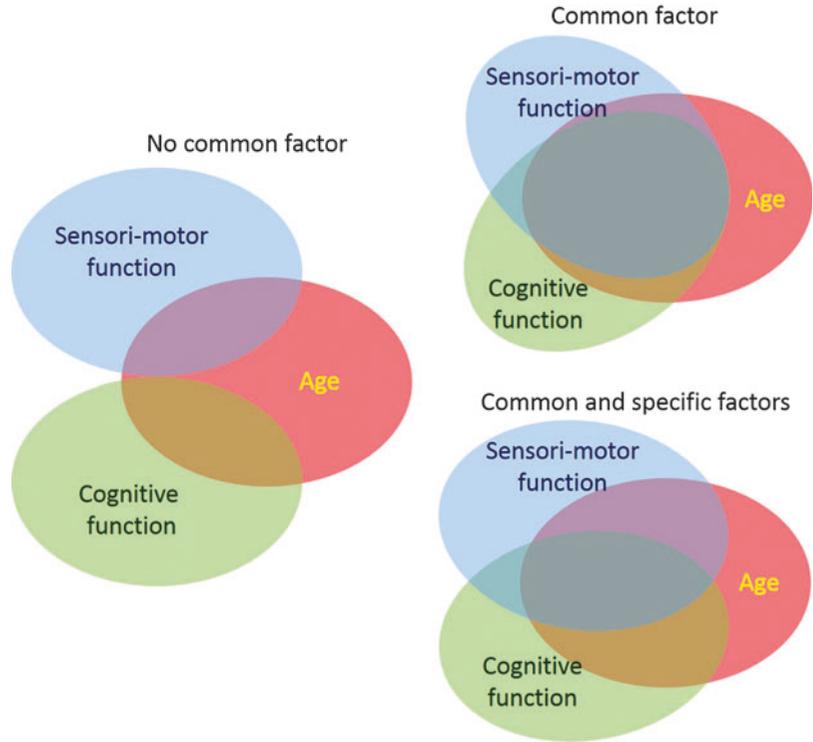


**Common Cause Theory in Aging, Fig. 3** Top: Independent factor model with direct age effects. Bottom Left: Second-order (hierarchical) common factor model with indirect age effects. Bottom Right: Second-order (hierarchical) common factor with direct and indirect age effects (Figures adapted from Salthouse and Czaja (2000) and (Allen et al. 2001))



### Common Cause Theory in Aging, Fig. 4

Venn diagrams depicting three possible models of shared variance between age, cognitive, and sensorimotor functioning. *Left:* No common factor (domain-specific factors only); *Top right:* Common factor; *Bottom right:* Common and domain-specific factors. Sensorimotor variables have also been described as “functional biomarkers” (Anstey et al. 1993; Lindenberger and Ghisletta 2009)



### Longitudinal Evidence for the Common Cause

Recognizing that longitudinal designs were necessary to properly examine within-person coupling of cognitive and noncognitive variables (Hofer and Sliwinski 2001), a number of research groups employed multivariate latent growth curve (and related) techniques to test covariation in levels and rates of change between cognitive and sensory measures (Anstey et al. 2003a, b; Lindenberger and Ghisletta 2009). Importantly, these studies demonstrated only modest associations between rates of sensory and cognitive decline (e.g., 9% shared variance between change in memory and vision; Lindenberger and Ghisletta 2009), as well as providing support for domain-specific factors. Again, it was argued that the evidence for a common cause factor was strongest for memory and vision and for memory and speed, which were the only inter-domain pairings to have correlated rates of change in the Australian Longitudinal Study of Ageing (Anstey

et al. 2003b). Bivariate dual change score models have been used to test bidirectional time-ordered associations between cognition and sensory function (Ghisletta and Lindenberger 2005). In these analyses, levels of visual acuity were predictive of subsequent declines in processing speed, and conversely, levels of processing speed were predictive of subsequent declines in visual acuity. Consistent with other studies, large domain-independent effects were reported. Ghisletta and Lindenberger (2005) framed their discussion of this dynamic link between cognitive and sensory functioning in relation to common cause, biomarker mediation, and cascade hypotheses. Each of these longitudinal studies provides a complex picture of the interdependent nature of cognitive and sensory aging, but overall supports the notion that there are both common and independent factors driving declines in cognition and sensation. In addition, the modest interassociations suggested that initial enthusiasm for the overarching importance of a common cause factor was overstated. The divergence in findings from earlier studies

demonstrates the importance of longitudinal data for modeling time-dependent processes that are inherent to theories of psychological development and aging. Longitudinal designs enable direct examination of age changes and covariation in rates of change – which is necessary to test predictions made by the common cause hypothesis. Indeed, it has been well documented that age changes are confounded with age differences and population trends in cross-sectional data, and this can produce positively biased correlations between variables that actually share no association, or even a negative association, in their developmental trajectories over time (Hofer and Sliwinski 2001; Lindenberger et al. 2011; Lindenberger and Potter 1998).

### Limitations of the Common Cause Theory

The common cause theory has both conceptual and methodological limitations that constrain its overall attractiveness as a comprehensive explanation for cognitive aging. Although common factor models often provide good fit of cross-sectional associations between cognitive and noncognitive variables and are often interpreted as reflecting broad explanatory mechanisms (Salthouse and Czaja 2000), simulation studies have shown that common factor models cannot always be rejected even when they are false (Allen et al. 2001). Many of the analytic strategies employed provide supporting evidence of a common factor rather than conduct critical hypothesis testing of the common cause theory.

One of the main challenges for the theory is that it implicates a wide range of psychological and physical functions with no obvious candidate (s) for the ensemble of common causes. A broad range of measures including peripheral hearing, visual acuity, reaction time, grip strength, lung capacity, processing speed, and episodic memory have all been shown to converge onto a common age-related factor to varying degrees, yet there is no well-defined system that is known to directly underlie performance across all of these domains

(Christensen and Mackinnon 2004). Thus, at the time the common cause was attracting peak research attention, it was not possible to specify the broad mechanism (Salthouse and Czaja 2000). In the words of Ghisletta and Lindenberger (2005), the common cause theory is “empirically and theoretically under-identified” (p. 580). Indeed, when conjecturing about the common cause, proponents have cast a wide net when naming candidate mechanisms. These have ranged from general notions of “brain aging” and “integrity” of the central nervous system to more specific etiology such as structural changes or atrophy, white-matter loss or hyperintensities, gray-matter loss, impaired frontal circuitry, dopaminergic neuromodulation, inflammation, oxidative stress, telomere length, and genetic expression (Salthouse and Czaja 2000; Ghisletta and Lindenberger 2005; Christensen and Mackinnon 2004). Unfortunately, many studies examining the common cause theory have lacked direct measurement of any of these mechanisms. It is for these reasons that the latent variable reflecting a common factor should be distinguished from a putative common cause mechanism (Christensen and Mackinnon 2004).

### Conclusion

Understanding relations between functional domains is an important step to developing a complete description of human life-span development. Cognition, sensation, and motor functioning are broad ability domains that are central to the study of human aging. Their age-related associations demonstrate the importance of considering cross-domain interdependencies in human development. The common cause hypothesis shone a spotlight on this important field and stimulated research into shared mechanisms underlying sensory and cognitive aging. It remains plausible that a common etiology underlies some of the age-related declines in both cognitive abilities and sensorimotor function (Li and Lindenberger 2002; Christensen and Mackinnon 2004), but it is clear that a comprehensive account of cognitive

aging must also include domain-specific factors. According to relatively recent evaluations, it is reasonable to expect that substantial portions of decline across a range of domains can be attributed to a small number of causal pathways (Lindenberger and Ghisletta 2009). Common causes are likely to draw from some of the central processes underpinning brain aging, such as systemic inflammation affecting vascular health, oxidative stress, and genetics. It is important that future research directly assesses the role(s) of candidate common causes.

## Cross-References

- ▶ [Australian Longitudinal Study of Aging \(ALSA\)](#)
- ▶ [Berlin Aging Studies \(BASE and BASE-II\)](#)
- ▶ [History of Biomarkers in Geropsychology](#)
- ▶ [History of Cognitive Aging Research](#)
- ▶ [History of Cognitive Slowing Theory and Research](#)
- ▶ [Individual Differences in Adult Cognition and Cognitive Development](#)
- ▶ [Physiological Effects on Cognition](#)
- ▶ [Sensory Effects on Cognition in Later Life](#)

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## Communication with Older Adults

Mary Lee Hummert

Communication Studies Department, University of Kansas, Lawrence, KS, USA

### Synonyms

Aging and communication; Elderspeak; Intergenerational communication; Language and aging; Patronizing talk; Person-centered communication

### Definition

Communication with older adults refers to face-to-face or mediated interactions between individuals or within groups in which at least one of the individuals meets – or is perceived to meet – the cultural standard for classification as an “older adult.” The specific standard varies across cultures and is generally based on chronological age (actual or perceived) or another demographic factor such as retirement status.

Communication with others – whether in family, social, or institutional contexts – is important to the psychological well-being of older adults. Communication is the means through which older adults achieve and maintain personal control as well as the social, familial, and professional relationships that are essential to their emotional health, life satisfaction, and general well-being. From the perspective of the life span theory of control (Heckhausen and Schulz 1995; Hummert and Nussbaum 2001; Fowler et al. 2015), communication may become the sole avenue to exercising personal control for those older adults in declining health. Although normal aging is associated with changes in hearing and cognition (e.g., name recall) that can affect language and communication, the extent to which individual older adults experience these changes varies widely and most develop coping strategies that

enable them to maintain their communication skills (Kemper et al. 2015). Yet negative age stereotypes about the communication competence of older adults create challenges for them and their communication partners across contexts. This relationship between negative age stereotypes and communication carries implications for not only the psychological and social, but also the physical, well-being of older individuals.

### The Communication Predicament of Aging

Age stereotypes can be positive (e.g., the wise and loving perfect grandparent) as well as negative (e.g., the bitter and demanding shrew/curmudgeon), but negative stereotypes are more accessible and numerous than positive ones (Hummert 2011). Even in East Asian cultures that traditionally have placed a strong value on filial piety, negative age stereotypes predominate and play a role in intergenerational communication (Giles and Gasiorek 2011). Negative age stereotypes include beliefs about the physical, cognitive, and psychological characteristics of older adults that have implications for their communication competence. Examples are hard-of-hearing, sick, inarticulate, slow-thinking, forgetful, sad, lonely, inflexible, and demanding (Hummert 2011). Drawing on communication accommodation theory, the *communication predicament of aging* model (CPA; Ryan et al. 1986) illustrates how these stereotypical beliefs contribute to a negative feedback cycle in communication with older adults.

According to the CPA model, when a younger person meets an older person, recognition of the physical signs of age (grey hair, wrinkles, etc.) may activate these stereotypical beliefs and result in a communication style that accommodates to the presumed needs of the older person. That is, the younger person may speak slowly and loudly, use short sentences and simple language, employ exaggerated intonation for emphasis, and/or call the older person by first name or a diminutive (e.g., honey, dearie), all in an effort to communicate effectively. This stereotype-based, age-adapted

communication style, or elderspeak, constitutes *patronizing talk* because it implicitly (or in some cases, explicitly) questions the competence of the older person. In doing so, it challenges the older individual's autonomy to control his or her behavior and decisions (Savundranayagam et al. 2007).

Although control is an element in all patronizing talk, the degree of control can vary from moderate to high and the accompanying emotional tone may be warm or cold (Hummert et al. 2004). Three examples of moderate control illustrate variations in emotional tone from warm to cold: (1) "Here's the form, dear. Let me explain it to you"; (2) "Mom, don't overdo it – you're not as young as you used to be"; and (3) "Tom, as your physician, I think that I know what's best for you." Two high control forms of patronizing talk are also distinguished by emotional tone. The first form, directive talk ("I said to take your pill *NOW*"), lacks any hint of warmth that might soften the control message and indicate concern for the recipient. The second high control form is called secondary baby talk ("Now, sweetie pie, it's time to take our pill.") due to its similarity to the intonation patterns, warm emotional tone, and simple language used with infants (Caporael 1981). Older adults express their dissatisfaction with patronizing talk, and both middle-aged and younger adults evaluate it as disrespectful and controlling (Giles and Gasiorek 2011; Hummert et al. 2004).

In addition to capturing the antecedents that lead to patronizing talk, the CPA model outlines the consequences that create a feedback cycle with negative outcomes for older adults and their communication partners (Giles and Gasiorek 2011). These include unsatisfactory intergenerational relationships, avoidance of intergenerational contact, and reinforcement of negative age stereotypes in the younger and older individuals in the conversation. Ultimately, to the degree that the older person internalizes and conforms to the negative stereotypes as a result of such interactions, declines in physical functioning may follow (Hummert et al. 2004; Hummert 2012). Experimental studies and analysis of longitudinal data sets by Levy and colleagues (Levy 2009) have identified an association between negative self-stereotyping and an

increased risk of illness or death for older adults. The relationship between patronizing talk and negative stereotyping has been documented in numerous studies, but a recent study links patronizing talk to both cognitive performance and physiological stress, a risk factor for health problems. Hehman and Bugental (Hehman and Bugental 2015) randomly assigned older and younger participants to receive instructions for a cognitive task in either a patronizing or nonpatronizing style. Analysis of performance and stress responses revealed that older participants exposed to patronizing talk had poorer performance and higher stress responses in comparison to older participants in the nonpatronizing condition and young participants in both conditions.

### Context and the Risk of Patronizing Talk

Communication with older adults occurs in a wide variety of contexts such as family, social, institutional, organizational, and medical. Although patronizing talk and its consequences as illustrated in the CPA model can occur in any context, it is more likely to occur in contexts which make negative age stereotypes salient than in other contexts (Giles and Gasiorek 2011; Hummert et al. 2004). Three contexts assume prominence due to their importance to the psychological and physical well-being of older persons: institutional, medical, and family.

Institutional and medical settings in particular evoke negative age stereotypes of illness, frailty, and decline (Kornadt and Rothermund 2015). In fact, the initial identification of secondary baby talk occurred in observations of nursing home staff interactions with residents (Caporael 1981). Frail older adults in such living facilities may have repeated interactions that involve the more extreme forms of patronizing talk and thus are especially susceptible to the consequences illustrated in the CPA model (Giles and Gasiorek 2011; Hummert et al. 2004; Williams et al. 2009). Community-dwelling older adults may encounter patronizing talk from physicians and other medical staff in both hospital and out-patient settings. Patronizing talk in these

settings can emerge in several additional ways that disadvantage the older patient: not allowing time for the patient to describe concerns, failing to explore comments that hint at health problems, using an authoritative style that precludes the opportunity for questions, avoiding eye contact with the patient, attributing complaints to the patient's age, or directing communication to the patient's companion rather than to the patient (Fisher and Canzona 2014). Institutional and medical settings make age stereotypes salient not only for physicians and staff but also for residents and patients (Miche et al. 2014). Thus, these settings increase resident and patient vulnerability to the declines in psychological and physical well-being that can follow from exposure to patronizing talk (Giles and Gasiorek 2011; Hummert et al. 2004; Williams et al. 2009).

Age is salient within the family context because families are intergenerational by definition. In comparison to institutional and medical settings, the family context is one that is associated with positive age stereotypes about the warmth and wisdom of elders (Miche et al. 2014). At the same time, older family members report that they experience patronizing talk from their adult children (Hummert et al. 2004; Hummert 2012; Hummert *in press*). These problematic interactions primarily take the form of unsolicited advice and/or directives around topics of health, finances, living arrangements, and safety (e.g., driving) (Hummert et al. 2004; Hummert *in press*), all of which are related to negative age stereotypes of decline and incompetence. Within families, these conversations reflect a tension between paternalism (i.e., the desire to protect family members from harm) on the part of the adult child, on the one hand, and autonomy (i.e., the desire to control one's own actions) on the part of the older parent, on the other (Cicirelli 1992). Parallels can be seen in the problematic interactions between parents and adolescents, although in those interactions the expectation is that the adolescents will later achieve independence (Hummert 2012). With older parents, the expectation is that the need for paternalism will increase and the parent's ability to be independent will decline.

Older adults recognize that patronizing talk from their adult children is based on care and concern for their well-being, and so may find it difficult to discount as unwarranted even as they find it dissatisfying. Experiencing patronizing talk from valued family members therefore increases the parents' subjective experience of aging and susceptibility to negative self-stereotyping (Giles and Gasiorek 2011; Hummert et al. 2004; Diehl et al. 2014) and the related negative psychological and physical consequences of the CPA model. Communication between grandparents and grandchildren is also susceptible to the influence of negative age stereotypes and their consequences (Soliz et al. 2006), illustrating that these patterns of talk may be transmitted and reinforced across the generations.

### Improving Intergenerational Interactions

Older and younger adults have the opportunity to reduce the impact of negative age stereotypes on intergenerational communication. These opportunities are addressed in the communication enhancement, the age stereotypes in interaction, and communicative ecology of successful aging models, all of which build on the communication predicament of aging model (Fowler et al. 2015; Giles and Gasiorek 2011; Hummert et al. 2004).

The communication enhancement model offers suggestions on ways that caregivers and family members can use communication to empower frail older persons, creating an alternative positive feedback cycle to the CPA model (Savundranayagam et al. 2007; Hummert et al. 2004). In the CPA model, negative stereotypes influence communication with older adults when the recognition of age cues leads to implicit activation of beliefs about the communication needs of the older adult involved and the unconscious or automatic accommodation to those needs that can result in patronizing talk. The communication enhancement model calls for disrupting this process at the outset by conscious focus on the individuality of the older person. Communication can then be modified as

necessary to accommodate needs of the individual, empowering that person as a coequal partner with the provider or family member. The movement toward person-centered communication in caregiving is consistent with the individualized communication envisioned in the communication enhancement model (Savundranayagam et al. 2007; Williams et al. 2009; Storlie 2015). Empowering older adults through individualized communication increases the satisfaction of all parties and optimizes the opportunity for the older person to achieve improved well-being. It also sets in motion a positive feedback cycle by enabling the older person to maximize his or her communication skills and competence. The benefits of the communication enhancement model require conscious commitment, monitoring, and effort on the part of providers and family members. Intervention studies and assessment of training programs demonstrate that use of patronizing talk by caregivers can be decreased and person-centered communication increased to yield benefits for older individuals in residential facilities (Savundranayagam et al. 2007; Williams et al. 2009).

The age stereotypes in interaction (ASI) model considers how older adults themselves can use communication to avoid negative stereotypes at the beginning of an interaction or to redirect an interaction in a more positive direction after it has begun (Giles and Gasiorek 2011; Hummert et al. 2004). According to the ASI model, positive or negative age stereotypes may be salient at the beginning of an interaction with an older adult based not only on the context (e.g., family or medical) as discussed previously but also on the way in which the older adult communicates. Young, middle-aged, and older individuals associate several communication behaviors of older adults with negative age stereotypes (Giles and Gasiorek 2011; Hummert et al. 2004; Hummert 2012): painful self-disclosures (i.e., revealing a distressing personal experience such as the death of a spouse or child to a stranger or acquaintance), off-target verbosity (i.e., rambling and/or redirecting the conversation to a tangential or unrelated topic), self-stereotyping (e.g., referencing one's age or labeling a memory lapse as a "senior moment"), and older-to-younger

patronizing talk (e.g., disapproving/disrespectful talk, over-parenting by offering unsolicited and unwelcome advice, etc.). The ASI model predicts that the association of these communication behaviors with negative age stereotypes increases the likelihood that their use will initiate the negative feedback cycle of the CPA model. Conversely, older adults' ability to tell interesting stories, especially those that put history in context or provide an uplifting narrative to listeners, are associated with positive age stereotypes and a reduced likelihood that the negative cycle of the CPA will follow (Hummert et al. 2004).

The ASI model also considers how older adults can use their communication skills to interrupt and redirect the negative feedback cycle of the CPA through their responses to patronizing talk (Giles and Gasiorek 2011). The challenge for older adults is to respond to patronizing talk in ways that assert their autonomy and establish their competence, but to do so in a manner that builds a mutually respectful relationship with the other individual. Experiments have tested the effectiveness of passive, direct assertive, appreciative, and humorous response styles in achieving this goal. Results show that direct assertive responses, in comparison to passive responses, are better at establishing the competence of the older person but are perceived as more controlling and less respectful. Humorous and appreciative responses emerged as the most effective in establishing the competence of the older speaker in a warm and respectful way (Giles and Gasiorek 2011; Savundranayagam et al. 2007; Hummert et al. 2004).

Increasing older adults' awareness of how their own communication relates to age stereotypes can help them to avoid the consequences of the CPA model and achieve the benefits envisioned in the ASI and communication enhancement models. This awareness is at the center of the communicative ecology model of successful aging (Fowler et al. 2015). The ecology model focuses on the power of older adults to use communication to reduce their uncertainty about aging, increase their self-efficacy, take advantage of new communication technologies, and reach their own definition of successful aging (Fowler et al. 2015).

The three models may be compared on (a) their assignment of agency to older adults or others, and (b) their applicability across contexts (family, social, institutional, organizational, and medical). The communication enhancement model emphasizes the responsibility of caregivers and providers to engage in adapting their communication to the individual needs of older persons in order to support their full engagement in the communication process. Although being sensitive to one's communication partner is good advice in general, the communication enhancement model is particularly applicable in institutional, medical, or family settings in which the frailty or acute health condition of older individuals make it difficult for them to assert their agency without supportive communication partners.

In contrast, the ASI and ecology models assign agency to the older adult, but the former focuses on agency within individual interactions whereas the latter considers agency in communication holistically. In the case of the ASI model, the older adults have the ability to use their communication skills to avoid beginning the negative feedback cycle captured in the CPA model or to interrupt and redirect that cycle after it has begun. Within the ecology model, older adults have the agency to create the communication environment that supports their desired experience of aging. Both of these models apply across all contexts, but within medical and institutional contexts their applicability may be limited by the extent to which older adults' health status affects their communication agency.

## Concluding Thoughts

Age-related conditions such as stroke, dementia in its various forms, and Parkinson's disease create specific communication challenges for older adults, their family members, and caregivers. End-of-life communication also has its own unique characteristics and challenges. Neither of these topics is addressed specifically in this entry. However, the communication principles outlined here – the dangers inherent in drawing on negative age stereotypes as guides, the benefits of adopting

an individualized approach, and the importance of older adults using their communication skills to achieve their version of successful aging – provide a useful framework for communication with and by older adults in these special circumstances.

## Cross-References

- ▶ [Age Stereotyping and Discrimination](#)
- ▶ [Age, Self, and Identity: Structure, Stability, and Adaptive Function](#)
- ▶ [Age-Related Positivity Effect and its Implications for Social and Health Gerontology](#)
- ▶ [Aging and Psychological Well-Being](#)
- ▶ [Attitudes and Self-Perceptions of Aging](#)
- ▶ [Grandparenthood and the Changing Nature of Social Relationships](#)
- ▶ [Intergenerational Relationships](#)
- ▶ [Language, Discourse Production and Communication](#)
- ▶ [Social Connectedness and Health](#)
- ▶ [Social Media and Aging](#)

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## Comorbidity

Christine E. Gould<sup>1,2</sup>, Sherry A. Beaudreau<sup>1,3,4</sup> and Ruth O'Hara<sup>1,3,4</sup>

<sup>1</sup>Department of Psychiatry and Behavioral Sciences, Stanford University School of Medicine, Stanford, CA, USA

<sup>2</sup>Geriatric Research, Education, and Clinical Center (GRECC), VA Palo Alto Health Care System, Palo Alto, CA, USA

<sup>3</sup>Sierra Pacific Mental Illness Research Education and Clinical Center, VA Palo Alto Health Care System, Palo Alto, CA, USA

<sup>4</sup>School of Psychology, The University of Queensland, Brisbane, QLD, Australia

## Synonyms

Co-occurring disorders; Dual diagnosis; Multimorbidity

## Definition

Comorbidity generally denotes the occurrence of two or more psychiatric or mental health disorders in one person. Two conditions that co-occur are considered to be comorbid regardless of whether the etiology of the disorders overlaps or is distinct, regardless of the chronological development of the disorders (Goodell et al. 2011).

## Background

Most older Americans have at least one chronic condition (Administration on Aging: A profile of older Americans 2013) and one in four has two or more chronic conditions (U.S. Department of Health and Human Services 2010). With respect

to physical conditions, approximately three-fourths of older Americans have hypertension, half have arthritis, one-third have heart disease, one-quarter have some type of cancer, and one-fifth have diabetes (Administration on Aging: A profile of older Americans 2013). Older age is associated with the presence of more chronic conditions (Bayliss 2014), which makes comorbidity an essential topic for geropsychologists. Moreover, patients with chronic medical conditions have high rates of depression and other mental illnesses (Bower et al. 2014). The prevalence of psychiatric disorders may be as high as 45% among medical inpatients and outpatients (Kaszniak 1996). Other psychiatric conditions like anxiety or substance abuse are more likely to occur when the index condition of depression is also present. In light of the ubiquity of chronic medical conditions in late life and high rates of co-occurrence of medical and psychiatric disorders, one must assess and manage comorbid conditions when working with older adults. Failure to consider medical comorbidities may dilute treatment effects and confound diagnostic accuracy. Consideration of comorbidities may also refine our psychiatric phenotypes, help us identify the genetic bases of mental health disorder, and reveal their pathophysiological mechanisms. Before considering the identification and management of comorbid disorders, one should first carefully characterize comorbidity.

## Defining Comorbidity

The term “comorbidity,” first used by Feinstein in 1970, refers to the coexistence of two or more disorders within one person. One important aspect of Feinstein’s definition was that one of the disorders was the “index disease” being studied (Fortin et al. 2014). The term comorbidity originated in the medical literature but was soon adopted for use in psychiatry. The study of comorbidity became quite important with the 1980 publication of the third edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM) (American Psychiatric Association 1980) because

of the use of polythetic criteria to characterize psychiatric disorders. Polythetic criteria allowed for differing clusters of symptoms to be characterized as the same disorder. Additionally, symptoms such as sleep disturbance may be included in multiple psychiatric disorders.

By the 1980s and 1990s, researchers began using the term multimorbidity (Fortin et al. 2014) to describe the burden of multiple medical conditions. Currently, multimorbidity is most often used when three or more conditions are present. Comorbidity usually has one condition of interest (i.e., index condition), whereas in multimorbidity there is no specific condition of interest. Multimorbidity encompasses the complexities resulting from the presence of multiple conditions, as is often seen in primary care settings (Fortin et al. 2014). When working with patients with multimorbidity, clinicians must sort out different recommendations resulting from the separate clinical management guidelines for each chronic condition. Reconciling different clinical management guidelines often leads to confusion on the part of the patients and polypharmacy and even results in contradictory recommendations. Multimorbidity is an important term to be aware of for clinical geropsychologists, but here, comorbidity is the term that is focused on as specialized fields such as geropsychologists often focus on one presenting problem or one index condition.

Kraemer (1995; Kraemer et al. 2006) defined several distinct types of comorbidity that are especially relevant for those studying aging: clinical comorbidity, epidemiological comorbidity, familial comorbidity, and random comorbidity. The first type, clinical comorbidity, refers to a situation in which the prognosis differs for people who have the index disorder and a second disorder when compared with those who have the index disorder and not the second disorder. The second type, epidemiological comorbidity, occurs when two disorders co-occur more often than one would expect by chance alone. Epidemiological comorbidity may occur when the two disorders share genetic risk factors or if the two disorders are different clinical manifestations of the same disorder. Epidemiological comorbidity is of interest to clinicians and researchers because the presence

of one disorder (e.g., Down's syndrome) may signal that clinicians should screen for another disorder (e.g., dementia). The third type, familial comorbidity, describes comorbidity that occurs when the prevalence of one disorder differs among relatives of patients with a second disorder when compared with relatives of patients without the second disorder. For instance, the occurrence of obsessive-compulsive disorder is higher in relatives of individuals with Tourette syndrome compared with families without Tourette syndrome. Lastly, disorders that do not fit into these other three categories, that may simply co-occur at random, and that have no relevance to clinical decision-making would be called random comorbidity using Kraemer's model (Kraemer 1995). For example, the presence of social anxiety disorder and a completely unrelated condition like shingles could be considered randomly comorbid. Unrelated disorders such as these are considered an example of random comorbidity.

Prognosis and treatment recommendations can vary based on co-occurrence of conditions in clinical comorbidity (Kraemer 1995). This entry, therefore, focuses on issues relevant to clinical comorbidity because it is most relevant to geropsychologists in both clinical practice and clinical research settings.

### **Diagnostic, Prognostic, and Treatment Implications of Ignoring Comorbidities**

Among older adults, age-related physiological and other body system changes can complicate diagnosis and treatment. One disorder may cause another (e.g., hypothyroidism can lead to depression), whereas other conditions may exacerbate one another (e.g., anxiety and chronic obstructive pulmonary disease). Hence, prognosis and treatment recommendations may vary based on the comorbid disorders present.

Sleep disturbance is one of the most frequent complaints among those with depression or anxiety in late life and as such can be thought of as a core-presenting symptom of these two mental health disorders. Nevertheless, sleep disturbance can also occur due to the presence of a

diagnosable sleep disorder, such as sleep apnea, an extraordinarily common sleep disorder in older adults. Failing to adequately assess for and diagnose sleep apnea can mean patients obtain a diagnosis of a psychiatric disorder when in fact they should be given the diagnosis of a sleep disorder. In the example of sleep apnea misdiagnosed as depression, treatment with antidepressants may have modest results at best, whereas augmenting antidepressant treatments with continuous positive airway pressure (CPAP) could alleviate the sleep-disordered breathing while also improving depressive and anxiety symptoms.

With respect to prognosis, a person with an anxiety disorder and breathing disorder may be slower to respond to behavioral treatments because of modifications needed in teaching diaphragmatic breathing or breathing retraining compared with a person with an anxiety disorder and no breathing difficulties. Indeed, it is well documented that the presence of such comorbid disorders such as pain and depression slows the response to pharmacological and psychological treatments for late-life depression. Such examples are very common in geropsychology. Given the considerable implications of many comorbid conditions for diagnosis, prognosis, and treatment, it is imperative that geropsychologists adequately assess for and address comorbid medical and psychiatric disorders in older adults.

### Assessing Comorbidities

A critical issue is how best to evaluate and assess a comprehensive range of comorbid disorders. The main challenge to studying comorbidity is the inherent heterogeneity of one's sample. Consideration of this heterogeneity is essential to identifying the effectiveness of evidence-based treatments, yet characterization of comorbid samples is challenging. Frances et al. (1990) highlight several issues that influence how comorbidity is measured and classified. To start, with more disorders included in a classification system, there is more likelihood of comorbidity. Additionally, splitting disorders and using categorical classifications increase the rates of disorders and the rate

of comorbidity. Often in the DSM, which relies on polythetic criteria, there is substantial symptom overlap, which can lead to increased rates of comorbidity; however, the use of a hierarchy in making diagnoses reduces rates of comorbidity.

A commonly reported issue relating to differing comorbidity rates and assessment is the halo effect, whereby an assessment geared toward detecting a particular disorder might also increase the assessor's awareness of a particular disorder. A halo effect also could be a function of the assessor's assumptions about disorders being related (Frances et al. 1990). Another reported issue regarding assessment and comorbidity includes selection of comprehensive versus narrower assessments. A comprehensive assessment, such as the Structured Clinical Interview for DSM (SCID), is more likely to detect the presence of comorbid conditions than would be the case if select measures of specific disorders were used. In the case of structured interviews (e.g., SCID), the assessor is comparing an individual's symptoms to the set list of diagnostic criteria. Assessors likely detect more conditions when using structured interviews compared with using a limited set of selected measures (e.g., depression and anxiety screens) because structured interviews force assessors to consider many different types of psychiatric conditions as the assessor reviews a set list of diagnostic criteria for each disorder. Different settings also affect the likelihood that specific pairs of comorbid conditions will co-occur, such as in an anxiety disorder clinic, where depression may be more likely to co-occur with social anxiety disorder; however in primary care clinics, depression may be more likely to co-occur with chronic medical conditions. The main challenge to characterizing comorbidity in psychiatry is the use of diagnoses based on groups of symptoms rather than etiologically defined disorders (Fyer et al. 1990). Prospective longitudinal studies will elucidate the etiology and course of psychopathology, which is needed to better understand the common pathways and courses of comorbid diseases.

In the medical literature, the burden of multiple conditions (i.e., multimorbidity) is measured using disease counts and established comorbidity

indices such as the Charlson Comorbidity Index (Charlson et al. 1987). These indices and counts do not characterize the specific relationship between an index condition and the associated conditions, as is the focus of comorbidity research. These indices are helpful in predicting negative outcomes such as mortality, but they have less relevance when trying to characterize specific comorbidities.

Personalized approaches to assessment can also be used. This would entail a multimodal assessment including reviews of medical evaluations, cognitive testing, functioning assessments, behavioral observations, and clinical interviews with the patient and an informant if possible. The thorough review of somatic symptoms can help differentiate medical disorders from psychiatric disorders. In the review of somatic symptoms, identifying the onset of symptoms and other factors in the time line is essential. Investigations of whether disparate treatment outcomes occur with different groups of comorbid patients will also help elucidate the relationships among comorbid conditions.

### Common Psychiatric Comorbidities

Many aspects of psychiatric comorbidity remain true from younger to older adulthood, although some differences exist. Psychiatric disorders seldom occur in isolation from other psychiatric symptoms or disorders regardless of a person's age. The psychiatric disorders ranked from most (anxiety disorders) to least common (schizophrenia) follow the same pattern in younger, middle-aged, and older persons (Kessler et al. 2001; Zarit and Zarit 2007). The tendency for some psychiatric disorders to occur together more often than others is also somewhat age invariant. The prevalence of psychiatric disorders and subthreshold symptoms, however, differs with age. In particular, the prevalence of any psychiatric disorder decreases with age, but subthreshold anxiety and depressive symptoms are documented as common with as many as 25% of older adults

reporting subthreshold depression (Zarit and Zarit 2007) and 20–29% reporting subthreshold anxiety (Gellis et al. 2014). Researchers have argued for a dimensional approach to understanding psychiatric disorders, rather than a purely categorical one, in order to capture these subthreshold psychiatric conditions (Maser and Cloninger 1990). The rationale for implementing a dimensional approach is all the more salient in older adults given the ubiquity of subthreshold symptoms. Because subthreshold psychiatric disorders are associated with substantial medical and cognitive comorbidity, especially in older adults, documenting and treating them is critical.

Anxiety and depressive disorders frequently co-occur and as such have garnered much of the attention regarding psychiatric comorbidity (Zarit and Zarit 2007). This has led some theorists to propose that anxiety and depression represent different phenotypic (i.e., expressed) manifestations of the same underlying disorder. Others have argued that the lifelong durability and trait-like nature of anxiety disorders increase the risk of developing depressive disorders, which tend to be cyclic over the life span. Older adults with any number of anxiety disorders, such as panic disorder and social anxiety disorder, often suffer from coexisting dysthymic disorder or major depressive disorder. In fact, there has been some suggestion that this overlap of depression and anxiety in older adults is greater than what is seen in younger adults, particularly when subthreshold symptoms are included. Cognitive disorders, namely, minor and major neurocognitive disorders, are much more likely to co-occur in older adults with psychiatric disorders than in older adults without any threshold or subthreshold psychiatric issues.

In addition, comorbid psychiatric issues require additional consideration in clinical situations with older patients, particularly because individuals with coexisting psychiatric problems often have more severe symptoms. The decision to treat one disorder, such as the anxiety disorder as primary versus treating the depressive disorder as primary, has implications for

treatment selection. Behavioral interventions targeting anxiety typically focus on reducing anxiety through relaxation skills training or desensitization through real or imagined exposure to feared situations or objects. Treatments for depression typically work to increase the person's social interactions, activity level, and experience of the environment as positive through a concerted effort to partake in enjoyable activities. These behavioral skills have been successfully used in older patients suffering from psychiatric disorders (Zarit and Zarit 2007). The presence of anxiety and depressive disorders could require a combined treatment approach or staged approach where the more urgent of the two disorders is first treated before treating the second disorder. With regard to pharmacological interventions, both anxiety and depression can be treated with some of the same medications (i.e., selective serotonin reuptake inhibitors or SSRIs), rendering this comorbidity issue potentially less relevant for medication management. Nevertheless, other situations, such as comorbid schizophrenia with generalized anxiety disorder, could require a more complicated medication regimen due to potential interactions and negative side effects of medications that treat the two separate disorders.

Less often discussed, but a critical issue for understanding psychiatric comorbidity in older adults, is the co-occurrence of personality disorders (Mordekar and Spence 2008). These disorders are characterized by long-standing patterns of inflexible and maladaptive behaviors that often go against society and cultural norms. This often leads to disruptions in interpersonal relationships. Again, as with other psychiatric disorders, the prevalence of personality disorders declines with age (Segal et al. 2006). The comorbidity of personality disorders with other psychiatric disorders, however, is quite high in older persons. Mood and anxiety disorders are the most commonly reported diagnoses comorbid with personality disorders. For example, it has been reported that 24% of older individuals with major depressive disorder also meet criteria for a personality disorder. Further, rates of comorbid personality

disorders are notably higher (73%) in older individuals with adult-onset depression than late-life-onset depression (45%) (Mordekar and Spence 2008). With regard to anxiety disorders, comorbid DSM-5 Cluster C personality disorders (avoidant, obsessive-compulsive, or dependent) are frequently observed in individuals of all ages who experience an anxiety disorder. Treatment of an older patient becomes even more challenging, as personality disorders are often associated with poorer prognosis. They complicate treatment delivery and can require a more sophisticated intervention approach and skill level of therapist for older adults seeking help.

### Common Medical Comorbidities

Older adults with psychiatric disorders often also have comorbid medical conditions. Psychiatric-medical comorbidity is likely a function of many factors including but not limited to age, poorer self-care, greater disability, and cognitive impairment. When working with older adults who have both psychiatric and medical disorders, one must determine the extent to which the medical disorder contributes to the psychiatric disorder of interest. Additionally, the manner in which the medical and psychiatric disorders are related temporally is important. For instance, chronic conditions may lead to depression, whereas depression itself may be a risk factor for chronic conditions and functional decline (Bower et al. 2014). Moreover, depression may make it more difficult for a patient to be motivated to manage their chronic conditions, leading to poorer outcomes, as may be observed in individuals with comorbid depression and diabetes (Bower et al. 2014).

There are multiple pathways through which psychiatric and medical disorders interact. To illustrate this point, take the example of late-life anxiety disorders. Chronic medical conditions, such as chronic obstructive pulmonary disease, may lead to physiological changes that predispose older adults to anxiety (Zarit and Zarit 2007). Alternatively, an acute illness or hospitalization

may lead to an exacerbation of worry and other anxiety symptoms (Zarit and Zarit 2007). It is also possible that medications such as steroids or anticholinergics prescribed to older adults could exacerbate or even cause anxiety (Zarit and Zarit 2007). The presence of an anxiety disorder prior to the development of a chronic condition may make the management of the medical condition more difficult, such as the presence of agoraphobia would likely interfere with patients' attendance at medical appointments. These are only a few examples of the multiple pathways connecting psychiatric and medical disorders.

In addition to the pathways connecting psychiatric and medical disorders, oftentimes the prevalence of psychiatric disorders may be greater and severity worse among older medical patients. For instance, depression is more prevalent among older adults with medical illness (Zarit and Zarit 2007). Functional limitations associated with medical illnesses, sensory impairments, ambulation difficulties, and pain may limit an older patient's ability to engage in pleasant activities. Behavioral theorists posit that these functional limitations reduce participation in enjoyable activities and thus cause depression.

Psychological stress, experienced by those with psychiatric disorders, may also adversely affect physical health by exacerbating chronic conditions like hypertension (Haley 1996) and preventing immune responses that are important in recovery (e.g., cancer). Individuals with severe mental illness (SMI), such as schizophrenia, die 10–15 years earlier than their counterparts without SMI. These individuals with SMI also have elevated risk of having comorbid medical conditions likely due to multiple factors. The presence of SMI requires substantial management and can result in the psychiatric disorder taking precedence over and obfuscating other problems, which is referred to as diagnostic overshadowing (Bower et al. 2014). Some antipsychotic medications contribute to weight gain, increased risk of diabetes, and metabolic syndrome, whereas other lifestyle choices (e.g., sedentary, poor diet) and comorbid conditions (e.g., substance use disorders) may contribute to the development or

worsening of chronic medical conditions (Bower et al. 2014).

## Treating Patients with Comorbidities

Personalized or patient-centered medicine ideally can be used to tailor treatments to patients with comorbidities. Individualized treatments can take into account the patient's medical and psychiatric comorbidities. Individualized treatments allow providers to consider the index condition being treated as well as other factors, such as cognition, which can influence outcomes. Careful assessment provides a strong foundation for tailored, personalized treatments. Additionally, interdisciplinary teams are an essential part of delivering patient-centered treatments to those with comorbidities. The team members can address medical and psychiatric conditions through the collaboration and communication across disciplines.

There is also a need to include patients with comorbidities in randomized control trials (RCTs). Patients with comorbidities are included in large and inclusive RCTs called "pragmatic" or "effectiveness" RCTs rather than the smaller efficacy studies. Effectiveness trials focus on examining the effects of treatment under the usual conditions (i.e., in community practice) rather than under the ideal conditions (i.e., controlled research setting) as is the case for efficacy studies. Moderator analysis (Kraemer et al. 2006) can be used to examine the effect of comorbidities on treatment outcomes. The resulting findings will likely yield information about what treatments work best for which groups of patients. These findings can be used to refine existing treatments, develop new treatments, and inform patient-centered medicine.

## Conclusions

Psychiatric and medical comorbidities are common across the life span. Among older patients, high rates of comorbid psychiatric disorders co-occur frequently with chronic medical conditions.

Medical conditions and associated functional impairments may precede and lead to psychiatric conditions. Chronic psychiatric conditions can also affect an individual's physiology and immune responses, lifestyle, and the clinician's assessment (i.e., diagnostic overshadowing). The complex relationship between comorbid psychiatric disorders and medical and psychiatric disorders points to a need to use multimodal assessments to accurately diagnose and treat older patients with these comorbidities. Additionally, more research is needed to determine the manner in which comorbid conditions affect treatment outcomes in older patients. Prospective longitudinal studies and large-scale effectiveness trials could address this issue.

## Cross-References

- ▶ [Anxiety Disorders in Later Life](#)
- ▶ [Depression in Later Life](#)
- ▶ [Subsyndromal Psychiatric Disorders](#)

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## Complementary and Alternative Medicine

Emma E. Poulsen

School of Psychology, The University of Queensland, Brisbane, QLD, Australia

### Synonyms

Holistic medicine; Natural medicine; Non-conventional medicine; Unorthodox medicine

### Definition

Complementary and alternative medicine (CAM) is an umbrella term used to describe a group of diverse medical and healthcare systems, practices, and products that are not generally considered part of conventional medicine, that have not been part of the public healthcare system or administered by conventional medical practitioners (Adams et al. 2009). There has been a noted increase in CAM use across all populations during the past 20 years (Andrews 2002), including older adults (aged over 65). Depending on how CAM is measured, studies suggest 40–65% of older adults use either some form of CAM therapy and/or over-the-counter CAM products (Cohen et al. 2002). Older adults have been identified as being significant consumers of CAM, and the factors that influence this use are varied and have unique implications compared to other cohorts.

### Population Ageing, Chronic Illness, and Health System Responsiveness

Complementary and alternative medicine (CAM) is broadly consumed by older adults and its use is on the rise. CAM, and indeed health care in general, is being influenced by the demographic shift of the ageing population (Adams et al. 2009). It is predicted that there will be 1.5 billion individuals over the age of 65 by 2050, driven by decreasing fertility rates and improved life expectancy

(World Health Organization 2011). This comes at the cost of increased economic and social pressures on a range of systems and infrastructure globally. How health services are consumed and provided is changing across both traditional and nontraditional services.

The ageing population will place particular strain on the health system with disease patterns moving from acute short-term, infectious or parasitic diseases to chronic long-term, noncommunicable diseases (Hale et al. 2007). As longevity increases, frailty and chronic illness rise as physical and cognitive capacities decline at the later stages of life (World Health Organization 2011). In particular, the demand for chronic care, rehabilitation services, and palliative care all increase with the ageing of populations (Hale et al. 2007).

Criticisms have been made of the existing medical system and the difficulty it will face catering to the increased demand on services due to changing disease patterns (Holman 2004). The current health system is typically focused towards treating acute illnesses that are episodic where the health practitioner typically has the majority of control in determining treatment and management approaches, and the patient is largely a passive recipient. It has been argued the traditional medical model of health care (that focuses on biological aspects of disease and illness) is less conducive to treating chronic illnesses where treatment is ongoing and long-term management of symptoms is often the goal, rather than seeking a cure. Due to the ongoing and often personalized experience of chronic illness, it is argued that the roles in treatment need to shift from the health practitioner having full control to provide the patient with more authority over their treatment plan, allowing them more responsibility and autonomy in management of their conditions (Holman 2004). The current model of healthcare delivery offers limited flexibility.

### Chronic Illness and CAM Use

The ageing population is at increased risk of chronic health complaints illness (Cherniack

et al. 2001). Older consumers are cognizant of the need to treat these health complaints, and it has been found that as health conditions deteriorate, CAM use increases (Cherniack et al. 2001). Indeed, CAM use is five times higher in the chronically ill population compared to a healthy population. In general, research completed with chronic illness populations have noted that CAM use rates are elevated and typically centered around management of health conditions (Cherniack et al. 2001).

Within the chronically ill population, the use of CAM has been linked to a belief that CAM is a “safer” option than conventional medicine with fewer side effects to conventional medicine (Vincent and Furnham 1996). Furthermore, CAM users have reported strong beliefs in the efficacy of the CAM product/service being consumed (Vincent and Furnham 1996). Practitioners who provide CAM services often have longer consultations and reportedly provide more personalized services than offered by conventional medical systems (Gammack and Morley 2004). This in itself has a therapeutic benefit that can be particularly useful in the treatment of non-life-threatening chronic illnesses.

### The Active Consumer

Researchers have noted that the flexibility in services offered through CAM allows the individual to play an active role in the management of their long-term chronic disease (Bishop et al. 2007). CAM offers a different approach to the traditional biomedical model, and studies have shown it can provide a prevention-focused, flexible healthcare model for chronic and degenerative diseases (Bishop et al. 2007). While the need for conventional medicine is still undisputed, the argument that CAM offers a more versatile form of care when dealing with non-life-threatening and chronic ailments has merit and may assist in addressing the need created by the ageing population. This shift appears to be occurring as traditional health systems are not currently structured to cater for the increase in long-term chronic diseases that is occurring across the globe associated

with population ageing (World Health Organization 2011).

Traditional medicine and CAM use are very much rooted in cultural contexts, and the legitimacy of both health treatment options is influenced by sociocultural perspectives (Root Wolpe 2002). The sociocultural context not only influences people’s perceptions of both traditional medicine and CAM but also the illnesses that trigger their use. In the literature surrounding health service provision, there is an expanding body of research attempting to describe a shift towards consumerism and the identity of health users (Milewa 2009). The typical health consumer now interacts with health services as an active participant, picking and choosing the products best tailored and personally suited to their needs rather than being a passive consumer. The ability to make personal decisions, select from a range of options, and make choices based on a sense of personal responsibility and shared decision making are valued by many patients. Patients who adopt this viewpoint are more likely to look for broader healthcare options beyond what is offered by traditional health service providers, including services offered by CAM.

With higher uptake of CAM use, there is increasing pressure for conventional medical practitioners to have knowledge about individual patients CAM usage. Historically, many doctors have not discussed CAM usage with their patients. Research has demonstrated that up to 77% of CAM users did not disclose their CAM use to their treating practitioner (Xue et al. 2007). CAM users who discussed their CAM use with their medical practitioner were more likely to describe themes of acceptance and control whereas CAM users who did not have these conversations were more likely to describe their treating physicians as narrow minded (Vincent and Furnham 1996). To add to this, general practitioners frequently underestimate the extent to which their patients use CAM (Nahin and Straus 2001). This is concerning as studies have additionally shown that patients often have a poor understanding of the effects of CAM. Harmful interactions have been found between some CAM products and conventional medicine

approaches, e.g., herbal therapies and pharmaceutical therapies (Votova and Wister 2007).

### The Third Age

Increasing longevity of life has contributed towards a period of time referred to as the Third Age, between postretirement but prior to age-imposed limitations such as illness (Weiss and Bass 2002). This growing generation in general has improved physical and mental health, greater wealth, and higher levels of education, with predicted longer life-spans than their predecessors. The Third Age provides a platform for older adults to explore personal growth, self-fulfillment, freedom, and personal engagement, with a noted increase in the desire to maintain health status and postpone the inevitable decline in health (Weiss and Bass 2002). Indeed, there is often an acute awareness of one's mortality coupled with uncertainty about future health needs (Weiss and Bass 2002). The combination of increased resources and the time to use them has placed older adults in an optimal position to experiment with previously unexplored services and products, e.g., CAM. There is often a sense of responsibility for personal self-maintenance that promotes concepts such as awareness of medical conditions, proactive intervention, wellness techniques, self-care of diet and exercise, and new learning. With this combination of factors, an increase in CAM use among this population is understandable (Andrews 2002).

### Antiageing Movements

Antiageing movements through media and marketing have additionally influenced the use of CAM through increased consumerism of antiageing products (Milewa 2009). There exists a marked increase of interest in products and services that are marketed as being able to slow down or even reverse the natural ageing process. Improvements in access and marketing that targets consumers through media such as the press, television, and Internet have contributed to this increased interest. While CAM services have increased broadly, there has been a particular boom in CAM technologies aimed towards antiageing with middle-aged and older adults

being primary consumers (Weiss and Bass 2002). An increased focus on positive frameworks of growing older that include the denial of physical signs of ageing and the promotion of healthy active living has been witnessed. In particular, the chronological process of ageing has been reframed as a transition, emphasizing a distinction between chronological age and cognitive age of individuals.

### Personal Motivators of CAM Use

Some researchers have categorized the motivators for individuals choosing to use or not use CAM as being in terms of push/pull influences. Pushes indicate factors that "push" an individual away from conventional medicine. Typically, these experiences are underpinned by dissatisfaction with conventional medicine, e.g., poor communication, adverse side effects, poor treatment options (Sirois and Gick 2002). Pulls in contrast indicate factors that draw the individual towards CAM, e.g., holistic approach, long appointment times, and perceived safety of the approach (Furnham 2005). Typically, there appears to be a mix of motivators that change over time and an interplay factors that influence whether an individual is a CAM user or nonuser. It is often the case that older adults use CAM in conjunction with conventional medicine, as a concurrent service to the management of their health care. Indeed, in some studies CAM users were found to consult with a specialist doctor more frequently than non-CAM users (Adams et al. 2003). The researchers hypothesized that this suggested a pragmatic approach to selecting treatments that "best fit" their health concerns.

Research on push versus pull factors has been varied and there is little consensus in the literature on which variables are consistently associated with CAM use in the past or future. For example, one found that personal control over health and dissatisfaction with conventional medicine were inversely related to CAM use (Testerman et al. 2004). In previous research however, criticisms of the existing medical system have been proposed to influence CAM use (Willison and

Andrews 2001). A more recent study that found dissatisfaction with conventional medicine was positively correlated with past but not future use (McFadden et al. 2010). An important variable that is not always addressed in research is dissatisfaction with conventional medicine treatment versus dissatisfaction with the treating physician. For some individuals, there were high rates of satisfaction with their physician; however, they felt that the use of CAM would assist in relieving symptoms in a way that conventional medicine was not able to provide (Testerman et al. 2004).

A number of attitudinal dimensions have been identified as being related to CAM use. Those who are more likely to seek CAM have been identified as having a heightened awareness and commitment to environmental issues (Astin 1998; Kranz and Rosenmund 1998). Other attitudes that have been linked to CAM use include a belief in personal responsibility towards health and holistic healthcare approaches (Astin 1998). Holistic beliefs include views of the mind–body relationship as being in balance and maintained by self-healing. Some studies have noted that as holistic beliefs and health complaints increased, so too did CAM use, indicating that both personal beliefs about health care and a desire to relieve illness symptoms influence CAM use (Vincent and Furnham 1996). It has been proposed that conventional medicine, through focusing on the physical elements of a disease, fails to account for the person as a whole (Kranz and Rosenmund 1998). For individuals holding this perspective, CAM provides an appealing alternative.

It has been suggested that CAM users perceive that they have increased control over the active management and choices concerning their health (Astin 1998). Previous researchers have hypothesized that a desire for control (Astin 1998) and a sense of personal responsibility towards health and holistic healthcare approaches (Furnham and Kirkcaldy 1996) are important factors that influence an individual's choice to use CAM. The desire to seek holistic, natural, and preventative approaches is often motivators for commencing CAM use (Kranz and Rosenmund 1998). A systematic review explored 94 studies that included themes of control, illness, holism

treatments, natural treatments, and life philosophies and how they related to CAM use (Bishop et al. 2007). The researchers reported that a desire for participation in treatment decisions, active coping styles, and holistic approaches to health were all significantly related to CAM use, however control was not. Many of these studies use a cross-sectional design so directionality cannot be easily established to determine if beliefs about CAM use, active coping styles, and holistic approaches to health were formed before or as a result of CAM use. Other research has found positive relationships between personal control and CAM use for healthy individuals (McFadden et al. 2010). Testerman et al. (2004) did not find such a link but his population was recruited from a medical clinic. These studies demonstrate that the specific relationships between predictor variables are often complicated.

### **Structural and Sociodemographic Influences on CAM Use**

There are also a number of structural and personal sociodemographic influences that influence frequency and type of CAM use (Kelner and Wellman 1997). The physical availability and access to CAM products, personal income, insurance plans, private health care, and distance travelled to access services have all been linked to CAM use (Kelner and Wellman 1997). Studies have consistently shown that CAM use is higher in rural and remote regions compared to urban settings (Robinson and Chesters 2008), and lower in Metropolitan areas compared to nonurban locations (Adams et al. 2003). This is an issue of particular concern to older adults as there are often mobility and driving restrictions that further complicate their access compared to younger cohorts (McLaughlin and Adams 2012). Difficulty accessing conventional health services in rural regions compared to urban areas may be influential in the decision to use CAM (Robinson and Chesters 2008). Indeed, the relationship between geography and location to CAM use is not as strongly established in the literature as other

elements including health status, gender, income, and level of education. Connected elements to geography may include population of available clinicians, proximity of specialist services and range of services, socioeconomic status of the region and policies, and politics of the region (Adams et al. 2011). A number of studies specifically exploring older adult CAM use in rural settings found that CAM is used far more broadly than the treatment of existing health complaints, but also for maintaining current health status and well-being (Adams et al. 2003; Robinson and Chesters 2008).

## Conclusion

The ageing population, the antiageing movement, and shifts in consumerism and disease patterns have all contributed to changing the way in which older adults consume traditional health care and CAM. CAM use amongst older adults is an increasing phenomenon that is uniquely impacted on by a number of broader cultural shifts. The combination of the ageing population and the rise of chronic illness requires all health providers, independent of their qualifications or personal beliefs, to recognize and be informed about the processes and factors influencing CAM uptake in the older population. There is a need for future research to investigate directional relationships to explain the mechanisms which influence decisions to adopt and maintain CAM therapies. This information will potentially provide guidance for healthcare service providers who seek to understand how CAM usage interacts with conventional medicine, and will help ensure that the most effective health-related outcomes for those in later life.

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## Conceptual Model of Habit Reforming to Improve Balance and Prevent Falls

Lindy Clemson and Jo Munro

Ageing, Work and Health Research Unit, Faculty of Health Sciences, The University of Sydney, Lidcombe, NSW, Australia

### Synonyms

Automatic behaviors; Challenge your balance; Cues to action; Do more and be safe; Integrate balance and strength training within daily tasks; Load your muscles; Visualize and plan

### Definition

Understanding how habitual behaviour can be adapted and changes maintained are core concepts in an applied model of behaviour change to embed balance and strength training into daily life activities and routines with the goal of reducing the risk of falling.

### Definition Statement

**Habits:** automatic behavioral responses to environmental or situational cues developed through repetition in consistent contexts.

**Falls:** an event which results in a person coming to rest inadvertently on the ground or floor or other lower level (WHO).

**Balance:** the ability to maintain an upright posture and keep the body within the base of support with minimal postural sway. Maintaining balance involves motor planning and the integration of input from multiple sensory systems.

**Functional exercise:** training that is performed with purpose to enhance a certain movement, movements, or activity that is closely aligned with daily tasks (Liu 2014; Chou 2012).

**Lifestyle-integrated exercise:** This is a specific type of functional exercise whereby activities or actions that are designed to improve physical ability, such as to challenge balance or improve muscle strength, are embedded within everyday tasks and routines (Clemson, 2012).

### Introduction

This entry outlines a conceptual framework that underpins the adoption of an innovative approach to balance and lower limb strength training to reduce the risk of falls. The Lifestyle-integrated Functional Exercise (LiFE) program, proven effective in reducing falls and improving function in a randomized trial, (Clemson et al. 2012) embeds balance and lower limb strength activities within daily life tasks and routines. Activities are tailored to the person's capacity and their lifestyle. The framework is an applied one and is based on a

habit reforming theory, principles of self-efficacy, and an understanding of occupation-person-environment demand theories.

### **Functional Exercise Programs That Improve Balance, Reduce Falls, and Improve Function**

There is strong evidence for the core role of balance in providing protection from falls for older people with studies demonstrating that balance training is more effective than strength training alone in preventing falls (Sherrington et al. 2008). Further, the evidence for functional exercise training having direct benefit in improving balance, physical function, and the capacity of older adults to perform activities of daily living is growing (Liu et al. 2014). Functional training has been defined as any type of training that is performed with purpose to enhance a certain movement or activity (Liu et al. 2014). Functional exercise appears to be most effective when the training content is specific to the outcome (Liu et al. 2014; Chou et al. 2012) and activities that involve dual or multitasking have a greater capacity to reflect function.

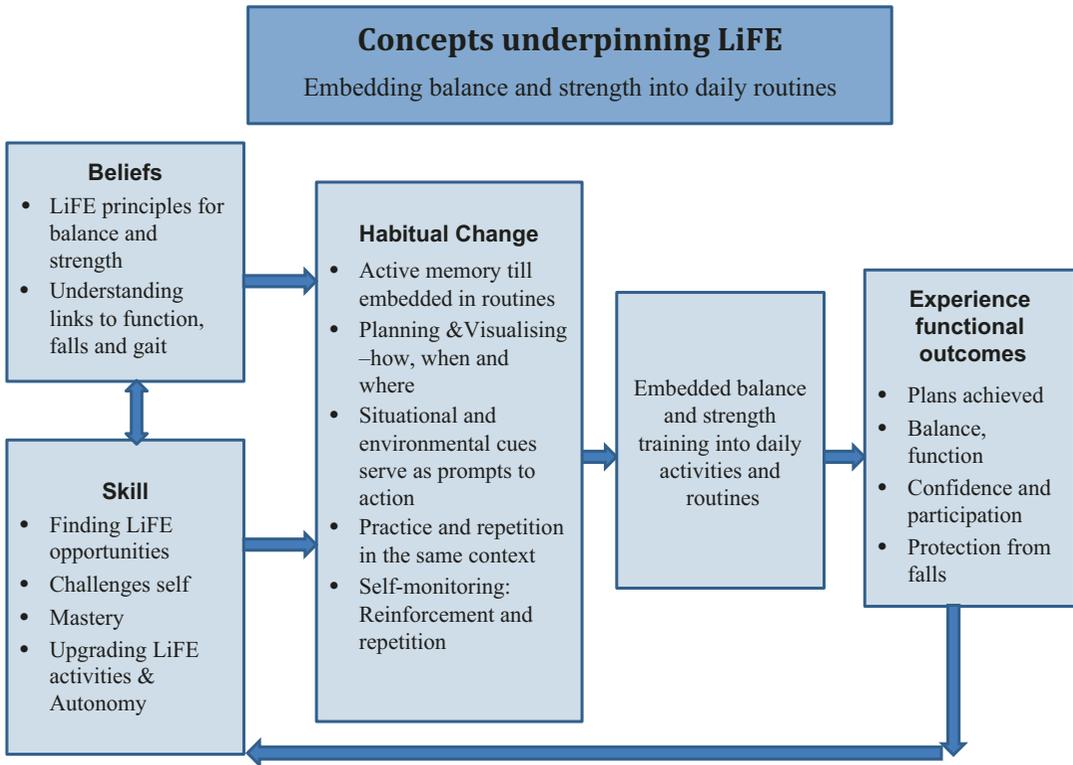
Exercise programs that involve multiple components are suggested as the most appropriate for physically frail older adults because they align more closely with the demands of functional situations (Cadore et al. 2013). Examples of specific functional training programs include a music-based multitask training program which improved gait and balance and reduced falls through activity to music and involved dual tasking (Trombetti et al. 2011). Other approaches to improving physical fitness and capacity to perform daily life activities have tested programs that specifically incorporate activities of daily living. One such program used a multistation circuit approach which mimicked daily functional tasks (Dobek et al. 2007). The Lifestyle-integrated Functional Exercise program (LiFE) (Clemson et al. 2012) is different to these in that it embeds balance and strength training into daily life activities throughout the day and is performed within the participants home and their community environments.

With poor health, slow gait, and unsteady balance predictive of difficulty in long-term engagement in exercise, it is not surprising that the effect of any exercise dissipates after the program ceases (Gine-Garriga et al. 2013). To maintain outcomes, the program needs to have an effect more than just preventing falls, for example, improving functional capacity. Typical positive comments from LiFE participants such as “I can keep catching the buses so I can still get to visit my daughter” or “I can stand up now to put on my trousers” or “I can keep going to the club because I can easily get out of the chair” reflect that personal outcomes must be relevant to the person and their lifestyle. Understanding what enables older people to continue to exercise will also provide guidance as to what features are essential when undertaking training and also what tools are needed to facilitate adoption and personal sustainability.

### **LiFE Trial Outcomes**

LiFE was tested in a three-arm randomized trial (Clemson et al. 2012) where LiFE and a structured exercise program were compared to a control group who received a “sham” gentle exercise. The trial recruited 317 people 70 years or older who had either had two falls in the previous year or one injurious fall. After a 12-month follow-up, there was a 31% significant reduction in rate of falls (IRR = 0.69) for the LiFE participants compared to the control group who received a gentle exercise program. The structured program (balance and strength exercises performed three times a week) showed reduced falls, but this was not a significant difference compared to the control group. In the LiFE program, there were significant and moderate effect sizes for both static balance and dynamic balance and for balance confidence. For LiFE, while there were steady improvements for hip and knee strength, ankle strength was the only strength measure to show a significant effect. LiFE demonstrated moderate to large effect sizes in measures of function and daily activity and in a measure of participation. Adherence was sustained with 64% still engaged in LiFE activities at 12 months.

The LiFE program has been successfully implemented in a restorative home care service showing positive outcomes in a pragmatic



**Conceptual Model of Habit Reforming to Improve Balance and Prevent Falls, Fig. 1** Conceptual framework underpinning embedding balance and strength training into daily life activities and routines (Lifestyle-

integrated Functional Exercise (*LiFE*) Program to prevent falls. Trainer’s manual. Clemson, Munro and Fiatarone Singh, 2014 Sydney University Press)

randomized trial (Burton et al. 2013). It has also been incorporated in a group-based program for women at retirement (Fleig et al. 2015).

**The Lifestyle-integrated Functional Exercise (LiFE) Conceptual Model**

**Embedding Balance and Strength Training into Daily Routines**

Figure 1 summarizes the main concepts underpinning how to embed balance and lower limb strength activities into daily life activities and routines (Clemson et al. 2014). The LiFE program includes features that enhance beliefs, attitudes, and understanding of the program as well as training in skills specific to the program. A central and core process of change are strategies to encourage habitual change, based on habit re-framing theory (Lally and Gardner 2013). LiFE activities are

linked to specific daily tasks using situational and environmental cues that serve as prompts to action. Planning includes both setting what activities and where and how they will be performed and visualizing doing this in selected situations. They are performed intentionally and consciously until they become habitual and embedded in daily occupation. Feedback, monitoring, and positive reinforcement are strategies used to improve skill and enhance self-efficacy in the performance of the activities. The experience of positive functional outcomes will sustain engagement in the program. These outcomes may include protection from falls, increased function, self-confidence in balance demanding activities, and greater participation in activities and life roles.

**Beliefs**

When training people to implement such programs, we believe it is important for participants to

understand the principles of balance and strength training underlying the program. Motivation can be enhanced if people are able to link doing the particular activities to specific outcomes. Features of the model are designed to inform and enhance beliefs, attitudes, and understanding of the underlying principles of the program. To engage in an embedded exercise program, it is necessary to have a belief that it is possible to improve balance and strength and that this will have a direct impact and benefit; this may be to reduce fall risk, to improve gait or to improve functional capacity in performing activities of daily living.

#### LiFE Principles for Balance and Strength

Many people are unaware that they have poor balance. Only 6% of the general older population engages in any balance challenging activities. Being able to safely and functionally maintain posture requires motor planning and sensory input from the vestibular system, vision, and proprioception. Being able to maintain balance is a complex process. Further, the notion that balance is something that a person can improve is a very poorly understood phenomenon. Most people do not understand that they can improve their balance. Nor are they aware how they could do this, that is, by challenging themselves in specific ways that are tailored to their personal capacity. The program outlines several principals for challenging balance (Clemson et al. 2014). The LiFE principles for improving muscle strength are applied to the groups of muscles known to provide protection from falls – hip, knee and ankle muscles. The program does not use weights or resistance bands as these would not be part of the participant's daily routine. Instead it relies on the person using their own body weight (e.g., standing up from a chair slowly to increase quadriceps strength).

The overarching LiFE principles are (i) to improve balance, we must challenge balance and continuously increase the challenge to our balance, and (ii) to improve strength, we must continue to load the muscles.

#### Understanding Links to Gait, Function, and Falls

Providing brief but targeted explanations about how the type of exercises directly link to

beneficial outcomes can impact motivation. We suggest that there would be numerous opportunities during assessment and training to provide examples which link the exercises to improved function in doing daily living tasks, to improved gait, and how the LiFE activities can provide protection from falling. These examples need to be relevant to the person. This is intended as conversation during training at appropriate moments when the opportunity arises and not intended as a didactic lecture. For example, “moving sideways” or sideways stepping is one of the balance activities. This could be illustrated by referring to how strong hip abduction is important if a sideways stepping response is required to protect from overbalancing. Further, people with a previous hip fracture are more likely to have poor hip abduction strength suggesting the importance of strong hip muscles.

#### Improving Balance and Strength Can Improve Walking Stability and Strength

Other examples could relate to the ability to walk safely. Understanding how the gait changes and how this impacts fall risk may provide a motivation for older people to engage in balance and strength training which can also improve their mobility. The changes in gait in the older person may be influenced by a variety of factors including musculoskeletal changes such as decreased strength, reduced range of motion at a variety of joints, neurological factors, or low confidence.

Gait analysis is complex. However, a simplified analysis of the gait of older people generally states that older people have a shorter stride length, a wider base of support, and a slower pace. Anecdotally, many older people shuffle. This means that their feet are in contact with the ground for longer periods of time through the phases of the gait cycle. This may make them feel more stable but may not necessarily protect them from falls. The inability to lift the foot to effectively clear an obstacle may make the person more likely to trip and therefore fall.

Improving balance and strength in the legs should translate to an improved ability to walk. For example, strengthening the dorsiflexors may lead to an improved ability to lift the forefoot for

heel strike and less chance of “catching” the toe and tripping. If this is added to better balance while standing on one leg, therefore a more stable supporting leg in the stance phase in the persons gait cycle will be improved. This in turn should lead to safer walking and possibly more confidence walking. The program encourages participants to think about the way they walk, with the heel down and the toe up. That is, they need to concentrate on making contact with their heel and then consciously pushing off with their toe. With improvements in both strength and balance, the person is encouraged to walk with an improved gait and encouraged to scan ahead as they walk (Clemson and Swann 2008).

### **Balance Challenges While Dual Tasking Can Have a Functional Benefit**

LiFE activities often involve tasks that require multiple skills to be used at the same time. This is often referred to as dual tasking as the tasks involve varying combinations of physical movement and upper and lower limb coordination, as well as attention to the task at hand. Examples of dual tasking include a one-legged stand while cleaning your teeth or squatting (bending at the knees) rather than bending at the waist when selecting items from a lower shelf in the supermarket.

By embedding LiFE activities in daily life routines, the person is automatically placed in situations of competing demands. This connects balance and strength training to daily living tasks which naturally adds challenging demands. This can include, for example, selectively paying attention to the environment around them as well as dual tasking as they are doing the LiFE activity.

Having a poor capacity to perform dual tasking in tasks that involve gait variation and demand attention has been shown to predict an increasing risk of falls (Kuptniratsaikul et al. 2011). This risk is increased for repeat fallers (Beauchet et al. 2008). Training in dual-task activities that challenge balance in clinic situations has been shown to improve gait stride and variability and dynamic and static balance (Silsupadol et al. 2009). LiFE has shown that this can be done in everyday situations and that these skills

transfer to other functional tasks. It may be that the tailored and embedded activities of LiFE enhance the integration of skills such as task coordination, postural control, and spatial processing.

### **Functional Activities Also Involve Planning, Concentration, and Attention**

Activities that involve planning, concentration, attention, and strategizing could have a direct impact on function (Liu-Ambrose et al. 2008). Think of what is involved in challenging balance when talking on the phone, carrying things while turning around or going up stairs, or tandem walking down the hall carrying a cup of tea. Liu-Ambrose et al. (2012) propose that it is not just physiological improvements that can be gained from exercise but that executive function and functional plasticity can improve from targeted exercise. They draw on understandings of brain function, evidence from their own and others work in resistance training, and on studies exploring the relationship between fallers’ performance on tasks that demand attention and tasks involving executive function (Anstey et al. 2008). They assert that, along with physiological change, such mechanisms may play an important role in how exercise improves function and reduces fall risk.

### **Skills**

#### **Finding LiFE Opportunities**

There are many opportunities throughout the day to embed balance and strength activities. The starting point is to chart a typical day routine over a week. LiFE activities are then matched to specific daily routines or tasks for that individual. Rather than looking for ways to do less, participants are encouraged to look for ways to do more and to add balance and strength activities into more daily tasks.

#### **Challenges Self and Mastery**

The concepts of challenging oneself, mastery, and upgrading are interconnected. They are all important skills that underpin most exercise programs. To improve and continue to improve balance, a person will need to practice challenging balance

activities. To improve strength, a person has to continue to load their muscles and continue increasing the load on their muscles. To continuously upgrade their activities, the participant needs to be able to set a goal related to a LiFE activity, determine when they have mastered that activity or achieved the goal, and then set a new, more challenging goal. Self-efficacy refers to the perception of one's ability to reach a specific goal (Bandura 1997). The ability to set realistic, short-term, achievable goals as well as mastering an activity can increase the participant's beliefs about self-efficacy when they prove that they can master the activity.

Mastery refers to the ability to perform an activity at a certain level. Inherent in this concept is the idea that new challenges can always be created once a particular challenge has been met. Mastering a skill involves breaking it down into simple and manageable steps and having incremental goals working toward achieving these steps. In the LiFE program, participants have to master an activity at a lower level before they can safely progress to a more challenging activity. For example, when a participant can stand on one leg with two-hand support, then the goal becomes moving to a one-hand support and then one-hand intermittent support. Participants master the activity and then set a new goal which upgrades their level of activity.

#### Upgrading LiFE Activities and Autonomy

Upgrading is based on the principles, that is, progressively increasing challenges to balance or increasing load on lower limb muscles within one activity or combining activities that target two or more principles (e.g., sway to limits of stability sideways when standing on one leg and climbing up stairs two steps at one time without using the handrail for support are both very advanced LiFE activities).

Finally, and most importantly, the aim is to give the participants the skills to become autonomous in implementing the program themselves, to understand how to upgrade, and to select appropriate activities that will continue to challenge their balance and load their muscles in safe and correct ways. Thus, planning and setting goals

require joint decision-making, a sense of ownership of the goal, and encouragement to contribute "how, when, and where" more LiFE activities can be undertaken.

#### Habitual Change

Facilitating habit change requires strategies that transition the novel activity into a routine part of the daily task (Lally and Gardner 2013). That is, LiFE activities need to become habitual. When the activities become habitual, they are more likely to be sustained.

#### Active Memory Till Embedded in Routines

Habits are automatic actions. So to change a habit requires thinking and planning within active memory until it becomes stronger than the current action and becomes automatic or "embedded." This suggests also that the number of activities chosen to change at one time should be manageable.

While learning the program during the training phase, participants must consciously think about the activities and embed them into daily tasks. That is bringing them into consciousness or active memory. We learn new habits by incrementally processing over time using our active (or procedural) memory. Over time they become habitual and automatically embedded in daily occupation. Habits are routine, goal-directed behaviors that are set in motion by situational or environmental cues (Ronis et al. 1989). These can be automatic and may go unnoticed or may be intentional where the situation needs to prompt us to action.

Changing habits requires time. This is why training in the LiFE program was taught over five sessions, two phone calls, and two booster sessions but which extended over a 12-week period. LiFE requires working with active memory until the activity becomes a stable and enduring habit and is embedded in routine. This is facilitated by practice and repetition in the same context.

#### Planning and Visualization: How, When, and Where

Holland et al. (2006) stated that planning and visualizing changes were important because they helped formulate the intent to action and acted to strengthen the association between the situation or

environment and the action. Participants in the LiFE program are expected to plan when and where they will perform the activities and to which of their daily tasks they will link the activity. They are also asked to visualize themselves performing the activity while doing their daily tasks. The particular task then becomes the cue for remembering to do the LiFE activity. For example, a participant could practice tandem standing while washing up; then doing the washing up becomes the cue to do the tandem stand. But in addition to practice, they are also encouraged to imagine or visualize themselves in the future doing this.

When they have mastered the skill of performing the desired activity embedded in a specific daily task and are doing this routinely, they should then try to visualize themselves performing it in other daily tasks. Participants can then generalize the activity performance to other contexts. The idea is to be able to transfer the activities to as many tasks and places as possible through their daily routine. They can plan to embed the activity in the new task in addition to the former task.

For example, they might start with bending their knees (squatting) to get the detergent from below the sink. Once this is mastered, they then plan and visualize themselves bending their knees in other situations such as the bathroom to get the toothpaste out of the cupboard or in the kitchen when getting the plates out for dinner.

Visualization is a strategy to assist intent to action and included as a step in planning where the activities can and will be embedded. It also assists participants to generalize the activities to a variety of tasks and places. Recording how, when, and where on the “LiFE Activity planner” is important to clarify steps and to commit to action, but it is the visualizing and planning that are the key features of this process. Such intentions to implement the action and planning will greatly increase the chance of carrying out the action.

#### Situational and Environmental Cues Serve as Prompts to Action

A planned commitment to a behavioral response occurs within a particular situation and in response to a particular cue. The ability to replace

old habits with new ones is dependent on both conscious planning and the influence of situational cues (Lally and Gardner 2013; Holland et al. 2006; Lally et al. 2011). Changing behavior requires prompts to elicit the desired behavior. In LiFE there are several methods of providing the cues to prompt the desired behavior. There are general prompts that apply to all participants. These include bending your knees if you need to reach for anything below waist height or go on your toes if reaching above waist height.

To facilitate the embedding process, the participants plan which daily tasks the LiFE activities will be linked to or embedded within. These tasks then become the situational cues to prompt the performance of the LiFE activity. Situational cues can be a place and time, for example, the kitchen sink in the morning; a feature of the environment, for example, the doorway between the hall and the bathroom; or a pattern of interaction with the environment, for example, standing in the supermarket line. These cues act as a prompt to elicit the behavioral response – the performance of the LiFE activity.

The program encourages participants to make changes to their environment to facilitate the performance of the LiFE activities such as moving commonly used items to a different place to promote repeated performance. Some examples include moving the detergent to a lower shelf to prompt knee bends and moving the tea cups to a higher shelf to prompt toe raises. The aim is to have participants performing the strength and balance activities without having to consciously think about including them in their daily tasks. This way, they become habitual.

Fleig et al.’s (2015) implementation of LiFE with younger women in a group setting particularly noted the importance of habit theory and how using activity and object-based cues were particularly effective in generating action and automaticity.

#### Practice and Repetition in the Same Context

Practice and repetition is crucial to habit formation. Lally and Gardner (2013) outline the stages of habit formed in a similar context each day. So rather than planning too many different contexts,

you might start with squatting (instead of bending your back) every time you close a drawer in the bedroom and kitchen. Once habits are formed, this can be generalized to broader contexts such as the supermarket, the garage, or other places that the participant goes.

Planning and practice are both critical in implementing new habits. Participants have to plan to do the activity, visualize themselves doing the activity, and then practice doing the activity consciously and repeatedly until it becomes habit. When a new action is performed, a mental association between situation and action is created, and repetition reinforces and establishes this association in memory.

**Self-Monitoring, Reinforcement, and Repetition**  
Participants engage in planning the changes. The therapists demonstrate the activities and provide opportunity for participants to practice, self-monitor through planning and recording sheets between sessions, and provide feedback and positive reinforcement. To enable habit change, this approach to exercise needs to be taught over a period of at least 8 weeks and preferably 12 weeks. Therapist support is needed to assist in setting session goals initially and then to move to increasing autonomy so participants are planning, setting “how, when, and where” themselves, and monitoring their progress. To change habits, there must be continual repetition and practice.

The power of goal setting, feedback sheets for monitoring exercise that are acknowledged by the trainer, and other forms of encouragement and self-incentives relative to personal goals cannot be overestimated. In resistance training, self-regulation is known to directly contribute to enhanced confidence in maintaining performance at challenging levels, to using correct form and to continual upgrading as one level is mastered (Winett et al. 2009). This requires cognitive (knowing what to do), motivational (wanting to perform and the confidence that you can), and behavioral (being able to do it) factors.

### **Experience Functional Outcomes**

Participants gain intrinsic reinforcement for the performance of the activities in a variety of

ways. If they engage in the planned activities and can upgrade over time, they will achieve improved balance and function and increased confidence in mobilizing and in desired activities and will have more protection against future falls.

In fact, protection from falls alone, although a major outcome, is not going to be an ongoing incentive. Other outcomes are needed, such as better balance and function, in order to enhance motivation sufficiently to adopt and sustain the program.

### **Applied Theory in Practice**

The innovative LiFE program is different to a usual exercise program and may require a shift in thinking or focus for therapists and trainers and the participants. Occupational therapists look for ways of making tasks *easier* for their clients or of having them do *less*. The LiFE program encourages participants to look for ways of doing *more* and seeking out more demanding environments. Physical therapists are more familiar with prescriptive programs where dosage is increased by repetition, weights, or external resistance and performed in sets at regular times each week.

The model is intended to be applied in practice, and providing this framework enables the assessments, planning, and recording tools as well as the training process be conducted such that they integrate the key elements and features of the model. This kind of program requires the participant to spend time implementing the program throughout their day, and it therefore needs to be tailored, relevant, practical, and functional.

The LiFE approach has been shown to work in different settings and provides another choice for a successful fall prevention program with potential to maintain function. Further work could elucidate which groups of people an embedded approach of balance and strength training would benefit the most. In addition, qualitative inquiries would be welcome that can further elucidate the features and mechanisms of the concepts underpinning the program which are essential to successful uptake and long-term sustainability of such programs.

## Cross-References

- ▶ Decision Making
- ▶ Environmental Influences on Aging and Behavior, Theories of
- ▶ Everyday Cognition
- ▶ Mindfulness Approaches
- ▶ Physical Activity and Aging
- ▶ Risk Taking in Older Adulthood
- ▶ Working Memory in Older Age

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## Conflict Management and Aging in the Workplace

Dannii Y. Yeung<sup>1</sup> and Henry C. Y. Ho<sup>2</sup>

<sup>1</sup>Department of Applied Social Sciences, City University of Hong Kong, Hong Kong, China

<sup>2</sup>School of Public Health, University of Hong Kong, Hong Kong, China

### Synonyms

Conflict strategies; Conflict styles

### Definition

Workplace conflict emerges when there is a disagreement between two or more parties in the organization or when a person perceives incompatible needs, goals, desires, or ideas with another person (Deutsch 1994). There are two major forms of conflict in the workplace: Interpersonal conflict takes place when a worker perceives that his/her valued outcomes are deprived due to interference from the opposing worker, while intergroup conflict arises when a group of workers perceive a deprivation of valued outcomes due to interference from the opposing group (De Dreu 2011).

### Introduction

Conflict is inevitable in the workplace as long as there is social interaction between two or more

parties, including individuals, units, departments, and organizations. It involves cognitive and behavioral reactions toward incompatible goals, competing interest in scarce resources, and interference in goal attainment (Hocker and Wilmot 1991). Depending on one's attitudes, values, and goals, a social situation can be perceived as either a threat to one's interests or an opportunity to cooperate and maximize the benefits of both parties. This behavioral intention in turn determines whether escalatory or de-escalatory action should be taken.

Abundance of conflict research has provided evidence for the detrimental effects of conflict when it is managed poorly. In particular, prior research has found that workplace conflict contributes to reduced job satisfaction and organizational commitment, poorer health and well-being, and disruptive behaviors that are costly to employers, such as absenteeism and turnover (De Dreu 2011). However, although it is undeniable that conflict can result in a number of negative outcomes, research from the past two decades shed light on the positive and constructive benefits of conflict when it is managed appropriately in the workplace. For example, workplace conflict has been found to enhance communication, resolve continuing problems, facilitate team performance, stimulate learning, and promote creative thinking under the condition that the conflict is problem-focused, cooperatively oriented, and involves integrative efforts to achieve optimal solutions (De Dreu 2011). Therefore, effective conflict management is crucial to team effectiveness and work productivity.

The number of mature workers aged 45 and above in the labor force has been growing drastically over the past decade, for example, from 34.9% to 42.9% in the United States (US Bureau of Labor Statistics 2011). The composition of labor force becomes more diverse, comprising mature workers from the baby boom cohorts (1946–1964) and later cohorts from generations X (1965–1976) and Y (1977–1992). The presence of workers from multiple age groups within an organization intensifies the occurrence of conflict because of differences in work values, work ethics, goal orientations, and conflict styles between younger and older workers.

In the face of changing demographic trends, how conflict can be managed effectively is a major concern for many organizations. It is therefore a pressing task to identify and unravel the underlying mechanisms of conflict in the mature workforce. By drawing from various areas of research, valuable insights can be obtained to reveal the influences of motivational orientation, goal orientation, and social identity on conflict strategy preferences among younger and older workers. Effective measures can then be proposed in light of the conditions that are required for conflict to result in positive outcomes. In the first section of this entry, the dual concern model (Rahim 2011) and the theory of cooperation and competition (Deutsch 1994) will be discussed to identify the major determinants of conflict strategy in the workplace. The second section will discuss the socioemotional selectivity theory (Carstensen 2006) and the social identity theory (Tajfel and Turner 1986) and review the empirical findings on age differences in conflict management. Implications and future directions on managing the workplace conflict will be discussed in the concluding section.

### Conflict Management in the Workplace

Working adults' responses to conflict can yield diverse consequences. According to the dual concern model, the ways to deal with interpersonal conflict can be categorized into five styles, including obliging, dominating, integrating, avoiding, and compromising (Rahim 2011). The selection of conflict styles is determined by one's motivational orientation, i.e., the degree of attempts to satisfy concern for self and concern for other parties. In particular, obliging strategy is used when concern for self is low and concern for others is high. This involves meeting the needs of the opposing party and giving into his/her demands. Dominating strategy is used when concern for self is high and concern for others is low. This involves forcing the opposing party to accept and give into one's personal views and demands. Integrating strategy is used when concern for self and others are both high. This involves

collaborating with the opposing party in order to reach a mutually agreed solution so that the interests of both parties are satisfied. Avoiding strategy is used when concern for self and others are both low. This involves neglecting the conflict entirely to allow the conflict to dissipate on its own. Compromising strategy is used when concern for self and others are both moderate. This involves a give and take negotiation so that an intermediate position can be reached.

Similar to motivational orientation, another line of research examined goal orientation as the underlying determinant of conflict behaviors. According to the theory of cooperation and competition (Deutsch 1994), goal interdependence, which is the perception of how goals are related, influences social interaction. Specifically, goal interdependence can be grouped into three categories: cooperative goals, competitive goals, and independent goals. These three types of goal orientation are proposed to have a significant impact on the way conflict is handled. For cooperative goals, individuals perceive their goals to be positively related to each other so that successful achievement of one's goal would lead to the successfulness of another in reaching his/her goal. Individuals who are motivated by cooperative goals would avoid the escalation of conflict since working cooperatively as a group would be more effective in achieving the most desirable outcome for both parties. In comparison, for competitive goals, individuals perceive their goals to be negatively related to each other; so increasing the chances of success for one person would diminish the chances of success for another person. Under this win or lose perspective, conflict will most likely be escalated since individuals are motivated to do better than others and behave competitively in order to ensure that they succeed while others fail. For independent goals, individuals perceive their goals to be unrelated to the goals of others; so their personal goal attainment is prioritized, while other people's goals are irrelevant to their concerns and efforts. Motivated by an independent orientation of goals, actions are taken in order to ensure one's personal interests are met, regardless whether the other party is satisfied or not.

## Age Differences in Conflict Management

Although the dual concern model and the theory of cooperation and competition are prominent in the literature on conflict management, they generally assume that goals and motivation remain more or less constant over the life span. Applying these two frameworks to the age-diversified workforce would lead to the prediction that a worker's behavioral responses are determined by his/her motivational or goal orientation, regardless of his/her age. For example, an older worker who has high concern for self and low concern for others would be as likely as a younger worker to prefer the use of dominating strategy. However, the literature on life span development stresses that older adults shift their goal orientation from knowledge-related goals to emotional goals when they perceive future time as increasingly limited (Carstensen 2006). Therefore, it is doubted whether these two models can fully explain the patterns of conflict strategy use in an age-diversified workforce.

Socioemotional selectivity theory (SST; Carstensen 2006) can be applied to understand conflict behaviors of older workers since it provides a theoretical explanation for age-related changes in developmental goals and social behavior. According to this theory, the way emotion is regulated is guided by future time perspective, which becomes increasingly limited as the person ages. Younger individuals who are likely to perceive an expansive future time prioritize knowledge-related goals, including knowledge acquisition, career advancement, and expansion of social network. As individuals grow older, they are more likely to perceive limited time and therefore shift their priority to emotional goals such that emotionally meaningful experiences are emphasized and valued. Therefore, the emphasis of emotional goals motivates older individuals to make use of adaptive emotion regulatory strategies that can maximize positive emotional experiences, while younger individuals are less likely to focus on emotion regulation.

When applying SST to predict conflict styles of younger and older workers, it is expected that older workers' emphasis of emotional goals

motivates them to concern for others more than themselves and to cooperate instead of to compete, such that they are more likely to use passive strategies such as obliging or avoiding. Assertive strategies such as dominating style are less likely to be utilized by older workers as these strategies will prevent them from maximizing positive emotional experiences. In contrast, younger workers tend to use more assertive strategies to manage conflict situations as they focus on knowledge-related goals and are concerned for themselves more than others. These speculations are supported by research findings. For example, in a national survey of 1785 working adults in the United States, Schieman and Reid (2008) revealed that among male workers with higher authority, younger workers engaged in more aggressive and competitive conflict behaviors than did older workers. Similarly, Davis et al. (2009) examined behavioral responses toward workplace conflict in a sample of 2513 American working adults. This study demonstrated that both younger and older workers used active-constructive strategies such as perspective taking or creation of solutions to deal with conflict incidents at work, though older workers displayed a greater tendency to utilize passive-avoidant strategies such as yielding or adapting.

Past research on conflict management showed that the selection of conflict strategies varies by role of the conflict partner. For instance, in the study measuring conflict styles of 1219 managers in the United States, Rahim (1986) demonstrated that employees were more likely to use obliging to handle conflict with superiors and utilize compromising with peers. When resolving conflict with subordinates, they tended to use integrating as primary styles and avoiding as backup styles. Both Lee's (1990) and Nguyen and Yang's (2012) experimental studies further support the influence of the role of the conflict partner in the selection of conflict strategies. Specifically, there was a greater tendency to use direct and assertive strategies to resolve conflict with subordinates, compromising strategies to deal with peer conflict, and indirect and harmony-preserving strategies to handle conflict with supervisors. However, these studies did not take age into consideration in

the examination of conflict behaviors. To address the limitation of the prior research, Yeung et al. (2015) measured behavioral responses to workplace conflict in a sample of 280 Hong Kong Chinese managerial and executive employees aged between 22 and 66 years. The participants were asked to recall a personal workplace conflict experience that happened in the past 3 months. They also reported their goal orientations and conflict responses during the conflict situation. Results of this study revealed that relative to younger employees, older employees utilized more avoiding to handle conflicts with supervisors and less dominating with subordinates. These age differences could be explained by the higher level of cooperative goals held by the older workers relative to their younger counterparts, supporting the proposition of SST on the age-related variation in goal orientation.

In addition to the influences of motivational orientation and goal orientation reviewed above, one's social identity can also affect the selection of conflict strategies, especially during intergroup conflict. The social identity theory, which was developed to provide theoretical contributions toward social phenomena such as intergroup relations, stereotyping, and group processes (Tajfel and Turner 1986), is suitable to explain the intergroup dynamics of an age-diversified workforce. Social identity is defined as an individual's self-concept based on his/her perceived membership of relevant social groups that are of value and emotional significance to him/her. In a conflict involving a younger worker and an older worker, the individuals may identify themselves as members of the younger or older age group, which subsequently influences their thoughts, feelings, and behaviors toward the intergroup conflict (De Dreu 2011). Members of an in-group are motivated to enhance positive distinctiveness compared with the out-group members. This in-group-out-group bias is commonly manifested in intergroup conflict where members of opposing parties utilize strategies that favor the in-group and denunciate the out-group. Intergroup conflict is expected to be most severe in organizations with age diversity and distinct group boundaries between younger and older workers, as this can foster intergroup

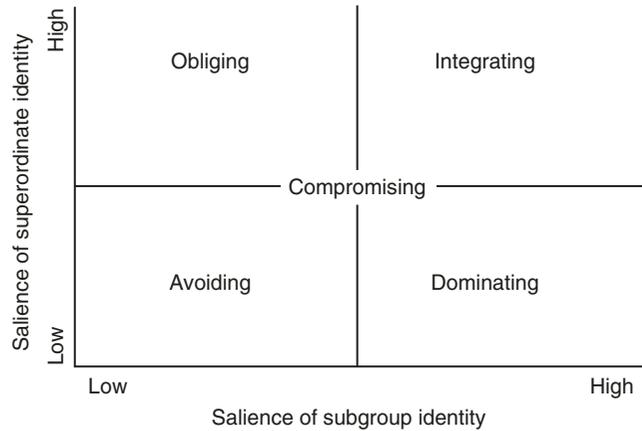
competition and social conflict, causing a higher likeliness for opposing intergroup relations to be formed (Dencker et al. 2007).

While the social identity theory makes general assumptions about the behavioral responses of conflict, five types of conflict strategy can be predicted by integrating with the dual concern model (Haslam 2004). According to the integrated model of conflict, the two axes of the dual concern model, concern for self and concern for others, can be reconceptualized as the salience of subgroup identity and the salience of superordinate identity, respectively. Salience of subgroup identity refers to one's social identification with a subgroup (younger or older workers), while salience of superordinate identity refers to one's social identification with a superordinate group (employees of an organization). This reconceptualization is possible because concern for self is consistent with the behavioral intentions of subgroup identity, while concern for others is consistent with the behavioral intentions of superordinate identity. As presented in Fig. 1, conflict between younger and older workers is escalated when dominating strategy is utilized by those who have a salient age group identity. In order for the conflict to be reconciled, social identity must be salient on both subgroup and superordinate dimensions so that an integrative solution can be reached.

To test the effect of social identity on conflict behaviors, Ho (2014) examined the relationships among social identity, goal orientation, and conflict strategies in a cross-sectional survey among 380 clerical workers in Hong Kong. Two hypothetical scenarios involving conflict with a younger worker and an older worker were used to stimulate workplace conflict. In response to each conflict scenario, participants were asked to respond to a questionnaire on how they perceived their goals as related to the opposing worker and the type of conflict strategies that they prefer to utilize under the circumstances. Results of the moderated mediation models revealed that organizational and age group identities had a combined influence on conflict strategies through goal orientation, but the pattern differed by the age of the opposing party. In the conflict with a

### Conflict Management and Aging in the Workplace, Fig. 1

The integrated model of conflict (Adapted from Haslam 2004)



younger worker, individuals were more likely to use integrating when both of their organizational and age group identities were high. Individuals who were identified as members of the organization but had moderate age group identification were more likely to use compromising toward the younger worker. Furthermore, organizational identification was related to the use of obliging toward the younger worker when age group differentiations were minimal. It was also found that these relationships could be explained by the low level of independent goals held by the respondents.

In the conflict with an older worker, individuals were more likely to use integrating strategy when their organizational and age group identities were high. Individuals who were identified as members of the organization but had minimal age group identification were more likely to use obliging strategy toward the older worker. Furthermore, organizational identification was related to the use of compromising strategy toward the older worker when the level of age group differentiations was moderate. These relationships could be explained by the high level of cooperative goals held by the respondents.

Ho's (2014) study suggests that social identity contributes more to independent goal orientation with younger workers and cooperative goal orientation with older workers. This difference in goal orientation when the age of the opposing party differs may be explained by values deeply rooted in the Chinese culture. According to Confucius'

ideology, it is a virtue to respect senior adults and sacrifice one's own interests to establish and maintain relationships with older people. Therefore, during conflict with older workers, one's cooperative intention is a major determining factor of how the conflict should be managed. Nevertheless, consistent with the findings of the literature on intergroup conflict, in-group membership can diminish conflict of interest and facilitate cooperation between opposing parties.

### Implications for Managing an Age-Diversified Workforce

In general, the literature on conflict management in the workplace holds the assumption that the same set of predictive factors of conflict behaviors is applicable to all working adults, regardless of their age. However, as reviewed above, goal orientations change as a person grows older, suggesting that the way older workers deal with conflict incidents may not be the same as those utilized by younger workers. Even though researchers can infer from past aging research on interpersonal tensions to predict conflict responses of older workers, these studies focus largely on conflicts with family members and close friends. Therefore, it remained unclear whether younger and older workers react to workplace conflict differently, as it usually involves coworkers and clients who are not perceived as emotionally close as family members and close friends. The findings of our research tentatively suggest that similar to other nonwork conflicts,

older workers utilize more passive strategies (e.g., avoiding) and fewer destructive strategies (e.g., dominating) to manage workplace tensions than do younger workers (Yeung et al. 2015). Putting research findings from the literatures on life span development and conflict management together, it seems older individuals manage daily interpersonal conflicts in a similar way, regardless of the context. This proposition awaits future investigation to explicitly compare within-individual use of conflict strategies and goal orientations across different life domains to confirm whether the age-related pattern of conflict management is context-specific or not. In addition, by integrating the dual concern model and social identity theory, Ho (2014) further demonstrated that social identity can influence goal orientation, which would in turn influence one's preference for conflict strategy. Specifically, workers with higher organizational and age group identities tend to hold more cooperative goals and therefore use more integrating strategies to handle conflicts with an older conflict partner. Future research should include the assessment of social identity to accurately predict conflict strategies of working adults.

The majority of conflict management research was conducted on Western populations. Past cross-cultural studies on conflict management suggest that Chinese employees, in general, are more likely to utilize non-confrontational strategies (such as avoiding or compromising) than their Western counterparts (Bazerman et al. 2000). Yeung et al.'s (2015) study demonstrated a robust age effect, even in a sample of working adults with cultural norms of non-confrontational conflict approaches. Older Chinese workers displayed higher level of avoiding strategies when handling conflicts with supervisors than did younger Chinese workers. Future studies should replicate this age effect in a cross-cultural comparison study by recruiting both Western and Asian working adults of a wide age range.

In addition to the examination of age variation in conflict management, future studies should also investigate the impact of conflict strategies on work outcomes. Past studies often suggest that avoiding strategies are related to higher work and conflict stress (Friedman et al. 2006) and

reduced job satisfaction (De Dreu and Dijkstra 2004). It is questioned whether older workers' greater preference for avoiding strategies is associated with poorer work outcomes and psychological well-being. However, according to SST, older adults' use of passive strategies is indeed consistent with their developmental goal orientation that emphasizes on emotional goals and interpersonal closeness (Carstensen 2006). Therefore, greater use of passive strategies should contribute positively to their well-being or have a less harmful effect. Cross-sectional studies of Yeung and Fung (2012) and Yeung et al. (2015) have demonstrated that the use of emotional suppression and avoiding strategies is beneficial to the older workers by improving their sales productivity and lowering the level of negative emotions and interpersonal tensions. These findings imply that the use of passive strategies is not always harmful to working adults but depends largely on the age of the users. The long-term beneficial effects of passive strategies on older workers though await future investigation.

## Conclusion

Age differences in conflict management are observed, which can be explained by age-related changes in goal orientation and social identity.

**Acknowledgments** Both Ho (2014) and Yeung et al. (2015) measured conflict strategies by the Rahim Organizational Conflict Inventory II (Form C), which was used with permission from the © Center for Advanced Studies in Management. Further use or reproduction of the instrument without written permission is prohibited.

## Cross-References

► [Socioemotional Selectivity Theory](#)

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## Contextual Adult Life Span Theory for Adapting Psychotherapy (CALTAP) and Clinical Geropsychology

Leander K. Mitchell  
School of Psychology, The University of Queensland, Brisbane, QLD, Australia

### Synonyms

Case conceptualization; Formulation

### Definition

The Contextual Adult Lifespan Theory for Adapting Psychotherapy (CALTAP) model is a transtheoretical model developed to assist in increasing the understanding of both who the older adult client is and the broad context within which he or she presents for therapy.

### Introduction

The Contextual Adult Lifespan Theory for Adapting Psychotherapy (CALTAP) (Knight and Lee 2008) is a model that has been developed with an older adult population in mind. Fundamentally, the model provides a framework within which a holistic and in-depth understanding of older adult clients can be developed. In order to achieve this, the CALTAP model draws on lifespan developmental principles and social contexts (both current and historical and at a cultural and cohort level). The model has also been designed to be transtheoretical in nature rather than being

wedded to any one particular type of therapy (e.g., cognitive behavioral therapy, interpersonal psychotherapy, etc.). The CALTAP model therefore offers the opportunity for the clinician to explore the case history of the client at a broad level and then determine the best therapeutic approach to meet the goals of therapy.

Drawing on Knight's (1996) contextual, cohort-based, maturity-specific challenge (CCMSC) model of psychotherapy, the CALTAP model elaborates on the CCMSC model by outlining a more integrated approach to psychotherapy with older adults and adding consideration of the importance and relevance of culture (Knight and Lee 2008). CALTAP identifies the following factors for consideration in psychotherapy with older adults: context, culture, and cohort. The CALTAP model (like the CCMSC model) is designed to be transtheoretical; that is, the model is not linked to any one particular approach to therapy and as such may be used across approaches to psychotherapy. Regardless of therapeutic focus, the model has the goal of increasing the therapists understanding of the client, outside the context of any one particular type of therapy, by encouraging the importance of understanding and incorporating the depth and breadth of contextual influences (Knight and Poon 2008). Having such an understanding not only guides case conceptualization but provides a frame for selecting and adapting therapeutic modalities, the use of clients' idiosyncratic strengths and challenges, and choice of therapeutic method which avoids reliance on stereotypical beliefs which can be subtle in nature and insidious in effect. For example, while older adults are more likely to experience chronic illness, some cope better with chronic illness than others. The CALTAP model therefore encourages the clinician to explore the client's experience of chronic illness both with respect to their current circumstances and to current and historical contextual factors that may be contributing to their ability to cope. A stereotypical mind-set without guidance from a model such as CALTAP, on the other hand, might assume that all older adults have difficulty coping with chronic illness, resulting in treatment missing the most appropriate therapeutic goal(s).

The CALTAP model also encourages consideration of both strengths and challenges within individual (e.g., maturation, presenting problem), environmental (e.g., context), and social contexts (e.g., culture, cohort). The focus of this model is on exploration and adaptation, encouraging the psychologist to adapt to the needs of the client (based on the information they gather) rather than having the client adapt to the psychotherapy or the underlying beliefs of the therapist. At its broadest level, the model considers both intra- and interindividual factors as they relate to the client. The model also encourages consideration of interpersonal, intergenerational, and intercultural elements. Therefore, the CALTAP model is a tool that encourages a structured approach to gathering information about the client, which is multifactorial in nature and considers the client from a number of different perspectives (e.g., interpersonal, intergenerational, and intercultural). Such a comprehensive method of collecting data guides therapy goals and offers both the therapist and the client a means of understanding who the client is and what they bring to therapy.

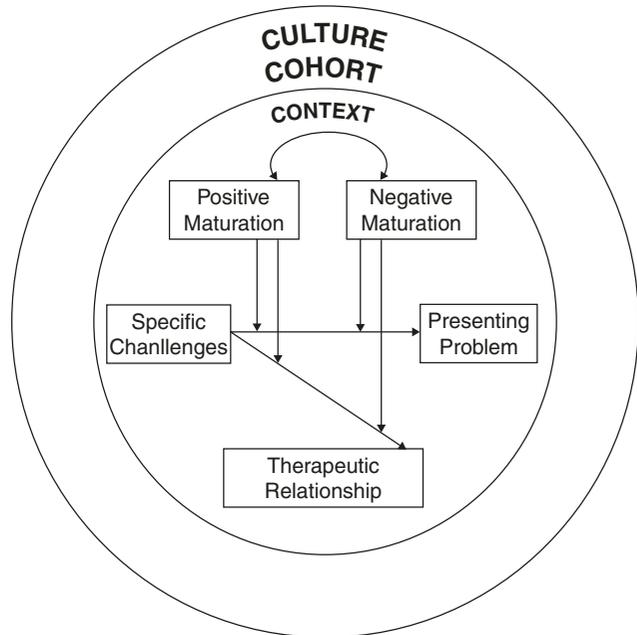
## The Elements of the CALTAP Model

### The Element of Context

The inner circle of the model (see Fig. 1) focuses on the individual and immediate context. The central diagram (i.e., "positive maturation," "negative maturation," "specific challenges," "presenting problem," "therapeutic relationship") encapsulates intraindividual factors, while the domain of "context" within which this central diagram sits considers both interindividual and interpersonal factors. This portion of the model therefore highlights the importance of consideration of the elements that might be broadly framed as the everyday context in which the client lives, including personal, environmental, and social factors. With regard to personal factors, consideration is given to what the clients themselves bring to therapy and the therapeutic relationship, as well as the interactions between those elements, which are captured via the central diagram within the center circle. In considering environmental

**Contextual Adult Life Span Theory for Adapting Psychotherapy (CALTAP) and Clinical Geropsychology,**

**Fig. 1** Contextual Adult Lifespan Theory for Adapting Psychotherapy (CALTAP) model



and social factors, the focus is on the context in which the individual currently lives and socially engages, including such things as housing and living arrangements, the medical environments in which they engage, recreational settings, interpersonal environments, and family and social settings, for example.

The maturation elements capture lifespan developmental processes, those positive and negative changes that are posited to occur naturally as people age. Positive maturation reflects gains with increasing age, and negative maturation includes decrements in functioning with age, along with those things that people are more at risk of with increasing age (e.g., reduced processing speed, increased risk of illness, etc.). The broad and generic nature of the model also allows for consideration of variations in developmental processes, acknowledging the fact that while the lifespan developmental literature offers insight into normative developmental processes, individual differences in development can and do occur.

“Positive maturation” refers to the elements of cognitive and emotional complexity (Knight and Poon 2008). Cognitive complexity encompasses the accumulation of knowledge and skills across a lifetime, as a result of both structured and

unstructured learning, that result in what can be summarized as maturation in cognition. Emotional complexity refers to the notion that as people age, they become better able to regulate their emotions (Mather and Carstensen 2005) and also experience more complex, as well as less intense, emotions than those perceived to be experienced by younger adults (Ong and Bergeman 2004). “Negative maturation,” on the other hand, encompasses the broad areas of both physical decline and cognitive decline. Physical decline encompasses the idea that as people age, their body and bodily functions tend to become less efficient and less effective, and the risk of illness increases. Variability in decline is influenced by lifestyle choices of the individual as well as the normative changes associated with aging. Cognitive decline refers to the normative changes in cognition as the individual ages. Such changes include decrements in processing speed, attention, and memory (e.g., Kemper et al. 2003; Light 2000; Salthouse and Ferrer-Caja 2003). As with physical decline, and all elements of maturation, the level of decline and/or development (i.e., “negative maturation” and “positive maturation”) will, in part at least, depend on the life that the individual has led and the genetic hand they have been dealt.

The CALTAP model structures a holistic approach, neglecting neither the positive nor the negative aspects of developmental processes – at an individual level – in order to build understanding of the client within a therapeutic context.

“Specific challenges” refer to life circumstances that challenge the individual and therefore can impact on the sense of self and the sense of well-being. Examples of such challenges can include chronic illness, disability, and changes in interpersonal functioning (e.g., dealing with grief, caregiving, role changes, etc.). To illustrate, with regard to chronic illness and disability, not all older adults will develop such conditions, and how much of a challenge such factors are to the individual will depend on a number of elements, not the least of which being the severity of the illness or disability, the coping ability of the individual, and the support available. Grief is another example of a “specific challenge,” which may not only cause the person to think about his or her own existence but can also impact on psychosocial functioning. Length and intensity of relationship, manner of death, coping skills, and support all play a role in how well the individual might cope with the challenge of grief. “Specific challenges” also include role changes such as caregiving. Older adult caregivers can be frail and ill themselves; they may lack support or experience emotional distress as a result of the changes in their partner and themselves. With regard to the challenges that role changes may create, traditional partner roles can be challenged when the person who always saw themselves as the caregiver becomes the care receiver. Like the elements of maturation, there is no clear formula or template here, which is considered a strength of the CALTAP model as it encourages consideration of the individual, in his or her own context and specific circumstances.

As illustrated in the central portion of the diagram via the arrow configurations, the CALTAP model also highlights that the elements of “positive maturation,” “negative maturation,” and “specific challenges” each play a role in shaping the “therapeutic relationship” as well as the “presenting problem.” An individual’s context will necessarily impact on his or her ability to

form relationships, including with a therapist, and will shape the therapist’s ability to form a good rapport with the older client. The direction of the arrows and links they create among the elements within the center circle make intuitive and clinical sense, although such relationships have not been established via research specifically focused on the CALTAP model. One might need to consider at the very least, for example, whether bidirectional arrows should exist between “specific challenges” and “therapeutic relationship” and between “specific challenges” and “presenting problem.” The bidirectional arrow between “positive maturation” and “negative maturation” highlights the interrelationship between these elements as coexisting within lifespan development.

As a group (i.e., the central portion of the diagram), the aforementioned elements are located within the center circle labeled “context.” The construct of “context” itself looks to capture details of the settings within which older adults currently engage, including the environments in which they live, work, and play. It therefore looks to emphasize consideration of what elements of the individual’s living arrangements, work or volunteer commitments, and socializing (at professional and personal levels) might be relevant to the presenting problem and therapeutic intervention choices.

“Context” is an apt name for this central portion of the model given that exploration of such elements provides the psychotherapist with an appreciation of the immediate context within which the client both exists and presents. One of the key strengths of this portion of the model then is to discourage stereotypical beliefs about the older adult and call attention to both environmental and intraindividual influences as a firm basis upon which to begin effectively meeting the therapeutic needs of the individual client. However, the positioning of the central portion of the diagram (which focuses on intraindividual factors) specifically within “context” (which focuses on interindividual factors) can be confusing since intuitively it makes sense to look at each of those factors separately outside the realms of such a model. It may therefore be beneficial for

the clinician to think of the central diagram and “context” as two separate elements, rather than as one embedded within the other.

### The Elements of Cohort and Culture

Moving out from the center circle, “cohort” and “culture” form the outer ring of the model and represent consideration of interindividual factors. This is a change from the first iteration of the CALTAP model (Knight and Lee 2008), where the two elements were initially presented as separate rings. The significance of the two elements now being encapsulated within the one ring represents a recognition by the authors that, realistically, cohort and culture are inseparable, with each having an effect on the other, and so now present them together (Knight and Poon 2008). While the illustration of the model does not highlight this point, consideration of both historical and current contextual factors for “cohort” and “culture” is encouraged.

#### Cohort

At a population level, cohort refers to portions (sometimes arbitrarily determined) of the population thought to share common characteristics as a result of what might be termed shared world experiences. Knight and Lee define cohort, specifically in relation to the CALTAP model, as a group of people, often determined based on when a person was born, who are therefore assumed to have been “. . .socialized into certain abilities, beliefs, attitudes, and personality dimensions, which remains relatively stable with age and distinguishes the group from other cohorts” (Knight and Lee 2008, p. 61). For example, an individual born between the years of 1946 and 1965 is defined as belonging to the baby boomer cohort, a group of people born in the Western world after World War II, when conception rates were high with the arrival of peace. Slight variations in definition can occur depending on, for example, in which country the individual was born. Further, Knight and Lee’s definition implies that to think of someone as belonging to a larger cohort such as baby boomers may risk stereotyping the individual by characterizing the client in terms of the

overarching qualities assumed to be characteristic of a particular population rather than seeing clearly the qualities of the individual. Clinicians are encouraged to avoid pigeonholing their clients within one “popularized” cohort by using information about one fact in the context. Consideration should also be given, therefore, to the potential areas of influence within the cohort portion of the model, which may include such things as intellectual abilities, education level, personality development, historical experiences, norms, and values. As such, the cohort influences are based primarily on life experiences and the impact those experiences have on the development of the individual.

More specifically, cohort encourages the psychologist to explore and gain an understanding of the older adult’s sense of self, which has been developing over a lifetime. As previously mentioned, consideration should be given to both the historical context and the current context in order to understand where the older adult has “come from” and where she or he is now. Cohort influences are historical in nature, which act to build the individual into who they are today and how they interpret their world. A key implication of the cohort portion of the model is that many of the distinctions that can be made between young people and older people at any point in time may be due to cohort influences and the sociohistorical context in which the individual became an adult rather than developmental changes due to aging or of being at different points in the lifespan. Recent discussions regarding the CALTAP model have made it clear that the model is also seen as useful in terms of helping clients understand their own aging processes and the meaning of variations between themselves and younger family members as caused at least partially by differences in cohort rather than age (Knight and Pachana 2015).

#### Culture

The final element of the CALTAP model is “culture,” which Knight and Poon (2008) describe as twofold, with variations in both cultural values and beliefs, as well as ethnic and racial considerations, being important considerations.

These factors contribute to not only who the clients are but also how others treat them, how the clients interpret psychological distress, and their willingness to seek assistance.

Knight and Lee (2008) offer a definition of culture that encompasses the idea of the individual taking on group characteristics via the process of socialization, expressed as customs, language, beliefs, and behaviors. The element of culture highlights the importance of interpreting each client in the context of her or his own cultural existence, thus refraining from relying on ill-informed or stereotypical beliefs when it comes to exploring the element of culture with the client. Assumptions about culture from such concrete factors as skin color and general appearance miss important factual information with regard to how the client actually interprets themselves under the banner of culture.

Also encouraged is the exploration of the cultural beliefs toward older adults within the client's own environment. The model therefore also encourages consideration of culture from two perspectives, that of the client and that of those around them. The importance of this consideration is that it helps to determine the client's place within her or his environment, potentially highlighting such things as the availability of support and the degree of respect (or place they hold) within the particular environment. As with all the elements of the CALTAP model, such in-depth considerations highlight the need to have an understanding of the individual beyond stereotypical beliefs, one that specifies the individual within the heterogeneous older adult population as a guide toward appropriate and effective treatment decisions.

## Summary

As a transtheoretical model, CALTAP offers the psychotherapist the ability to develop an understanding of the individual that can assist in guiding therapeutic approach by focusing the clinician's attention on both intra- and interindividual factors of relevance.

The importance of this is that formulation models (i.e., models for conceptualizing a client's case in order to guide treatment focus) for specific types of therapy often neglect such factors, providing instead only a snapshot of the client as applicable to the needs of the therapeutic approach being used. Contextual factors, however, are an important addition in understanding how to best apply therapy to the case of the individual client. The CALTAP model therefore encourages consideration of both the forest and the trees.

The breadth of scope of the model, however, is also one of its limitations. There is comfort in having small, targeted goals as can be established from formulation models associated with specific types of therapy. The CALTAP model, on the other hand, looks to incorporate much more data, which can lead to lack of clarity with regard to establishing the goals of therapy. However, by exploring the elements of the CALTAP model with the client, the clinician has the opportunity to assist the client in broadening their understanding of their own context, which may in fact help provide for the development of more nuanced goals.

The CALTAP model recently was explored as a useful tool for consideration within the cognitive assessment context as well (Knight and Pachana 2015). Knight and Pachana (2015) expand on the model's utility by highlighting its relevance within the cognitive assessment domain. The authors encourage clinicians to become similarly aware of the depth and breadth of the client's individual context given that such knowledge contributes detail and richness to the data available in the assessment arena, as well as influencing assessment decisions, thereby improving validity overall and allowing for more targeted assessment choices and more individualized recommendation strategies.

The CALTAP model encourages psychologists to consider the range of contexts within which the older adult client presents at the level of the individual, offering a transtheoretical tool to assist in individualizing therapy and to help both the client and the psychotherapist understand the intra- and

interindividual factors of relevance to the presenting problem. Authors of the model primarily leave the decision of how to use the model in practice up to the individual clinician although the model is intended to guide more than the intake interview. CALTAP was designed as a tool to guide case conceptualization and as a broader framework that can guide assessment, selection, and adaptation of therapeutic approaches and identify relevant factors for assessing outcomes.

## Cross-References

► [Interpersonal Psychotherapy](#)

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## Creative Aging, Drawing on the Arts to Enhance Healthy Aging

Andrzej Klimczuk

Warsaw School of Economics, Warsaw, Poland

## Definitions

The term “creative aging,” in the broadest sense, describes an aging policy idea that focuses on highlighting the creativity of older adults in order to prepare individuals and communities to manage old age. Programs focus on the evolution of creativity over the lifespan and aim to provide meaningful participatory engagement, especially through the arts.

## A General History of the Creative Aging Movement and Best Practices

The history of professionally led creative aging programs may be traced back to the origins of the constructs of successful aging and healthy aging. These gerontological concepts were developed in the 1960s in opposition to the prevailing construct at that time, namely disengagement theory. At the same time, aging interest groups emerged which promoted cultural and lifestyle issues for older adults.

Some of the well-known creative aging programs started in the 1970s in the United States (USA) with combining art and activities for older adults. These programs were led by professional artists, such as Susan Perlstein (the founder of Elders Share the Arts) and Liz Lerman (the founder of the Dance Exchange). Also, organizations such as the Society for the Arts in Healthcare, founded in 1990, and Generations United, established in 1986, began various activities and programs related to the creativity of older adults in the context of health care, intergenerational programs, and public policies.

Cutler (2009) describes the creative aging movement also emerging in Europe in the 1970s. However, at that time similar early initiatives

related to the arts and aging were usually described as part of the community arts movement. Examples in the United Kingdom (UK) include the Plymouth Arts Centre and community arts funding initiatives of the Calouste Gulbenkian UK Trust. More specialized programs emerged in the 1980s, such as the Age Exchange (a center of reminiscence and intergenerational arts). Moreover, in Europe various initiatives were (and still are) established through the Universities of the Third Age movement, such as courses, workshops, and debates focused on the arts and humanities.

In recent years, the creative aging movement became widespread around the world. There is a growing diversity of activities, but the arts remain at the core of initiatives. In the USA in 2001, Gene Cohen and Susan Perlstein established one of the best-known such organizations, the National Center for Creative Aging (NCCA) by building a partnership with the National Council on Aging and the National Endowment for the Arts (NEA), in affiliation with George Washington University. The organization advocates on issues concerning the arts and aging, promotes combining of the arts and aging policy, organizes events and conferences, provides training and e-learning courses and toolkits, and maintains databases of resources and best practices.

### **Creative Aging Programs**

Creative aging programs aim to foster older persons' social engagement, skills, and opportunities for creative expression ("Creative Aging Toolkit for Public Libraries" (2016)). Three forms of creative aging practice include: (1) health and wellness programs (e.g., use of art therapies in institutionalized settings for older adults with dementia); (2) community engagement programs that focus on civic involvement of older people through the arts (e.g., volunteering, mentoring, and intergenerational programs); and (3) lifelong learning (LLL) programs that aim to improve the quality of life of older adults by building skills during various courses. Thus, creative aging programs are not simply synonymous with art

workshops for seniors and tend to be delivered by professionals in diverse settings (e.g., long-term care facilities, public libraries, senior centers, and non-governmental organizations that focus on education, culture, heritage, and socialization).

Creative aging programs may also be considered as examples of new healthcare services that deliver enjoyable and fun activities in safe environments. As Hanna and Perlstein (2008) argue, creative aging may also provide a new perspective that encourages and promotes the potential (capital) of older adults rather than emphasizing their problems. To achieve this, creative aging programs should be aimed at increasing morale and passing on a legacy to younger and future generations of older adults as a means of sustaining the culture (a cultural and symbolic capital), improving physical health (human capital), and building relationships (social capital). In other words, such programs provide the basis to foster the empowerment of older adults by the promotion of emancipation or social justice, democratic citizenship, and human capital (Payne 2012).

### **Creative Caregiving**

Creative caregiving techniques and exercises mainly draw on creative and art therapies to enhance the quality of life in both older people and caregivers, the latter including both informal (e.g., family) and professional caregivers ("NCCA Creative Caregiving Guide" 2016). In addition to the arts, creative approaches can draw on culture, science, business, and technology. Artistic creativity, for example, involves exploring new ways of interpreting the world that can produce texts, sounds, and images in response to stimulating thought-provoking questions. Creativity can also result from innovation and design. The innovation may involve the translation of ideas into new products, services, management models, or social processes. The design includes processes integrating creativity and innovation, leading to useful solutions in a caregiving context. Creative caregiving is congruent with "older-person-centered and integrated care" promoted by the World Health Organization (2015).

## Creative Aging Policy

Creative aging policy can be used both as theories (descriptive models) and as ideologies or strategies (normative models) that provide frameworks for constructing positive responses to population aging. This form of policy is typically considered in the context of other aging policies ideas such as successful aging, productive aging, healthy aging, active aging, positive aging, aging in place, and intergenerational policy.

Creative aging policy aims to engage older adults in creative activity and involves a shift away from highlighting problems of aging to promoting the potential of older adults (Klimczuk 2015). It focuses on providing opportunities, technological innovations (gerontechnologies), and social innovations for all older adults, not only those who have had careers within cultural and creative industries. It supports a creative approach to leisure time in old age, regardless of whether the focus is on professional or amateur activities.

There is a complementarity of creative aging policy to the official United Nations active aging policy and thus to the related concept of healthy aging, both referred to in the 2002 “Madrid International Plan of Action on Ageing” (MIPAA). A “glocalization” of policy ideas, that is, translating and implementing general policy ideas from international organizations’ policies to the local level (cities and communities) and regional level, is also implied.

## Selected Theories and Research on Creativity and Aging

There are two contrasting frameworks – the “peak and decline model” and the “lifespan developmental model” – that provide frameworks to understand creative aging as a means of constructing positive responses to population aging.

The “peak and decline model” is based on the Western cultural definitions of creativity that highlight production, quantity, and novelty (Levy and Langer 1999). These features can be evaluated through use of psychometric and

productivity tests that usually lead to the conclusion that with age, people tend to lose their creative abilities. This model has been criticized for excessive attention to results from standardized tests of creativity, which may not tap creativity as it is expressed throughout the lifespan. In contrast, the “lifespan developmental model” (also known as the continuity model) relies more on the qualitative measurement of creativity, with a greater focus on mechanisms leading to growth, change, and the evolution of creativity over the lifespan (Reed 2005).

Research conducted by Gene D. Cohen is considered groundbreaking in the field of arts and aging. Cohen has focused on the development of the brain in old age and its relation to creativity. His studies explore the hypothesis that maintaining a high level of creativity in old age requires not only appropriate external stimulation but also the inner need to solve increasingly complex problems with the use of creativity, and that this leads to positive health outcomes.

According to Cohen (2009), creativity in old age may be presented as the creativity equation ( $C = me^2$ ). Here creativity (C) may be seen as the result of one’s mass (m) of knowledge, which is multiplied by the effects of one’s two dimensions of experience (e<sup>2</sup>). These dimensions include an individual inner world experience (emotions and personality), and the outer world (experience and wisdom). From this perspective, aging has a positive influence on creativity due to the accumulation of knowledge and experience. Thus, the aging brain is still developing with new experiences and learning (Cohen 2001, 2005). These activities lead to the creation of new brain cells between our early 50s and late 70s. Thus, with proper stimulation and good health, further intellectual development is possible. Moreover, with age, brain functioning becomes more balanced in the areas responsible for emotions, and the brain’s two hemispheres are more evenly used. These changes allow older people to be more creative.

Cohen and his team (2006) carried out a study of the impact of community-based cultural programs on the physical health, mental health, and social activities of older people (aged 65 and older). The research sample consisted of 166

older people from the region of Washington, DC. Participants were divided into two groups – an intervention (chorale program) and comparison (usual activity) group. These groups were assisted by researchers at the beginning of the project, after 12 months, and after 24 months. The programs included artistic activities such as painting, ceramics, dance, music, poetry, theater, and talks on material culture and spoken histories. The research demonstrated that the cultural program participants reported a better overall degree of physical health, fewer doctor visits, less medication usage, fewer falls, and fewer other health problems than the comparison group. Advantages in sociological terms were primarily better morale, increased activity, and less loneliness than the control group. In other words, the intervention helped in reducing the risk factors that may increase the necessity for long-term care services. This is potentially due to an increase in a sense of control and meaningful social engagement.

### **Potential Personal and Societal Benefits of Creative Aging**

The literature about the arts and creative aging programs provides various examples of effects that may be achieved by the arts and creative expression intervention programs. For example, Moloney (2006) and Ehler et al. (2010) proposed several groups of beneficiaries from such programs. First, older adults themselves may achieve personal fulfillment, a sense of meaning, new competencies to cope with daily challenges, new social relationships, and opportunities for maintaining and improving health. Second, organizations that are developing and implementing programs, particularly within the arts sector, may find benefits including engagement of older artists, access to new audiences, the development of learning communities, and changes in program funding opportunities. Third, the health sector may benefit through increased health benefits for older adults, such as fewer visits to doctors and lower levels of depression (Castora-Binkley et al. 2010). Moreover, the engagement of older adults in creative activities in

care settings may lead to increased quality of life for staff, improved retention of personnel, facilitation of points of communication for visitors, increased social cohesion, the development of volunteering, and the establishment of new programs of activities. Finally, benefits may also accrue to the general public. Positive outcomes include here the promotion of intergenerational solidarity, the development of positive older role models, the establishment of cooperation between different sectors of society, and the provision of new strategies to reach diverse groups of older adults.

### **Conclusion and Future Directions**

In recent years, the dissemination of creative aging practices has appeared across the globe (Bloom 2014). However, at this point, barriers and challenges remain for the development of creative aging programs. These observations may be at the same time considered as potential directions for further research.

One set of challenges concerns insufficient dissemination among the public and healthcare professionals about outcomes from arts and aging programs. In addition, there has been only limited development of standardized techniques for evaluating the use of the arts in healthcare programs and identifying best practices (e.g., Thomas and Lyles 2007). Use of the knowledge and skills of professional artists in engaging with older adults within the community and healthcare settings remains limited. Aside from creative aging's greatest advocate, Gene Cohen, there is limited promotion of knowledge about the benefits of creative aging. There is a need for greater research efforts and a common language concerning creative aging. Finally, funding for interdisciplinary strategies in healthcare regarding the arts remains scarce.

### **Cross-References**

- ▶ [Age-Friendly Communities](#)
- ▶ [Gerontechnology](#)
- ▶ [Healthy Aging](#)

- ▶ [Leisure Activities in Later Life](#)
- ▶ [Music Therapy, Applications in Geropsychology](#)
- ▶ [Person-Centered Care and Dementia Care Mapping](#)
- ▶ [Workplace Creativity, Innovation, and Age](#)

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## Cross-Cultural Aging

Yang Fang\*, Xianmin Gong\*, Minjie Lu\* and Helene H. Fung  
 Department of Psychology, The Chinese University of Hong Kong, Hong Kong, China

## Synonyms

Aging in different cultures; Cross-cultural differences in aging

## Definition

In the current entry, cross-cultural aging is defined as cultural differences in aging of human psychology, including cognitive aging, socio-cognitive aging, and socio-emotional aging. The scope of cultural difference in the extant literature focuses mainly on comparison between East Asian and Western (North American and Western European) cultures.

## Introduction

Population aging is a worldwide phenomenon. This entry provides an overview of extant research on how age differences in cognition, affect, and behavior vary across cultures. While this inquiry is driven by the need for science to understand the relative contributions of culture in explaining the impact of aging on human

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\* Author contributed equally with all other contributors.

psychology, it also underscores the importance of recognizing the role of culture, in a world growing in its awareness of cultural diversity. The contents of this entry are thematically organized into cognitive aging, socio-cognitive aging, and socio-emotional aging with a focus on differences between Eastern (typically East Asian) and Western (typically North American) cultures.

### **Age Differences in Cognition Across Cultures**

Cognition has long been theorized to comprise two components: one is the biologically based hardware of basic cognitive functions, supporting speed of processing and working memory, for example, and the other is the culturally based software of cognitive functions, supporting language and decision-making. These components of cognitive functions have also been characterized as fluid and crystallized intelligence, cognitive mechanics, and cognitive pragmatics, as well as primary and secondary processes.

This division provides a possible framework to understand cultural differences in age-related cognition. Specifically, biologically based hardware of basic cognitive functions declines with age and does so equivalently across cultures, whereas culturally based software of cognitive functions could be cultivated by culture and be more resistant to the effects of aging (Park et al. 1999). According to this view, few cultural differences would be detected in the hardware of cognition in either younger or older adults. In contrast, one might expect more profound cultural differences in the life-span developmental trajectory of the software of cognition.

Recent evidence, however, suggests that culture also moderates the aging of the hardware of cognitive processes (Park et al. 1999). For instance, Hedden and colleagues found superior performance in Chinese versus American younger adults on auditory digit span task (a working memory measure), but no difference in Chinese and American older adults (Hedden et al. 2002). Park et al. posited that culture might bias people at the very beginning phase of cognitive encoding to

attend to certain types of information at the expense of other information (e.g., context-object bias). This, in turn, has a major influence on follow-up cognitive processes of the selected information (including those that were once thought of as basic processes) (Park et al. 1999). Therefore, cultural differences in cognitive aging may not neatly follow the dichotomous characterization of cognitive processes.

To better comprehend the interplay of age and culture in cognition, Park, Nisbett, and Hedden developed a new theoretical framework, based on a distinction between culture-invariant and culture-saturated cognitive tasks and measures (Park et al. 1999). These authors asserted that the effects of culture and age on cognition were task dependent. On culture-invariant cognitive tasks, individuals from different cultures would perform similarly, and age-related declines on the tasks would happen at an equivalent rate across cultures. On culture-saturated cognitive tasks, however, individuals' performance would vary as a function of culture. Specifically, cultural differences would increase with age if the differences are based on automatically activated processes and would decrease (termed as cultural convergence) with age if they are based on effortful, strategic cognitive processes. Accordingly, age-related cultural convergence could result from the leveling effects of biologically based functional declines on basic cognitive processes, influencing one's cognitive resources. On a resource-demanding task, older adults would have insufficient resources to support flexible use of strategies, resulting in cross-culturally equivalent task performance.

According to Park et al.'s framework, culture is more likely to interplay with age on culture-saturated than on culture-invariant cognitive tasks and measures. To understand this influence, it is necessary to identify culture-saturated cognitive measures and then discuss the interaction effects of culture and age on these measures.

### **Holistic-Analytic Thinking**

Previous literature has well documented a preference for holistic thinking in collectivistic Eastern cultures and a preference for analytic

thinking in individualistic Western cultures. Individuals with holistic thinking tend to attend to contextual information, emphasize relationships and group functions, make relatively little use of natural categories, and rely on intuitive, dialectical reasoning. Individuals with analytic thinking, however, attend to objects, emphasize individual functions, readily make use of categorical information, and rely on rational, logical reasoning (Masuda et al. 2008).

### Context-Object Bias

The cultural divergence on holistic-analytic thinking results in different attentional biases in Easterners and Westerners. Easterners normally pay greater attention to contextual information (e.g., a picture's background) and tend to bind context and object together, whereas Westerners normally pay greater attention to objects, even when they are embedded in the background (Masuda et al. 2008).

Cultural differences in context-object bias have been found to diminish with age. For example, some studies find that younger East Asians are more sensitive to the context of facial expressions than younger North Americans. However, this cultural discrepancy disappeared in older adults (Ko et al. 2011; Masuda et al. 2008). The results of these studies are consistent with Park et al.'s framework in which they assert that cultural differences in cognition could decrease with age on tasks that require effortful and controlled processing. In these studies, it was highly resource consuming to integrate contextual and facial information, making both Asian and American older adults unable to complete the tasks well and leading to age-related cultural convergence (Park et al. 1999).

### Categorical Processing of Information

The divergence on holistic-analytical thinking also leads to differences in categorization strategies used by Easterners and Westerners. First, Easterners typically make less use of natural categories compared to Westerners when categories are not highly salient. Second, Easterners use more thematic categorization, whereas Westerners use more taxonomic categorization when categories are salient enough to be accessed (Park et al. 1999). Taxonomic information refers to

similarity of features and attributes among objects, whereas thematic information refers to causal, spatial, and temporal relationships among objects (Ji et al. 2004). For example, in the "chicken-cow-grass" test (Chiu 1972), Westerners tend to pair the chicken and cow together due to their shared taxonomic similarity (i.e., both are animals), while Easterners tend to categorize the cow and grass together due to their functional relationship (i.e., cows eat grass).

These cultural differences in processing of categorical information become amplified with age. For example, cultural differences in memorizing categorical information are larger among older than younger adults, and the age-related decline in memorizing categorical information is more pronounced in Eastern versus Western cultures (Gutchess et al. 2006; Yang et al. 2013). These interaction effects could be interpreted within Park et al.'s framework. Specifically, limitations in cognitive resources make it increasingly difficult for older Easterners to employ an unfamiliar strategy (i.e., categorization), and therefore Easterners may suffer more severe age-related loss in using categories. In contrast, cultural preferences and prolonged experience make it less resource demanding for older Westerners to categorize, and therefore their age-related decline in category processing may be reduced (Gutchess et al. 2006).

In short, divergent thinking styles make people from Eastern and Western cultures process information differently. The cultural differences in cognition are especially evident in measures of context-object bias and categorical processing of information – all of which appear to be readily accounted by Park et al.'s theoretical framework of the interaction between age and culture on cognition.

## Age Differences in Social Cognition Across Cultures

### Attributions of Social Behavior

A well-established finding in social psychology is errors of attribution error. People tend to explain causal relationships in terms of dispositional (e.g., personality traits), rather than situational forces

(e.g., social pressure). This bias manifests as the correspondence bias, which refers to one's lack of awareness of situational constraints, leading to insufficient correction for these constraints when making dispositional inferences.

Besides social psychologists, life-span psychologists have also focused on social attributions in the context of aging. With an American sample, Blanchard-Fields and Horhota (Blanchard-Fields and Horhota 2005) found that older and middle-aged adults displayed the correspondence bias to a greater extent than did younger adults (Blanchard-Fields and Horhota 2005). The difference between older and younger adults was eliminated only when a plausible motive (but not other situational constraints) for the actor's behavior was made salient. The researchers attributed this finding to cognitive decline and insufficient motivation of older adults to consider the situation faced by the actor if they were not prompted to consider the actors' plausible motives.

The cross-cultural difference in susceptibility to the correspondence bias is well established. People from relatively individualistic cultures, such as the United States, Canada, and Western Europe, are more susceptible to this bias than people from relatively collectivistic cultures, such as East Asian countries including Japan, Korea, and China. This tendency is chiefly explained in terms of East Asians' subscription to the holism – the notion that nothing is isolated and everything is connected and their tendency to take constraints faced by individuals – imposed by the social collectives and situational contexts they are embedded in into account (Nisbett et al. 2001). Blanchard-Fields, Chen, Horhota, and Wang inquired into cultural differences in correspondence bias at different ages by comparing adults from two age groups, younger and older, in two cultures, American and Chinese (Ko et al. 2011). In addition to finding a cultural difference (the Americans showed stronger correspondence bias than the Chinese regardless of age group), they found that this cultural difference was affected by age – older Americans demonstrated a stronger correspondence bias than younger Americans (replicating prior findings), whereas older Chinese showed a weaker bias, albeit statistically

insignificant, than younger Chinese (Blanchard-Fields et al. 2007). The researchers suggest that age-related changes in susceptibility to the correspondence bias are not driven by decline in cognitive processing capacity but rather by “lifelong accumulation of cultural experience,” which helps older adults to “internalize cultural-specific models of attribution.”

### **Implicit Theories and Their Consequences: Dialecticism and Holism**

Another psychological domain investigating the effects of culture on age concerns the lay theory of naive dialecticism (often simply referred to as dialecticism). Naive dialecticism is a “constellation of lay beliefs about the nature of world” whose roots can be traced to folk Taoism, with influences from Buddhist thoughts (Spencer-Rodgers et al. 2009). The beliefs related to naive dialecticism revolve around three themes: that everything is related to one another (*holism*), that change is cyclical, and that we should be tolerant of contradiction. These themes are endorsed by members of a number of East Asian cultures, including Japan, China, and Korea. Dialecticism influences cognition, affect, and behavior in a number of ways. For example, members of dialectical cultures are more likely to prefer dialectical proverbs to nondialectical proverbs, reason more dialectically about social contradictions, and perceive emotions of opposite valence as compatible with each other (Spencer-Rodgers et al. 2009).

As the culture-specific influence of dialectical beliefs on emotional experience and well-being across the life-span will be covered in another entry, this section will focus on how dialecticism influences self-concept and cognitive-behavioral tendencies in older adults. Zhang and his colleagues examined age-related changes in dialecticism (and its close conceptual counterpart, *holism*) cross-culturally (Zhang et al. 2014). Comparing younger and older adults in Hong Kong and America, they found distinct age-related changes in self-reported dialecticism and a behavioral measure of holism, the framed-line test (FLT). Specifically, while older people reported being less dialectical than younger

people in both cultures, only Chinese older adults, not their American counterparts, exhibited stronger holistic tendencies on the behavioral measure of holism, the FLT. These findings suggest a potential for the influence of culturally endorsed implicit theories to grow with age, but such growth is likely to be domain specific.

### **Age-Related Changes in Personality Across Cultures**

Personality is characterized by habitual patterns in behavior, thought, and emotion. This section reviews some models of personality and examines their manifestation in younger and older age groups in different cultures.

#### **Big Five and Indigenous Models of Personality**

Often regarded as the most influential model of personality, the five-factor model (FFM) has been supported in cross-sectional and longitudinal studies in multiple cultures (McCrae et al. 1999). The model comprises five dimensions of personality – extraversion, openness to experience, neuroticism, agreeableness, and conscientiousness. Evidence further suggests that, across cultures, older people are more conscientious, more agreeable, less neurotic, less open to experiences, and less extraverted than younger people (McCrae et al. 1999).

However, some personality psychologists have argued that the FFM is culturally biased and is insufficient when it comes to explaining personality variability in cultures outside of North America and Western Europe. This sentiment has spurred an emic (indigenous) approach to the study of personality. In China, this has resulted in the development of the Chinese Personality Assessment Inventory (CPAI) (Cheung et al. 2001), which argues that a sixth personality construct, interpersonal relatedness, should be added to increase its relevance to the Chinese context. Interpersonal relatedness comprises harmony (avoidance of interpersonal conflict), Ren Qing (abiding by the rules of social exchange),

face (concern of others' opinion of oneself), and flexibility (seeing others' views or methods). Notably, these CPAI personality factors, which include interpersonal relatedness, replicate fairly well in European American populations, hence supporting the CPAI applicability in cross-cultural personality research (Lin and Church 2004).

Interestingly, when measured across the life-span, changes in interpersonal relatedness showed cross-cultural variation. Fung and Ng found that interpersonal relatedness is higher among older Chinese than younger Chinese, but this age difference is not found among European Canadians (Fung and Ng 2006). This suggests that Chinese exhibit culturally valued norms and traits more strongly as they age. The same trend is also observed in the domain of dispositional optimism: Americans (who live in a culture that value optimism) become more optimistic with age, whereas Hong Kong Chinese (who live in a culture that value optimism considerably less) become less optimistic with age (You et al. 2009).

#### **Collectivistic and Individualistic Tendencies**

Research on personality development across the life-span using nonfactor-based approaches has corroborated the aforementioned finding that age-related differences in personality across the life-span can vary among cultures. In Labouvie-Vief, Diehl, Tarnowski, and Shen's exploratory study, they examined how 20 "folk concept" scales of personality – taken from the California Psychological Inventory – changed over the life-span in Americans and Mainland Chinese (Labouvie-Vief et al. 2000). They discovered that older Chinese, compared to younger Chinese, expressed increases in self-control and good impression, together with a reduction in self-acceptance and flexibility. These results suggest that "collectivistic tendencies," which are related to norm orientation, are stronger among older Chinese, whereas "individualistic tendencies," characterizing extraversion and individual initiative, are weaker among older Chinese, compared to younger Chinese. In general, the age-related patterns found in the Chinese sample

are either absent or less pronounced in the American sample.

Taken together, findings from these cross-cultural studies suggest that aging can strengthen the endorsement and expression of traits and characteristics valued in one's culture (e.g., social reciprocity and collectivistic tendencies in the Chinese culture and optimism and individualistic tendencies in the American culture).

### **Age-Related Gains in Wisdom Across Cultures**

Most cultures tend to agree that we gain wisdom as we age, though recent evidence shows that age-related gains in different aspects of wisdom vary as a function of culture. With three age groups (younger adults, middle-aged adults, and older adults), Grossmann and his colleagues examined wise reasoning (e.g., acknowledging multiple perspectives, recognizing likelihood of change, perceiving flexibility in conflict development) about interpersonal and intergroup conflicts in Japanese and Americans aged 25–75 years (Grossmann et al. 2012). They found that younger and middle-aged Japanese, compared to their American counterparts, showed greater use of wise reasoning strategies only for reasoning about interpersonal conflicts, but not for intergroup conflicts, and this cultural difference did not extend into old age. In terms of intergroup conflicts, while Japanese and Americans started out at a similar level of intergroup wisdom at a younger age, only Americans exhibited age-related growth in this type of wisdom. The findings were interpreted as evidence for interpersonal wisdom to emerge at a younger age among Japanese than Americans, due to the relevance of wise reasoning to keeping harmonious relationships with others. Conversely, age-related growth in wise reasoning about intergroup conflicts is only observed in America. This may be because of the United States' relatively higher ethnic diversity that calls for wisdom in the intergroup domain. This finding suggests that although wisdom is a psychological quality that shows age-related growth across cultures, the trajectory of the growth

is influenced by domain-specific importance of different types of wisdom in each culture.

### **Age Differences in Emotion and Well-Being Across Cultures**

#### **Emotion Perception**

As people grow older, they tend to show preference for processing positive information rather than negative or neutral information. This effect was coined as “positivity effect” (Charles et al. 2003). For example, Charles and colleagues found that, while young participants demonstrated a negativity dominance during memory tasks (remember negative images better), such an effect was less pronounced among older adults, suggesting a reduction in negativity with increasing age. However, recent cross-culture studies suggest that this aging-related positivity effect might not be universal. In Western cultures, positive information is perceived as more emotionally useful because it helps individuals maintain optimism and self-esteem, which in turn fulfills culturally endorsed values of autonomy and uniqueness. In East Asian cultures, social harmony and interpersonal relationships are more important than individual uniqueness or autonomy. Thus, to maintain social harmony and avoid social mistakes, individuals may pay attention to different social cues from the environment, including both positive and negative information, and then provide appropriate responses accordingly. Hence, in these cultures, negative information may not be perceived as less important as positive information. This may, in turn, lead to a cultural difference in the aging-related positivity effect, such that the bias for processing positivity is not generalized to interdependent cultures.

Evidence showing this cultural difference comes largely from comparisons of Western and the Hong Kong Chinese cultures – studies conducted in Korea demonstrated the same age-related positivity bias as in Western cultures (Ko et al. 2011). For example, Fung and her colleagues found that, although older participants remembered positive information better than

neutral information (positivity enhance effect), they also remembered negative images as well as the neutral images (no negativity reduction effect) (Fung 2013). In another study, older adults recognized an announcement that conveyed negative emotions better than an announcement that conveyed neutral emotions. Using eye tracking methodology, Fung and colleagues demonstrated that Chinese older participants looked away from positive stimuli (Fung 2013).

Later, Fung and colleagues tested whether the cultural value of interdependence held by individuals moderated the age-related bias for positive information (Fung 2013). In both studies with memory tasks and attention tasks, results suggested that the age difference in negativity reduction effect was only observed among participants with lower levels of interdependence, similar to the result that has been demonstrated by Western samples. Yet, among Chinese participants with higher level of interdependence, no age difference was found.

To summarize, accumulated evidence has demonstrated the cultural variation in age-related positivity effect. Individuals from Chinese culture, who value interdependence more than Western individuals, may not regard negative information as more important than positive information and thus exhibit the age-related positivity effect to a lesser extent.

### **Emotional Experience and Well-Being**

In the Western literature, previous findings have demonstrated that older people exhibit a higher level of emotional well-being (more positive emotions and fewer negative emotions) compared to their younger counterparts (Shiota and Levenson 2009). The same pattern was found in the Chinese culture. Pethtel and Chen compared the emotional experience among a group of Mainland Chinese participants and found that older adults reported lower levels of negative emotions than did younger adults (Pethtel and Chen 2010). However, some recent studies observed a different pattern in other Asian cultures. Grossman and colleagues argued that although emotional well-being might be a universal goal, the way to achieve it might vary

across cultures (Grossmann et al. 2014). In Western cultures, well-being might be enhanced by experiencing more positivity and less negativity, and research shows that this is what Westerners tend to pursue, being more strongly motivated to maximize their positive emotional feelings and minimize negative one. However, in East Asian cultures that encourage tolerance for contradictions and changes, well-being is defined by a dialectical way of mixing positive and negative experience. Based on this dialectical belief, maintaining positive feelings and avoiding negative feelings may become less important for East Asians; they might instead prefer to strive for a balance between the positive and negative (Grossmann et al. 2014). Indeed, in Grossman's study, older Japanese participants reported a higher level of positive emotions than did their younger counterparts. Yet they reported the same level of negativity as did their younger counterparts, including the intensity of negative emotions, the focus on past negative experience, and the proportion of perceived negative interpersonal relationships. In another study conducted in Hong Kong, a similar pattern was found, such that age was associated with more positive emotions, but there was no correlation between age and negative emotions (Yeung et al. 2011).

In summary, in both Western and Eastern cultures, aging correlates with an increase in positive emotions, while a decrease in negative emotions is more frequently observed in Western cultures.

### **Emotional Regulation**

As outlined above, older people tend to report higher emotional well-being. Urry and Gross proposed that the underlying mechanism might be that older adults become better at regulating their emotions (Urry and Gross 2010). More specifically, to regulate emotions, older adults may tend to employ antecedent-focused strategies (e.g., cognitive reappraisal, attentional deployment) more than response-focused strategies (e.g., expression suppression) (Carstensen et al. 1999). The former is also associated with healthier outcomes. For example, as abovementioned, compared to younger adults, older adults pay more attention to

positive information and stimuli, suggesting they tend to use the strategy of attentional deployment. Given that the antecedent-focused strategies downregulate the negative emotions before they are full-blown, preventing individuals from negative and stressful experience, they tend to be associated with healthier outcomes.

Cross-culturally, age differences in emotion regulation only partially hold true in East Asian cultures. During the SARS outbreak in Hong Kong, Yeung and Fung found that compared to young participants, older participants reported more emotional-focus coping and lower levels of anger both at the peak of the SARS epidemic and at its end, suggesting that older people were more successful in managing their negative emotions under stressful situations (Yeung and Fung 2007). In another study conducted in Hong Kong, Yeung and colleagues found that an age-related increase in using cognitive reappraisal partially accounted for the age differences in positive feelings (Yeung et al. 2011). These data support the hypothesis that older people are better at antecedent-focused emotion regulation.

However, in the same study, no age difference in suppression was found. Yeung and colleagues speculated that because Asian cultures emphasized interpersonal harmony, suppressing one's emotions to avoid social conflict was always encouraged across different life periods (Yeung et al. 2011). Hence, older adults exhibited the same level of suppression as younger adults. In another study, older adults benefited from suppressing emotion. This emotional suppression was positively correlated with a lower intensity of negative emotion and better work performance among older adults but not younger adults (Yeung and Fung 2012).

Interestingly, although most of the aforementioned evidence suggests that older adults tend to control their emotions to preserve their social relationships, a study found that in Mainland China, where the hierarchy within family was emphasized, older adults were more likely to express anger to their kin to preserve their authority in the family hierarchy (Fung and You 2011).

## Conclusion

This entry provides an overview of how age-related changes in cognition, affect, and behavior vary as a function of culture. It should be acknowledged that most “cross-cultural” comparisons reported in this entry are mostly “East versus West” comparisons – in other words, imprecise depictions of the rich cultural diversity in our world. This bias in current research on culture should be an inspiration for researchers to broaden the scope of inquiry of age differences into cultures that are, at present, underrepresented. Similarly, most of the reported studies are cross-sectional (reflecting existing aging research in general), and their conclusions may be confounded by cohort effects. Despite these limitations, our review suggests that aging does take different forms, or at least manifest in different ways, in some domains across cultures. Examining the intersection of aging and culture may reveal important mechanisms about adult development.

## Cross-References

- ▶ [Age-Related Positivity Effect and its Implications for Social and Health Gerontology](#)
- ▶ [Aging and Psychological Well-Being](#)
- ▶ [Emotional Development in Old Age](#)
- ▶ [Positive Emotion Processing, Theoretical Perspectives](#)
- ▶ [Psychology of Wisdom](#)

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## Crystallized Intelligence

Patrick Rabbitt  
 Department of Experimental Psychology,  
 University of Oxford, Oxford, UK

Humans have recognized the difference between having knowledge and being able to use it for at

least 2,000 years. In 1963, Raymond B. Cattell was the first to propose a psychometric model for these distinct abilities (1963). Horn and Cattell (1966) further developed his theory and Horn (Horn 1968, 1982; Horn and Noll 1997) applied it to changes in cognitive abilities in old age. Horn showed that our abilities to solve problems rapidly and accurately (and so achieve high scores on intelligence tests), to respond fast to simple signals, and to quickly learn unfamiliar material such as lists of random words peak in our early twenties but decline as we grow older. These changes are slight from our 30s through our 50s but accelerate throughout our 60s, 70s, and 80s. Horn and Cattell termed these “fluid abilities” or “fluid intelligence” (gf) because they are not specific to particular problems but support performance in all mental tasks. In contrast to waning fluid abilities, Horn showed information that we have learned throughout our lives is relatively age robust. Following Cattell, Horn called such bodies of acquired information “crystallized intelligence” (gc). Their choice of the word “intelligence” emphasizes that Cattell and Horn did not regard gc only as a mental archive of semantic information, such as vocabulary, or collections of names of birds or trees, or athletic records but also as tool kits that we have invented or learned to carry out “procedures.” Some examples of these procedures might be constructing grammatical sentences, doing algebra, working out lines of play in chess or go, or managing a bank, a business, or a kitchen. This distinction is clear in Horn’s discussions but while his experiments do show that vocabulary and other kinds of semantic knowledge can survive well into old age with little loss, he did not systematically explore how far this is also true of complex procedural skills that we have learned over our lifetimes. Horn’s early experiments and discussions also do not make the important point that, in contrast to “fluid intelligence” or “fluid abilities,” the “crystallized” skills are intensely “domain specific.” That is, mastery of a particular skill may be of little help in learning or using others, even if these may seem quite similar. An analogy from information technology is that computer programs written to efficiently carry

out particular tasks are usually useless for any others.

Horn and Cattell’s distinction also implies a contrast between the difficulty of inventing, learning, and using a difficult procedure for the first time and its easy and automatic deployment once it has become familiar. This applies to cultural as well as individual accomplishments. Clay tablets, papyrus, libraries, and the World Wide Web can all be envisaged as means of “crystallizing” and indefinitely preserving semantic and procedural information that most individual humans could not discover or invent on their own: For example, it took Leibniz and Newton years of hard thought to invent the Calculus that schoolboys can now easily learn from textbooks in a few weeks.

The Cattell/Horn distinction raises interesting practical questions as to how we should view our likely trajectories of competence in our everyday lives throughout our lifespans. Though our fluid intelligence declines as we get older, can we still continue to practice demanding professions supported by information and skills that we have learned throughout our lives and still retain in our old age? An associated question is whether some kinds of crystallized abilities may be more age robust than others so that professional competence based on these durable abilities can be maintained longer than on more age-fragile skills?

A key issue is that retaining effective procedures is one thing, but carrying them out is quite another. Another helpful metaphor from information technology is the difference between developing and storing a program that is ideal to perform a particular task and having a system that is adequate to run it. As the “benchmark” bandwidth and memory capacity of an information processing system reduce, so will the maximum complexity of the programs that it can run. For humans “working memory” (see also entry *Crystallized Intelligence in this volume*) is a convenient term coined by Alan Baddeley and Graham Hitch (1974) as a blanket label for our abilities to rapidly shift attention from less to more important information, to process new information and to relate it to other information that has been recently registered or held in memory for many years, and to reorder all of this old and

new information so as to decide and implement what we should do next. All of the abilities implicit in the general concept of “working memory” are, in Cattell and Horn’s terms, “fluid” and age fragile. However, without a well-functioning “fluid” working memory system, we cannot manage to do complicated things for which we, long ago, learned reliable procedures: e.g., to produce a long, grammatical sentence, to understand and solve a complex business problem, to cook a complicated dish, or to plan and carry out apt sequences of moves in chess. So, as the efficiency of working memory sharply declines with age (Salthouse et al. 1989), we may still be able to perfectly describe effective procedures for completing complex tasks but become unable to meet the demands these make on our diminishing working memory capacity when we attempt to put them into practice.

A neat illustration of this is Susan Kemper’s (1990) analyses of diaries written by citizens of Kansas during the late nineteenth and early twentieth centuries. These often covered 40 or 50 years of their authors’ lives. As diarists aged the ranges of words that they used only slightly reduced (as Horn and Cattell’s empirical results predicted). Nevertheless, although their youthful diary entries were often long sentences and complex grammatical constructions, as they grew old, their sentences became shorter and their grammatical constructions increasingly simple. Retaining large numbers of words and retaining the ability to assemble them into complex sentences are different things.

This raises the interesting practical question whether some “crystallized abilities,” that is, kinds of learned knowledge and skills, can survive later in life than others. In 1935 Lehman (1935) pioneered studies of the ages at which distinguished mathematicians, scientists, poets, novelists, musicians, and artists had made their most remarkable contributions (Lehman 1942; Lehman and Ingerham 1939). Ages of greatest productivity and achievements were the early 20s and 30s for mathematicians, physicists, and chemists; the 40s and 50s for historians, philosophers, and novelists but might be as late as the 60s, 70s, or even 80s for some visual artists and musicians.

Does this mean that some skills are more age resistant than others?

Lehman pointed out that his data were not ideal to address these questions. Many of the careers documented took place in the eighteenth and nineteenth centuries when life expectancy was much shorter and career trajectories were very different. Recent studies confirm early age-related losses in scientific productivity but suggest that these now happen much later than in the historical periods for which Lehman collated data. Studies of British psychologists in the 1970s and 1980s (Over 1982); of large groups of less eminent physicists, geologists, physiologists, and biochemists in 1989 (Levin and Stephan 1989); and of the careers of economists and other scientists (Cohen 1991; Bayer and Dutton 1977), all found that, as they grow older, all academics publish less and in less prestigious journals. Recent studies of average or slightly above-average scientists find that their plateaux of greatest productivity last more than a decade longer than Lehman’s analyses suggested. Studies of artistic productivity also revise his conclusions. A 1999 analysis of the number of paintings produced by 739 graphic artists, works by 719 musicians, and books by 229 authors found that, like most contemporary scientists, their periods of maximum output were in their 30s and 40s. Unfortunately literary skills are not immune to changes that come with old age and with approaching death. Suedfield and Piedrahita (1984) analyzed the late work of distinguished novelists and found that the quality of writing in their correspondence declined during the 10 years before they died.

Other recent studies find that while the learned skills of bankers and business executives allow them to competently do their jobs in late middle age and even give them some advantage over younger colleagues with less experience, their ability to correctly analyze and cope with novel problems tends to have decline by their late 40s and 50s (Colonia-Willner 1998, 1999).

The current consensus is that while competence, even at learned and highly practiced skills, does decline with age, these changes are much smaller and slower than the earliest surveys suggested. The contrast between “early flowering

and early decline” in the hard sciences and “late flowering and late decline” in the humanities and visual arts now seems less clear-cut. One problem is finding comparable standards across different disciplines. Assessments of quality in the arts are much more contentious and differ sharply between various kinds of achievement. Standards of comparison are more elusive than the earliest studies assumed. For example, a tally of the year 2000 market value of paintings by 51 modern US artists found that for painters born before 1920, the average peak age for the valuation of their paintings was 50.6, but for those born after 1920, it was only 28.8. Changes from a cautious to a speculative market account for similar discrepancies (Colonia-Wilner 1999). From current sale prices, we might conclude that artists who are now elderly are painting much better (or at least much more profitably!) than their young contemporaries or, indeed, than themselves when young.

Ideal data to examine differences between “fluid” and “crystallized” abilities would be the achievements of large numbers of extremely gifted people on the same, difficult, mental skill on which they can be compared against each other in terms of a common objective standard. The careers of chess masters are as close to this as we get. Chess requires high levels of both fluid abilities, such as working memory and intelligence. It also requires crystallized knowledge because it has been so exhaustively researched and documented that, even for young prodigies, success at the highest levels needs long and intensive study. Chess play requires an ability to simultaneously hold many variables in mind and to recognize, as rapidly as possible, how patterns of relationships between these variables will alter if particular moves are made. Clearly there is a “natural talent” for chess because some prodigies play at a remarkably high standard at ages as early as 6–12 years. However, a study by Charness and colleagues found that even maintaining success at much lower levels than “grandmaster chess” requires 5,000 or more hours of deliberate practice over 10 years (Colonia-Wilner 1999). In terms of John Horn’s dichotomy, chess mastery requires both considerable fluid intelligence and a

formidable body of learned crystallized knowledge of tactics and strategy.

Statisticians such as Arpad Elo developed very sensitive and reliable systems for rating the relative strengths of different chess players. Because these have been used and validated for at least 50 years, even small changes in the playing strengths of individual grand masters can now be tracked from their 20s through to their 70s. Elo’s initial studies (Charness et al. 2005) found that nearly all the careers he compared showed improvements until 30s or 40s, a plateau of the best achievement until the late 50s or, in some few cases, early 60s but then a significant decline. During the historical spans of this and later analyses, chess at the highest level evolved so rapidly that players could not keep or improve their ranks unless they continually revised a vast body of theory on openings and end games. It is cheering to find that gifted individuals can, though perhaps with gradually increasing effort, remain at the very peak of an extraordinarily demanding profession until their seventh decades. Evidently, acquired knowledge and endless practice can support even a skill that is, essentially, computational and demanding of fluid intelligence until late in life. We must also remember that long after they had retired from competitive chess, these remarkable people could still play at a level that most humans cannot hope to reach at any age. We should also remember the wise comment of Gary Kasparov, perhaps the greatest player yet: “Excelling at chess has long been considered a symbol of more general intelligence. That is an incorrect assumption in my view, as pleasant as it might be.” Crystallized intelligence is intensely task specific.

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# D

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## Decision Making

Rui Mata

University of Basel, Basel, Switzerland

### Synonyms

Choice; Inference

### Definition

Decision making is the process by which a course of action is chosen from among two or more alternatives. This definition is broad enough to span different decision types and domains, from fast, habitual decisions to complex, life-changing ones. The extent to which such disparate decisions share or not the same underlying cognitive processes and are differentially affected by age-related change is an ongoing topic of research.

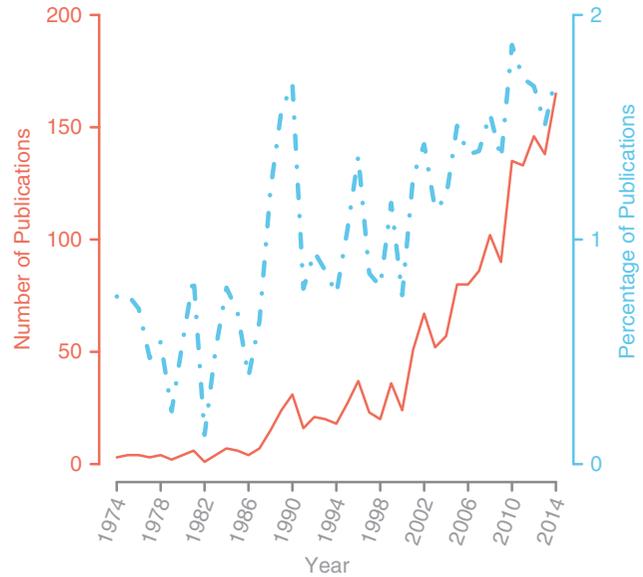
### Historical Background

There are a number of different traditions in psychology, economics, and related disciplines to describe and formalize decision-making processes. The perhaps most prominent approach comes from expected value theory and related views, which describe decision making as the

computation of expected value, that is, the weighting of the value of possible outcomes by their probability of occurrence (Bernoulli 1954). Variations of this principle introduce the idea of subjective value/utility and probability functions that may vary as a function of individual characteristics or situations, but such approaches typically do not make reference to the specific cognitive architecture underlying these calculations. One example of such a theory is cumulative prospect theory (Tversky and Kahneman 1992). A second approach, strongly anchored in cognitive science and psychology, tries more explicitly to link descriptions of decision processes to cognitive functions of attention, learning, and memory. The models associated with such an approach may also describe the computation of value and probability but often will make stronger assumptions about information search and updating of information. For example, sequential-sampling and reinforcement-learning models make assumptions about information sampling and updating to describe decision making. Other related approaches attempt to describe decision making at the algorithmic level by making assumptions about the series of computational steps required for search, stopping, and deciding (Gigerenzer and Brighton 2009). Third, and finally, a more recent approach investigates the neural basis of decision making, often making links to some of the formal and computational theories described above (Glimcher and Fehr 2014).

## Decision Making,

**Fig. 1** Depiction of an estimate of the number of publications on aging and decision making as well as the corresponding percentage relative to all publications on decision making in the past 40 years. The search was conducted using the terms “aging” and “decision making” in *all fields* in PubMed



The question of how decision making changes across the life span and, in particular, with aging, has received some attention. Yet, the field of aging and decision making represents less than 2% of all work in decision making, albeit there has been an increase in the relative proportion of decision research focusing on aging (see Fig. 1).

## Key Research Areas

There are a number of reviews on aging and decision making that emphasize how different aspects of age-related change can influence decision making, including affective and motivational (Samanez-Larkin and Knutson 2015), as well as cognitive and ecological, factors (Mata et al. 2012a). A complete understanding of the impact of aging on decision making will likely require the integration of different perspectives (Hess et al. 2015). Crucially, the ecological perspective suggests that there is no domain-general answer to the question of how changes in motivational or cognitive capabilities impact decision making. For example, the impact of age-related cognitive decline should depend strongly on the demands of specific task environments, such as memory demands. In other words, the quality of decisions made by people of all ages is the result of how task

demands and affordances interact with particular cognitive strategies. To better understand this interaction, one needs to describe the structure of decision environments and the cognitive or affective components that such environments exploit (Mata et al. 2012a). In what follows, the specific key research areas that have received most attention in the past are described with the goal of exemplifying the importance of age-related changes in cognitive and motivational components and the moderating role of ecological (i.e., task) characteristics on decision making.

## Perceptual Decision Making

Perceptual decision making refers to low-level decisions about immediately presented stimuli, with most research on aging having been carried out on visual discrimination, such as discrimination between different letters (E vs. F) or varying levels of brightness in stimuli presented very briefly on a computer display (e.g., for less than 1 s). The state-of-the-art approach is to use sequential-sampling models (e.g., diffusion models) to describe both reaction times and accuracy of responses simultaneously and account for possible speed–accuracy trade-offs. The latter models are able to distinguish between different components, such as motor components, response criteria components, and evidence accumulation

components, because each makes different predictions about the shape of the reaction time distribution of correct and error responses. Key results in this area are that older adults do seem motivated to perform well and show motivational adaptations by adopting more conservative decision criteria than the younger adults. Older adults are also overall slower in noncognitive (e.g., motor) components. However, the quality of evidence accumulation driving the decision process is significantly lower for older relative to younger adults in some but not all tasks (Ratcliff et al. 2007), suggesting that task characteristics, such as the nature of the stimuli, can be crucial in engendering age differences in perceptual decision making. The extent to which the results from perceptual decision making can be directly translated or are correlated to performance in higher-level decisions is yet to be investigated.

### Multiple-Cue Decision Making

The bulk of decision-making research has focused on problems in which decision makers have to integrate different pieces of information (i.e., cues, attributes) and deliberately decide between two or more options. The nature of information presentation may vary dramatically from those cases in which it is conveniently summarized in a table or, alternatively, needs to be retrieved from memory. A major distinction in this field concerns the existence of an objective criterion that determines the correctness of the decision, such that decisions amount to inferences, and those cases for which no objective criterion exists – decisions thus represent expressions of individual preferences. Some work on aging and multiple-cue decision making has artificially created objective criteria and examined the strategies selected by younger and older adults in inferential decision making (Mata et al. 2007). Strategies can be defined as sequences of operations or processes that are goal directed, that is, are aimed at accomplishing a particular task and, therefore, mediate task performance. The strategy concept has been used to describe cognitive processes and mechanisms of human cognition in many domains, including memory, arithmetic, and decision making. In particular, the strategy approach

has a long tradition in decision research with various strategies having been proposed, each with its particular cognitive demands and domain of execution (Shah and Oppenheimer 2008). For example, some strategies, like take-the-best (TTB), ignore significant amounts of information because they infer which of the two alternatives has the higher value on a criterion by (a) searching through cues in order of validity (i.e., how much the cue is correlated with the criterion), (b) stopping search as soon as a cue discriminates between decision alternatives, and (c) choosing the alternative this cue favors. In turn, other strategies, like weighted-additive strategy (WADD), consider all information by (a) multiplying each cue value by the respective cue weight (i.e., a measure of how important this cue is to the prediction), (b) summing up the results for each alternative, and (c) choosing the alternative with the highest sum. TTB does well in environments with many redundant cues or in which search is costly, the opposite being true for WADD. In the inference domain, there is some inherent difficulty in distinguishing age-related changes in preferences from the impact of age-related cognitive decline on the selection and application of specific decision strategies that impact the search and integration of information. Overall, work on inferential decision making suggests that older adults tend to search for less information prior to making a decision (Mata and Nunes 2010) and use simpler strategies that ignore some information (Mata et al. 2007) or strategies that do not rely heavily on memory (Mata et al. 2012b) to integrate information, possibly due to age-related cognitive decline. There are, however, other aspects related to age-related changes in motivation and preferences that can affect decision making. The work on the impact of aging on preferential decisions is summarized below for a number of areas in which age differences have been investigated, such as in the domains of risky, intertemporal, and social decision making.

### Risky Decision Making

Conceptions of risk and risk taking abound, with economists viewing risk as the variance or probability of possible outcomes, whereas

psychologists and lay people often emphasize the link between risk and the possibility of losses. There are a number of measures and tasks that attempt to capture individual and age differences in the tendencies to decide for or against risky courses of action. Some behavioral tasks provide explicit information about outcome magnitudes, whether outcomes are positive (gains) or negative (losses), as well as their respective probabilities (decisions from description), but others require individuals to learn about probability and outcome information over time (decisions from experience). A review of the literature suggests that the pattern of age differences in risky decision making is heterogeneous and may depend heavily on task characteristics (Mata et al. 2011). In particular, in decisions from experience, age-related differences in risk taking seem to be a function of decreased learning performance: Older adults may be more (or less) risk seeking compared to younger adults depending on whether learning leads (or not) to risk-avoidant behavior. In decisions from description, younger and older adults may show more similar risk-taking behavior at least when the cognitive demands of the task are low. The exact decision strategies used by younger and older adults in these tasks have not been fully investigated, thus making it difficult to disentangle the role of age-related changes in risk preferences due to motivational factors and more cognitive factors, such as the changes in strategy use due to age-related cognitive decline (Depping and Freund 2011). One interesting avenue for future research is to investigate which behavioral tasks can best capture the underlying risk preferences of older adults as captured in commonly used self-report measures.

### Intertemporal Decisions

Many important life decisions require trading off immediate rewards against future ones, such as the choice between spending and saving. This type of decisions is typically studied empirically using monetary decisions between smaller-sooner and larger-later amounts of money, for example, \$10 today or \$20 in 1 week. Overall, humans seem to deviate from the assumption of economic theory, which assumes exponential discounting

(i.e., constant discounting per time period). Instead, humans typically show a present bias by showing valuations that fall rapidly for small delay periods, but slowly for longer delay periods. The empirical literature concerning age differences in intertemporal decisions is mixed (Rieger and Mata 2015; Samanez-Larkin et al. 2011). However, the majority of existing studies seem to suggest a pattern, whereby older adults are more patient, by showing choices indicative of either less steep discounting rates or increased neural responses to later rewards (Samanez-Larkin and Knutson 2015).

### Social Decision Making

Aging is traditionally perceived as being associated with increased wisdom, including an increased ability to navigate the social world. But do older adults deal more or less strategically and prosocially relative to younger adults in social contexts? Standard economic theory assumes that people are, perhaps exclusively, motivated by material self-interest and thus do not care about the well-being of others. A number of studies have rejected this assumption and suggested that individuals of all ages have prosocial motivations (Engel 2011). The typical measures used to assess prosocial motivations consist of having individuals (i.e., players) make decisions in the context of groups in which other individuals may or not be anonymous. For example, individuals may be asked to allocate monetary amounts to themselves and others, with the amount assigned to the social partner being used as an indicator of prosocial motivation. The economic games include the dictator, ultimatum, and trust games, among many others (Rieger and Mata 2015; Engel 2011). The literature on age differences in social preferences in such games is relatively scarce and most work has only considered age as a nuisance variable. Some work does suggest an increase in prosocial motivations with increased age (Engel 2011), but there is evidence that such patterns may not hold across tasks or populations (Rieger and Mata 2015). More empirical studies investigating a more culturally and age-diverse set of participants are still needed to characterize age differences in such strategic social interactions.

Another area of research that has received some attention concerns decision making and problem solving in a social context. Such abilities are typically assessed by tallying the number and quality of solutions participants generate to deal with everyday problems, for example, the course of action to take under financial distress or how to handle a social conflict between members of a couple. A meta-analysis of such problems concluded that there is a decline in effectiveness of everyday decision making (Thornton and Dumke 2005), with a medium effect size difference between younger and older adults (Hedge's  $g \approx 0.4$ ). However, moderator analyses revealed that age differences were reduced when problems were of a social nature (Hedge's  $g \approx 0.2$ ). Overall, the literature suggests that there may be changes in social decision making, but it remains an open issue whether these are due to motivational or cognitive factors.

## Future Directions

An important avenue for future work concerns evaluating the consequences of basic age-related changes in motivational and cognitive changes on real-world decisions. There is some evidence for an inverted-U-shaped function of age and financial decision making in the real world (Agarwal et al. 2009). Yet, the exact mechanism for this pattern remains unknown, and it could be a function of age-related changes in financial knowledge, numeracy, fluid cognitive abilities, motivation, or all of the above. Prospective and longitudinal studies of decision making that include real-world outcomes are yet to be conducted but are sorely needed to distinguish such different possibilities.

The area of consumer decision making provides an interesting future test-bed for different theories because it likely conflates different influences, including cognitive and motivational factors (Yoon et al. 2009). One important principle to keep in mind in such work is that age-related cognitive decline may not always be associated with poor choice outcomes. For example, simple strategies that ignore information can lead to

satisfactory choices in many real-world consumer environments (Mata and Nunes 2010).

In sum, aging seems to be associated with changes in decision making, from simple perceptual decisions to complex social ones. The motivational and cognitive mechanisms leading to such changes still need to be uncovered, as do the task characteristics that foster or hinder successful choices by aging decision makers.

## Cross-References

- ▶ [Aging and Strategy Use](#)
- ▶ [Decision-Making Capacity in Older Adults, Overview of](#)
- ▶ [Everyday Cognition](#)
- ▶ [Risk Taking in Older Adulthood](#)
- ▶ [Working Memory in Older Age](#)

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## Decision-Making Capacity in Older Adults, Overview of

J. Kaci Fairchild<sup>1</sup>, Melissa A. Yanovitch<sup>2</sup> and Caitlin S. Moore<sup>3</sup>

<sup>1</sup>Sierra Pacific Mental Illness Research Education and Clinical Center, VA Palo Alto Health Care System, Stanford University School of Medicine, Palo Alto, CA, USA

<sup>2</sup>PGSP-Stanford PsyD Consortium, Palo Alto, CA, USA

<sup>3</sup>Ryan Dolby Brain Health Center, California Pacific Medical Center Neurosciences Institute, San Francisco, CA, USA

### Synonyms

Assessment; Competency; Decision-making

### Definition

The necessary cognitive and functional abilities required to perform a specific task or make a specific decision.

### Introduction

The term *capacity* refers to a person's ability to perform a specific task or make a specific decision. Determinations of capacity have historically been made by clinicians in clinical settings. This is in contrast to the legal term *competency*, which is a determination made by the court. At times these terms have been used interchangeably; however, for the purposes of this section, we henceforth use the terms “clinical capacity” and “legal capacity.”

Psychologists are increasingly called upon to make determinations of capacity. The reasons for this are multifactorial. It is widely cited that the number of older adults worldwide has grown exponentially. And while not all older adults develop dementia, they may experience physical and mental changes as they age that place them at risk for impaired capacity. There has also been shift of wealth from the World War II generation to the baby boomers and now to the Generation X, in increasingly diverse families that are separated geographically. Consequently, probate courts are seeing an increase in contested wills and guardianship proceedings (Moye and Marson 2007). The probate law has also shifted from a global and absolute view of capacity towards a more task- or decision-specific standard of capacity, recognizing a person can have capacity in one area but not another. Thus to meet the current legal standard of capacity, the capacity evaluation has also evolved to include neurocognitive, psychological, and functional assessments. Psychologists are often trained in these assessments thus are well suited to conduct capacity evaluations (Lichtenberg et al. 2015).

Yet while psychologists may have the appropriate training to address the functional, cognitive, and mental health components of the evaluation, they are often less familiar with the term capacity or the interventions available to persons with

diminished capacity. To further complicate the issue, professionals who often work with the probate laws surrounding capacity (i.e., lawyers and judges) may be less familiar with the unique needs of and challenges in working with older adults. So in 2003, the American Bar Association (ABA) and the American Psychological Association (APA) formed a workgroup to develop educational materials and handbooks for lawyers, judges, and psychologists. The intent of this workgroup was to provide a framework for professionals to draw upon in capacity determinations as opposed to more rigid standards of practice. The workgroup produced the first handbook, *Assessment of Older Adults with Diminished Capacity: A Handbook for Lawyers*, in 2005. The second handbook, *Judicial Determination of Capacity of Older Adults in Guardianship Proceedings: A Handbook for Judges*, was published in 2006. The final handbook, *Assessment of Older Adults with Diminished Capacity: A Handbook for Psychologists*, was published in 2008. These handbooks are available online at [www.apa.org/pi/aging](http://www.apa.org/pi/aging) and [www.abanet.org/aging](http://www.abanet.org/aging) (American Bar Association and American Psychological Association Assessment of Capacity in Older Adults Project Working Group 2008).

The following sections will detail the evolution of the legal capacity and guardianship laws; the core ethical principles inherent in decision-making capacity; the requisite functional abilities for determinations of capacity; the role of culture in capacity evaluations; a framework for capacity evaluations; and future directions for the field.

### **Evolution of Legal Capacity and Guardianship**

Over the past 65 years, the legal aspects of capacity evaluations have undergone significant change in the United States and internationally. In essence, there has been a shift towards increased autonomy and limited guardianship, resulting in various legal reforms. Historically, the concept of capacity was global and absolute in that a person deemed incapacitated would have his or her legal rights revoked in a broad range of legal domains (American Bar Association and American Psychological Association Assessment of Capacity in Older Adults Project Working Group 2008).

This has shifted over time and current legal practice uses the term “capacity” to refer to a person’s ability to complete a specific task or decision (Bailar-Heath and Moye 2014), thus recognizing that a person can have capacity in one area (e.g., medical decision-making) but not another (e.g., driving). Another relatively recent change has replaced the term “incompetency” with the term “incapacity” as the determination of these have evolved to integrate clinical findings into legal findings in a multidisciplinary manner (American Bar Association and American Psychological Association Assessment of Capacity in Older Adults Project Working Group 2008). This shift is in keeping with the view of capacity as being decision relevant, which holds that judgments of capacity are for specific abilities at specific time in a specific context and relevant to a specific decision (Buchanan and Brock 1989).

The past few decades have yielded significant reform in legal practice pertaining to adult guardianship in the United States. The ABA defines guardianship as legal decision-making power given to an outside entity or person in response to a determination of incapacity. The term itself is often used interchangeably with “conservatorship” depending on the state or country in which the determination is being made and may be used in reference to guardianship of property specifically (American Bar Association and American Psychological Association Assessment of Capacity in Older Adults Project Working Group 2008; Bailar-Heath and Moye 2014). Criteria for guardianship fall under state and not federal regulation, and thus there is variability across states in how guardianship determinations are made. These decisions are defined by either statutory or case law and are transaction specific. Examples of transaction-specific capacity include testamentary capacity, donative capacity, contractual capacity, capacity to execute a durable power of attorney, and capacity to consent to medical care. Despite the inconsistency in legal definition, basic guidelines for determining diminished capacity include disabling condition, functional behavior, cognitive functioning, and consideration of the least restrictive alternative. These guidelines are commonly expanded upon by state law (American Bar

Association and American Psychological Association Assessment of Capacity in Older Adults Project Working Group 2008).

As part of the recent capacity reforms, 32 states have passed comprehensive reform bills, and 261 separate capacity laws have been passed. Currently, more than 30 states now require clinical evaluation for capacity to determine whether an adult may qualify for guardianship (Bailar-Heath and Moye 2014). Further, the majority of US states have done away with the global and absolute determination of incapacity in favor of the relatively recent model of limited guardianship. In the limited guardianship model, a guardian is appointed on for the areas in which the person has been deemed to lack capacity (American Bar Association and American Psychological Association Assessment of Capacity in Older Adults Project Working Group 2008). In determining whether a person is in need of guardianship, all states begin with the assumption of capacity and put the burden of proof on the party attempting to establish guardianship. In other words, every person is assumed to have capacity until established otherwise.

In contrast to the variability of laws pertaining to capacity determinations based on state jurisdiction in the United States, international law offers a more unifying standard. Since the 1960s, guardianship law has been of particular concern in many countries. In 2006, the Convention on the Rights of Persons with Disabilities (CRDP) marked a major international milestone in the legal rights of persons deemed to have diminished capacity. The CRDP brought significant changes to the laws of member nations to protect the legal rights, status and autonomy of incapacitated adults, and to provide support to this legally vulnerable population (Bailar-Heath and Moye 2014). Among other things, these changes mark an increase in the emphasis on autonomy and independence, cultural sensitivity, and the consideration of least restrictive alternatives (Doron 2002).

Within the broader legal standards outlined in the CRDP, the laws regarding capacity determinations vary by country. Canada, the United Kingdom, and Portugal define incapacity using the

benchmark of an individual's ability to care for "person or property" (Bailar-Heath and Moye 2014). In Germany, the guardianship model has shifted focus towards a "care and assistance" model that allows the individual to be appointed with a caretaker who carries out specific tasks as defined by the court, protecting the incapacitated individual from losing his or her legal rights. Sweden offers two possibilities for legal support for incapacitated persons. In both, the individual is appointed an administrator, mentor, or trustee that is responsible for assisting him or her. Additionally, the person may forfeit legal capacity in specified domains only or may not lose any of his or her legal rights. Israel is gradually transitioning from guardianship laws that eradicate the legal rights of the individual in all domains, to the appointment of a guardian and retention of legal competence (Bailar-Heath and Moye 2014).

In Hong Kong, the courts that determine guardianship appointment are multidisciplinary panels made up of lawyers, someone who has personal experience with incapacitated individuals, and either physicians, psychologists, or social workers. The structure of the panels in Hong Kong illustrates the shift towards a psycholegal construct of capacity that has been the recent trend in numerous countries. Similarly, Australian guardianship tribunals include members of the community as well as legal professionals, and various provinces in Canada require collaboration of legal and clinical professionals (Bailar-Heath and Moye 2014).

The legal aspects of capacity evaluations are complicated by variance in laws according to country and state jurisdiction. However, recent reforms both in the United States and internationally point to a shift in consciousness towards providing those who are legally determined to be incapable of safely making decisions about their person or property the least restrictive guardianship and preserving many of their legal rights. By including clinical assessments in legal proceedings that determine capacity, the system is beginning to allow for a more holistic view of the individual's abilities as opposed to the historically broad revocation of legal rights.

### Principlism in Health Care

The concept of capacity spans the fields of health care and law. Yet health-care ethics is a third area which is central to the concept of capacity. Principlism is system of ethics deployed in health care that based on four moral principles of: (1) respect for autonomy, (2) beneficence, (3) nonmaleficence, and (4) justice.

The principle of respect for autonomy, also referred to as self-determination, is the person's ability to make his or her own decisions. This principle is rooted in the longstanding belief of the importance of personal freedom and individualism. Health-care providers are tasked with ensuring that autonomous decisions are intentionally made, with substantial understanding, and free from coercion (Beauchamp 2007; Beauchamp and Childress 2011).

Beneficence may be viewed as a group of principles that both prevents harm and also provides benefits that outweigh costs and risks. This principle reflects the moral obligation to act for the benefit of others and is often considered a foundational value in health-care ethics. It could be argued that the obligation to promote patient welfare is of the utmost importance in medicine. Beneficence obligates health-care providers to assist older adults in furthering their interests, often by removing or minimizing risk and harm to the patient (Beauchamp 2007).

The principle of nonmaleficence prevents providers from causing harm to others, or put simply is the "do no harm" principle. While beneficence includes the prevention of harm or reduction of risk for the ultimate benefit of the patient, nonmaleficence is the intention to avoid unnecessary harm or injury to the patient. As noted by Beauchamp (Beauchamp 2007), nonmaleficence is one of the most frequently cited codes in health-care ethics. Some have advocated to place the greatest emphasis upon this obligation, even if that is to the detriment of other obligations, including the respect for autonomy. Nonmaleficence obligates providers to inflict the least amount of harm to achieve a beneficial outcome.

Finally, the principle of justice requires the fair distribution of benefits, costs, and risks (Beauchamp 2007). Put another way, this principle

obligates providers to act on the basis of unbiased decision-making in the face of competing claims. Thus the principle of justice extends beyond equitable access to treatment, as it obligates providers to be aware of their own biases to ensure the fair distribution of health-care resources.

These four principles are not hierarchical; thus clinicians have an obligation to uphold each of them. While this is the ideal, ethical clinical practice dictates that the clinician must examine the balance of these principles by examining their respective weights on a case-by-case basis. Thus to weigh the respective weights is to carefully evaluate the risks involved in the situation. There are no hard and fast rules that dictate that one principle take precedence over another. To further complicate the matter, different professionals may place a greater emphasis on different principles. When faced with the same clinical case, providers may recommend different treatments based on their evaluation of the potential risks and benefits involved. For example, a provider may recommend an older adult with a history of falls and mild cognitive impairment be discharged to home with the assistance of home health aides in order to promote the respect for the patient's autonomy. However, another provider, when presented with the same clinical scenario, may recommend the patient be discharged to an assisted living facility in order to promote the principle of beneficence (i.e., prevent the patient from sustaining future harm). As is highlighted in this example, determinations of capacity are often a balancing act between these foundational principles of health-care ethics.

### Essential Functional Abilities

Assessment of functional abilities is a core component of capacity evaluations. In the field of geropsychology, the concept of functional abilities often refers to a person's ability to perform activities of daily living (i.e., bathing, grooming, eating) and instrumental activities of daily living (i.e., shopping, bill payment, household chores). Yet in capacity evaluations, the legal concept of functional abilities also refers to the intact decisional abilities that are generally agreed to convey capacity (Lichtenberg et al. 2015). These abilities,

which are drawn from case law, include *understanding*, *appreciation*, *reasoning*, and *expressing a choice* (Grisso 2003; Smyer 2007).

In the context of capacity assessments, *understanding* refers to the ability to comprehend the nature of a proposed decision, including an awareness of its risks and benefits. The ability to adequately understand a proposed decision is impacted by several factors including the person's intelligence, educational level, and the method by which the information is presented to them. The risks and benefits of a decision must be presented to a person in a manner that promotes their understanding.

While there are different interpretations of *appreciation*, it is generally thought to refer to the ability to understand the relevance or applicability of a decision to the older adult. At the most basic level, older adults must recognize that a decision must be made, that they are the decision-maker, and it is their life that will be affected by the decision. Thus it is not surprising that appreciation is greatly impacted by the degree of patient insight, as well as the type of decision to be made and the complexity of that decision.

*Reasoning* entails the process of rationally comparing different treatment options or proposed solutions in a consistent manner. Older adults must demonstrate that they can weigh the risks and benefits of the proposed choices as well as the possible consequences. The ability to reason directly impacts understanding and appreciation. If a person cannot rationally reason or logically manipulate the presented information, it is not possible to fully understand or appreciate the issues in the decision (Grisso and Appelbaum 1998).

Older adults must also be able to *express a choice*; those who are unable to outwardly communicate a choice or who waver in their choice are seen as lacking capacity (Lichtenberg et al. 2015; American Bar Association and American Psychological Association Assessment of Capacity in Older Adults Project Working Group 2008; Grisso 2003). That choice should be consistent with the person's value or beliefs; however, it is accepted that a person's value and beliefs may change over time. The importance of expressing

a choice should not be minimized as there are situations in which a person may be able to understand, appreciate, and rationally reason about a decision; however, due to a physical condition, such as stroke, is unable to express a choice. In situations such as this, it is impossible to know what that person's preference or desire would be.

In addition to these four functional abilities, *the role of values in the determination of capacity cannot be overstated*. The ABA and APA Assessment of Capacity in Older Adults Project Working Group (American Bar Association and American Psychological Association Assessment of Capacity in Older Adults Project Working Group 2008) defined values as "an underlying set of beliefs, concerns, and approaches that guide personal decisions." This definition is useful as it not only defines values but also highlights the relationship between values and decision-making. As highlighted in Moye (Moye 2007), the "extent to which a person's expressed choice is consistent with their values is an indicator of capacity"; thus, it is an essential component to the assessment of these functional abilities. An understanding of a person's values will also greatly assist in the development of appropriate treatment recommendations. Providers should also be aware of their own values so that any inherent biases regarding the decision at hand can be appropriately addressed.

### The Role of Culture in Capacity

In addition to being one of the fastest growing segments of society, older adults are one of the most culturally diverse groups. That diversity is projected to continue to expand in coming years as evidenced by recent US census data. In 2014, 14% of the adults in the United States were age 65 or older. A closer analysis of this census data reveals that within this older segment of the US populace, approximately 1 in 7 (14%) sampled identified as a racial minority. That percentage of racial minorities is projected to steadily grow to 18% by 2030 and 23% by 2050 (U. S. Census Bureau 2014). As noted by Karel (2007), within these racial groups are further subgroups (denoted by their countries of origin) with their own values and beliefs. These values and beliefs are often the

foundation for their views on aging, health care, family and familial roles, finances, and end-of-life. Among older White Americans, there are further ethnic, regional, and religious subgroups. And not surprisingly, these subgroups have strong values and beliefs that influence their views on many of the abovementioned issues.

There are also cross-cultural differences within the aforementioned principles of health-care ethics. In Western cultures, the principle of respect for autonomy or self-determination is strongly valued. This is evident in the widespread use of advance care directives and durable powers of attorney, which are designed to foster patient autonomy in situations where patients are unable to make their own decisions. This emphasis on patient autonomy is unique to Western cultures, as other cultures encourage collective decision-making that involves the patient's community and family. In cultures that value beneficence, providers are obligated to encourage hope above all else. This is contrasted with those cultures that value nonmaleficence, in which providers protect patients from harm by not directly addressing seemingly negative outcomes such as death or end-of-life (Searight and Gafford 2007).

### **Conceptual Framework of Capacity**

The ABA-APA Working Group on the Assessment of Capacity in Older Adults detailed a nine-part framework for conceptualizing capacity assessments (American Bar Association and American Psychological Association Assessment of Capacity in Older Adults Project Working Group 2008). The model builds off of the frameworks for guardianship as well as the framework for capacity assessment previously developed by Grisso (American Bar Association and American Psychological Association Assessment of Capacity in Older Adults Project Working Group 2008; Grisso 2003; Moye 2007). Components of the nine-part framework proposed by the ABA-APA work group includes the identification of: the relevant legal standards, functional abilities of capacity, relevant medical or psychiatric diagnoses contributing to incapacity, cognitive function, psychological and emotional factors, values and preferences, risks to the individual and of the

situation, ways of enhancing capacity, and a clinical judgment of capacity.

While a capacity assessment is a clinician's opinion about a person's ability to perform a specific task or make a specific decision, that task or decision has a specific legal standard. A clinical judgment regarding a person's capacity can then have a direct impact on that person's legal rights henceforth. Therefore, a familiarity with the legal standard is a requisite initial step in the approach to a capacity assessment. The expectation here is not that a provider becomes an expert in the legal standards surrounding the capacity in question, but more that the provider becomes familiar with the legal standard. This can be accomplished through a review of a state's statutory or case law or through a consultation with an attorney. Information gleaned from this review or consultation should be then used to guide the selection of the assessment battery, so as to ensure all aspects of the legal standard are met (American Bar Association and American Psychological Association Assessment of Capacity in Older Adults Project Working Group 2008). It should be noted that from the legal perspective, all persons are presumed to have capacity until proven otherwise.

The ABA-APA framework builds off of the previous work by Grisso (1986) to expand the concept of "function" to also include the identification and evaluation of the functional elements essential to the questioned capacity. Capacity assessments should include a tailored evaluation of the specific task or specific decision which can be accomplished through specific questions in a clinical interview as well as through direct assessment or observation of the person's functioning (American Bar Association and American Psychological Association Assessment of Capacity in Older Adults Project Working Group 2008). This portion of the capacity assessment will vary based upon to the type of decision-making capacity being assessed. For instance, if the assessment is one of financial decision-making, the provider should include a structured assessment of financial decision-making. If the assessment were one of testamentary capacity, the provider should include specific questions in the clinical interview designed to demonstrate a person's ability to

describe a will, to describe the nature and extent of one's assets, to name potential heirs, and to describe plans for distribution of one's wealth. This focus on functional abilities specific to the task or decision to be made is a defining feature of the capacity assessment.

The purpose of establishing or documenting a diagnosis in the capacity assessment is to identify a possible "causal factor" for potential incapacity (Grisso 2003). Older adults are vulnerable to many physical and psychiatric illnesses that may impact capacity including dementia, delirium, neurodegenerative disease (e.g., Parkinson's, Alzheimer's), stroke, and many more. Yet these conditions can have markedly different long-term outcomes, thus it is important to recognize the role of the prognosis of the condition in judgments of decision-making capacity. For instance, Alzheimer's disease is a progressive neurodegenerative disorder for which there is no cure. This is contrasted with delirium, which is a life-threatening medical condition in which a person's cognition can rapidly fluctuate, though with medical intervention can fully resolve. In both of these conditions, patients will have impaired decision-making ability. Yet in the case of delirium, patients are often able to fully recover decision-making abilities while those patients with Alzheimer's disease are not likely to regain their decision-making ability (American Bar Association and American Psychological Association Assessment of Capacity in Older Adults Project Working Group 2008). While a diagnosis can serve as a causal factor for the impaired decision-making, it can also serve as a prognostic indicator as to if capacity is likely to be regained. Yet a medical or psychiatric diagnosis by itself is insufficient to establish a patient's decision-making capacity as patients with impaired cognitive function due to a medical or psychiatric disorder may still retain the ability to make some decisions. Thus the focus should not be on the presence of the diagnosis but on the influence of the diagnosis on the person's decision-making.

Most states include a comment on a person's cognitive function as a necessary element in the determination of capacity. The causative role that many diagnoses have on decision-making is often

through their effect on cognitive functioning. Impaired cognitive functioning can result in impaired insight or impairment in the cognitive abilities necessary to perform a specific task or make a specific decision. This portion of the capacity assessment should include assessments designed to comment directly on the cognitive functions necessary to perform a specific task or specific decision, in addition to measures of overall cognitive function. For instance, assessments of financial capacity may include measures of written arithmetic whereas an assessment of driving capacity may include measures of visual attention and processing speed (American Bar Association and American Psychological Association Assessment of Capacity in Older Adults Project Working Group 2008). As with the determination of medical and psychiatric diagnoses, the purpose of the cognitive assessment is to characterize the level and nature of cognitive impairment and determine if (and how) the decision-making process is impacted by cognitive status.

Similar to the cognitive assessments, the purpose of the screening for symptoms of mental health disorders is to detect possible underlying factors that may impact a person's decision-making ability. Mental health disorders, like psychotic spectrum disorders and severe mood disorders, can impair a person's insight and ability to rationally weigh the risks and benefits of the proposed choices as well as the possible consequences. Many mental health disorders are amenable to intervention which presents with greater likelihood that the patient will regain decision-making ability (American Bar Association and American Psychological Association Assessment of Capacity in Older Adults Project Working Group 2008). It should be noted that many patients with clinically significant mental health symptoms are not captured by strict criteria-based diagnostic categories (Lyness et al. 2015), thus again the focus of these measures is not just diagnosis but to comment on the impact of the mental health symptoms on cognitive and functional abilities relevant to the questioned capacity.

As aforementioned, values are the beliefs, concerns, and experiences that directly inform one's decisions. The ABA-APA handbook

distinguishes values from preferences, as former refers to “preferred option of various choices that is informed by values.” Assessment of values and preferences is an essential component to a capacity assessment as one of the requisite functional abilities is the expression of a choice that is consistent with a person’s values. It should be noted that values and preferences can change over time thus a change in person’s values may not represent impaired decision-making capacity (American Bar Association and American Psychological Association Assessment of Capacity in Older Adults Project Working Group 2008). In addition to conveying capacity, knowledge of a patient’s values and preferences can assist in the development of effective treatment recommendations that are more likely to be accepted by the patient.

Some have argued that at its most basic, a capacity evaluation is a type of risk assessment (American Bar Association and American Psychological Association Assessment of Capacity in Older Adults Project Working Group 2008; Moye 2007; Ruchinskas 2005). The provider must consider all available data, including medical and psychiatric diagnoses, cognitive and functional impairment, and patient values and preferences, in the context of the risk of the situation. In addition to evaluating the patient in terms of the risk of the situation, the provider should also take account of social and environmental supports, as these may serve to mitigate or exacerbate the initial risk (American Bar Association and American Psychological Association Assessment of Capacity in Older Adults Project Working Group 2008; Moye 2007). For instance, the discharge of an older adult with limited mobility to independent living would carry more risk if that older adult lived in a two-level home and had no immediate family in the area to provide assistance. Those risks would be mitigated, however, if the older adult had the financial means to install a stairway lift and employ regular home health aides to assist him. Thus these risks were mitigated with effective interventions to enhance the older adult’s capacity. All recommended interventions should match the level of risk in the situation so to ensure the deployment of the least restrictive means necessary (American Bar Association and

American Psychological Association Assessment of Capacity in Older Adults Project Working Group 2008).

All capacity evaluations should include considerations of what can be done to maximize a patient’s functioning. As noted by Moye (2007), many of these recommendations are practical in nature and include things such as hearing or visual aids or medication management systems. Other interventions may include work with occupational or physical therapy as well as additional training or counseling. Efforts to maximize patient functioning represent opportunities for potential clinically impactful interventions (American Bar Association and American Psychological Association Assessment of Capacity in Older Adults Project Working Group 2008).

In the final component of the ABA-APA framework, the provider takes into consideration all of the data gathered through the capacity evaluation and provides a clinical opinion regarding the patients questioned capacity. This clinical opinion is oft expected to be presented in the form of a dichotomous conclusion (e.g., yes or no). There will be situations in which the determination of capacity will be clear based upon the available information such as when a patient is grossly impaired across multiple cognitive and functional domains or is unable to express a choice due to significant neurological impairment. Other decisions are more complex due to varying levels of impairment across multiple domains. In situations such as these, providers are encouraged to review the available data in the context of the patient’s values and preferences as well as any environmental supports or risks (American Bar Association and American Psychological Association Assessment of Capacity in Older Adults Project Working Group 2008).

## Conclusion

The rapid global growth of older adults has compelled geropsychologists to gain the requisite knowledge and skills to address issues surrounding capacity. This topic is particularly relevant to geropsychologists as these professionals

understand the physical and mental changes that occur in late life and can often increase the risk of impaired capacity. Geropsychologists are also trained in the psychological, neurocognitive, and functional assessments that are included in the capacity assessment. Yet while geropsychologists have the clinical expertise, they are often less familiar with the legal standards required to determine capacity. The legal and health-care fields continue to evolve in their definitions of capacity as the focus has shifted towards one that recognizes capacity to be decision and domain specific as opposed to a global judgment of ability. Geropsychologists may find capacity evaluations to be a type of risk assessment that requires the balancing of the four moral health-care principles, which requires an understanding and appreciation of the role of culture on these principles. While there are no current “gold standards” for the assessment of capacity, there are conceptual frameworks as well as other assessment-specific tools available to assist those in evaluations such as these. Psychologists who work with older adults are encouraged to explore these frameworks and suggested assessments as they move towards achieving competency in assessment of decision-making capacity.

## Cross-References

- ▶ [Clinical Issues in Working with Older Adults](#)
- ▶ [Cognition](#)

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## Delirium

Nadine A. Schwab<sup>1</sup>, Catherine C. Price<sup>1,2</sup> and Terri G. Monk<sup>3</sup>

<sup>1</sup>Department of Clinical and Health Psychology, University of Florida, Gainesville, FL, USA

<sup>2</sup>Department of Anesthesiology, University of Florida, Gainesville, FL, USA

<sup>3</sup>Department of Anesthesiology and Perioperative Medicine, University of Missouri-Columbia, Columbia, MO, USA

## Synonyms

Confusion; Derangement; Irrationality; Hallucination

Delirium is characterized by an acute change in an individual's mental state, marked by fluctuating patterns of confusion and inattention. It is unfortunately encountered by nurses, family, and physicians, both in hospital and home-based care settings. Delirium can affect individuals of any age, though it is more frequently experienced by older individuals. It raises the risk of mortality, causes distress to both patients and caregivers, and increases health care expenditures. It is an acute condition that may present independently or in combination with other dementia syndromes; therefore, accurate diagnosis and timely treatment are imperative. In this entry, the authors discuss delirium in the general hospitalized patient, then subsequently focused on postoperative delirium for major orthopedic and cardiac surgeries that have the highest rates of delirium-affected individuals.

## Delirium Defined

Delirium is an acute and temporary change in orientation and cognition. The Diagnostic and Statistical Manual of Mental Disorders (DSM-V; American Psychiatric Association and American Psychiatric Association, DSM-5 Task Force 2013, [www.dsm5.org](http://www.dsm5.org)) provides a description of

delirium with subtypes. These include delirium due to an underlying medical condition (*delirium due to a medical condition*), medications (*substance-induced delirium, substance intoxication delirium*), or withdrawal from medications (*substance withdrawal delirium*). Delirium can also be multifactorial (*delirium due to multiple etiologies*) (see Table 1 for criteria and descriptor information; ICD-10 criteria are presented in Table 2). Delirium can be present at hospital admission and presurgically, although it is more often seen in postsurgically managed general medical units and most frequently in intensive care units (ICUs).

## General Characteristics of Delirium

Delirium characteristics can vary by individual. Most common is fluctuating arousal with waxing and waning awareness of orientation. It is often accompanied by altered sleep-wake cycle and reversed night cycles. Hallucinations and delusions are common. Variability can be seen in activity levels; however, patients can present with hyperactive, hypoactive, or mixed hyper-hypo active cognitive and motor states. Hyperactive patients show increased psychomotor activity, such as rapid speech, irritability, and restlessness. These patients can be disruptive, time-consuming, and harmful to staff. They are therefore more readily identified and treated. Hypoactive patients, by contrast, typically show a calm appearance combined with inattention, decreased mobility, and have difficulty answering simple questions about orientation. Due to their calm appearance, these individuals are unfortunately less readily identified with delirium and may be inappropriately treated (Peritogiannis et al. 2015).

## Significance of Delirium

Although a temporary condition, delirium is a medical and societal stressor from an economic and healthcare standpoint. Delirium occurs in at least 10–24% of the general patient population,

**Delirium, Table 1** The following criteria are derived from the *Diagnostic and Statistical Manual of Mental Disorders*, 5th ed. All criteria (A-E) are required for diagnosis

DSM-V diagnostic criteria for delirium
(A) A disturbance in attention (i.e., reduced ability to direct, focus, sustain, and shift attention) and awareness (reduced orientation to the environment)
(B) An additional disturbance in cognition (e.g., memory deficit, disorientation, language, visuospatial ability, or perception)
(C) The disturbances in Criteria A and C are not better explained by another preexisting, established, or evolving neurocognitive disorder and do not occur in the context of a severely reduced level of arousal, such as a coma
(D) There is evidence from the history, physical examination, or laboratory findings that the disturbance is a direct physiological consequence of another medical condition, substance intoxication, or withdrawal (i.e., due to a drug of abuse or to a medication), or exposure to a toxin, or is due to multiple etiologies
Specify whether:
Substance intoxication delirium
Substance withdrawal delirium
Medication-induced delirium
Delirium due to another medical decision
Delirium due to multiple etiologies
Specify if:
<i>Acute:</i> Lasting a few hours or days
<i>Persistent:</i> Lasting weeks or months
Specify if:
<i>Hyperactive:</i> The individual has a hyperactive level of psychomotor activity that may be accompanied by mood lability, agitation, and/or refusal to cooperate with medical care
<i>Hypoactive:</i> The individual has a hypoactive level of psychomotor activity that may be accompanied by sluggishness and lethargy that approaches stupor
<i>Mixed level of activity:</i> The individual has a normal level of psychomotor activity even though attention and awareness are disturbed. Also includes individuals whose activity level rapidly fluctuates

with reports up to 50% of hospitalized older adults (over 65) (Inouye et al. 2014). Indirect costs of delirium stem from lost work and personal productivity by patients and caregivers and have been estimated to total more than \$164 billion in the USA alone (Inouye et al. 2014). Acute postoperative delirium has been shown to be an independent predictor of functional decline and morbidity after cardiac and orthopedic surgeries.

**Delirium, Table 2** The following criteria are derived from the 2016 ICD-10 Procedure Coding System (ICD-10-PCS)

ICD-10 diagnostic criteria
(A) Clouding of consciousness, i.e., reduced clarity of awareness of the environment, with reduced ability to focus, sustain, or shift attention
(B) Disturbance of cognition, manifest by both:
(1) impairment of immediate recall and recent memory, with relatively intact remote memory; and
(2) disorientation in time, place, or person
(C) At least one of the following psychomotor disturbances:
(1) Rapid, unpredictable shifts from hypoactivity to hyperactivity
(2) Increased reaction time
(3) Increased or decreased flow of speech
(4) Enhanced startle reaction
(D) Disturbance of sleep or the sleep-wake cycle, manifest by at least one of the following:
(1) Insomnia, which in severe cases may involve total sleep loss, with or without daytime drowsiness, or reversal of the sleep-wake cycle
(2) Nocturnal worsening of symptoms
(3) Disturbing dreams and nightmares which may continue as hallucinations or illusions after awakening
(E) Rapid onset and fluctuations of the symptoms over the course of the day
(F) Objective evidence from history, physical and neurological examination, or laboratory tests of an underlying cerebral or systemic disease (other than psychoactive substance related) that can be presumed to be responsible for the clinical manifestations in A–D
Comments: Emotional disturbances such as depression, anxiety or fear, irritability, euphoria, apathy or wondering perplexity, disturbances of perception (illusions or hallucinations, often visual), and transient delusions are typical but are not specific indications for the diagnosis
Use the fourth character to indicate whether the delirium is superimposed on dementia or not: F05.0 Delirium, not superimposed on dementia; F05.1 Delirium, superimposed on dementia; F05.8 Other delirium; F05.9 Delirium, unspecified

**Assessing Delirium**

To assist with diagnosis, a number of investigators have collaborated to develop and validate rapid bedside approaches to diagnose patients at the bedside and ICU. The Confusion Assessment Method (CAM; Inouye et al. 1990) is the most well-known measure for assessing delirium. The CAM assesses four features: acute onset and

fluctuating course (feature 1), inattention (feature 2), disorganized thinking (feature 3), and altered level of consciousness (feature 4). Delirium diagnosis requires the presence of features 1 and 2 and either 3 and 4 (note that memory impairment is not included, for this is sometimes absent in mild delirium, whereas it is present in other conditions, such as dementia (Inouye et al. 1990)).

The Society of Critical Care Medicine has strongly recommended routine evaluation of delirium in ICU patients. For critically ill patients where delirium prevalence ranges from 11% to 87% (Aldemir et al. 2001; Ely et al. 2001a), the CAM-ICU (Ely et al. 2001b) was designed. It assesses the same four features of the original CAM, but relies more on nonverbal responses. For this exam, patients are observed to assess the presence of acute mental status change, inattention, disorganized thinking, and altered levels of consciousness. We encourage you to review some excellent video introductions to the CAM-ICU available via the Internet.

The CAM has been translated into 20 other languages including Chinese, Dutch, German, and Spanish, with the CAM-ICU having high validity relative to other delirium scales available in those languages. Overall, the CAM and CAM-ICU's simple algorithms allow them to be useful for rapid identification of delirium by both physicians and staff nurses. After training, both scales should take approximately 2 min to administer.

Aside from the CAM instruments, other frequently encountered screening tools include the Delirium Rating Scale-Revised-98 (DRS-R-98; Trzepacz et al. 2001), the Memorial Delirium Assessment Scale (MDAS; Breitbart et al. 1997), and the Nursing Delirium Screening Checklist (NuDESC; Gaudreau et al. 2005). The DRS is a 10-item scale, rated by a clinician with psychiatry training and is based on a patient's behavior over a 24-h period. The DRS was later revised and renamed the DRS-R-98. The DRS-R-98 includes a 16-item clinician-rated scale, including 13 items assessing delirium severity and three diagnostic items. The MDAS is a 10-item clinician-rated scale, based on DSM-IV criteria, which assesses disturbances in arousal and level of

consciousness, cognitive function, and psychomotor activity. The NuDESC is a measure used exclusively in surgical and recovery ward patients and can be administered by trained nursing staff. It consists of a 5-item scale assessing disorientation, inappropriate behavior and communication, hallucinations, and psychomotor retardation over a 24-h period. See Table 3.

### **Prevalence of Delirium Type and Considerations for Risk Factors in General Medical and Surgical Populations**

The prevalence of delirium is reported highest before hospital discharge, this being often associated with respiratory infections, cellulites, and urinary tract/kidney infections. Central nervous system disorders have the second most frequently reported delirium codes with this particularly seen among those having craniotomy, CNS neoplasms, degenerative nervous system disorders, strokes/transient and other seizures/headaches, and other nervous system disorders (Lin et al. 2010).

Delirium due to a medical condition is the most common type of delirium, with drug-induced delirium being the second most frequently reported (Lin et al. 2010). Patients with drug-induced delirium, however, are typically younger than the other delirium groups and had the lowest proportion of comorbidities. Drug-induced delirium was also most common in patients who have lower extremity orthopedic surgery (relative to comparison groups of patients with pneumonia, urinary tract infection, congestive heart failure) (Lin et al. 2010). Dementia-related delirium, by contrast, is associated with high rates of admission from long-term facilities and older adults. This subtype typically has a higher mortality rate and greater frequency of atrial fibrillation, pneumonia, and urinary tract infections. General delirium risk factors include male sex type, increasing age, and cerebrovascular risk factors.

Structural brain disease traits are additional considerations for delirium risk. Although studies are of variable quality with regard to imaging methods, studies show that delirium patients

**Delirium, Table 3** Common delirium screening tools

Tool <sup>a</sup>	Pro	Con	Sensitivity/ specificity <sup>b</sup>
CAM	Based on DSM criteria; best in ED, postoperative and mixed inpatient settings; high interrater reliability	Potential for false negatives in postop population	46–100%/63–100%
CAM-ICU	Brief assessment (<2 min); can be used in nonverbal pts	Be used in nonverbal pts in postop population	46–100%/63–100%
MDAS	Best in postop settings; designed to track changes in delirium	Tested in modest number pts, limited generalizability; may only be assessed by physician	64.1%/100%
DRS	More useful than DRS-R-98 in more impaired patients	May only be assessed by psychiatric physician; not useful with repeated admin	91–100%/84–92%
DRS-R-98	Can assess severity of delirium; distinguishes delirium from dementia	May only be assessed by a trained nurse	91–100%/84–92% and <75%/<75% (in older adults)
NuDESC	Best sensitivity and specificity of tools for postsurgical populations; brief assessment	May only be used by a trained nurse	85.7%/86.8%

<sup>a</sup>*CAM*: Inouye et al. (1990); *CAM-ICU*: Ely et al. (2001b); *DRS*: Trzepacz et al. (1988); *DRS-R-98*: Trzepacz et al. (2001); *MDAS*: Breitbart et al. (1997); *NuDESC*: Gaudreau et al. (2005)

<sup>b</sup>Information adapted from De and Wand (2015). See article for further review

have preexisting brain differences. Patients with delirium are reported to have preexisting larger ventricle sizes, basal ganglia or caudate lesions/lacunae, white matter abnormalities in the periventricular and deep regions of the brain, greater cortical and subcortical atrophy, and decreased regional and overall perfusion. An important caveat, however, is that almost all of these studies are confounded by age; delirium patients are significantly older in age than those without delirium. White matter abnormalities and atrophy increase with age for many individuals, particularly those with hypertension and hypercholesterolemia. See De Groot and Slooter (2014) for a more thorough review.

Functional MRI techniques may improve understanding of neural mechanisms for delirium. Choi and colleagues (2012) assessed the functional brain patterns of delirious subjects. They found that activity in the dorsolateral prefrontal cortex and posterior cingulate cortex were strongly correlated in patients during an episode of delirium, as compared with control subjects who demonstrated an inverse correlation between these regions. The authors also revealed that

functional connectivity between the intralaminar thalamic and caudate nuclei were reduced during a delirious episode, but this connectivity recovered to normal function after resolution of delirium (Choi et al. 2012).

These studies lend further support to the hypothesis that there are predisposing demographic, comorbidity, and brain vulnerability factors contributing to the development of delirium. Attention will now shift to specifically discuss unique risk and treatment applications associated with two major surgery types: orthopedic and cardiac surgery.

### **Reducing Postoperative Delirium: Anesthetic Considerations and Perioperative Variables**

Postoperative delirium typically presents around 24 h after surgery and resolves in most patients by 48 h; however, in rare cases it can last for up to months or even a year or more. Different risk factors for orthopedic and cardiac surgery have been discussed in the literature and are therefore reviewed separately below.

### Specific to Orthopedic Surgery

Although delirium can be noted in elective orthopedic surgery, it is more prominent and concerning among urgent orthopedic surgeries such as hip fracture. Patients who develop delirium after hip fracture surgery have higher rates of mortality, are more likely to be diagnosed with dementia or mild cognitive impairment, and/or require institutionalization. There is an increased need to identify ways to reduce delirium in these patients. Recent randomized controlled studies suggest that analgesia and pain management and depth of general anesthesia are important modifiable factors for delirium prevalence after hip fracture surgery. A Cochrane review (Parker et al. 2004) compared outcome differences in hip fracture patients versus regional anesthesia. From five randomized controlled trials meeting inclusion criteria, there were more patients with postoperative confusion in the general anesthesia groups relative to the regional anesthesia groups. The authors concluded that with hip fracture surgery, regional anesthesia relative to general anesthesia results in a twofold reduction of acute delirium. Zywiell and colleagues (2014) found mixed results (Zywiell et al. 2014), however. They identified that patients who receive general versus regional anesthesia during a hip replacement surgery experience delirium at a greater frequency, though after a few days postsurgery, the differences are no longer significant.

Identifying and treating delirium risk factors in patients *prior* to surgery may also be a venue for reducing postoperative delirium. Investigators have recently lead a quasi-experimental intervention study (Bjorkelund et al. 2010) where preoperative patients with hip fractures admitted to the hospital were either treated with a multifactorial intervention program ( $n = 131$ ) or served as a control group ( $n = 132$ ). The multifactorial intervention program included: (1) the use of supplemental oxygen; (2) intravenous iv fluid supplementation and extra nutrition; (3) increased monitoring of vital physiological parameters (oxygen saturation, systolic blood pressure maintained  $>90$ – $100$  mmHg, red blood cell transfusion should be considered if hemoglobin  $<100$  g/l, avoid hypo/hyperthermia); (4) adequate

pain relief; (5) avoidance of delay in transfer logistics; (6) daily delirium screening; (7) avoidance of polypharmacia (sedatives/hypnotics with anticholinergic properties given in restriction); and (8) anesthesia recommendations (premedication with paracetamol, propofol and/or alfentanil iv on arrival to operating suite, spinal anesthesia with bupivacain, sedation with propofol) with systolic blood pressure maintained at  $>2/3$  of baseline or  $>90$  mmHG, red blood cell transfusion only when there is increased blood loss ( $>.3$  l) or hemoglobin ( $<100$  g/l), and postoperative analgesia with paracetamol as the first choice or in combination with an opioid. Findings showed less delirium in the intervention group relative to the control group, suggesting value of *multifactorial perioperative intervention approaches* rather than the use of one or two therapies alone.

Presurgical education may be an additional approach. One study (Krenk et al. 2012) showed that delirium did not occur for elective orthopedic surgery patients who were provided with more information about the anesthesia and surgical procedures, as well as prehabilitated by physiotherapists for appropriate exercise regimes commonly used after surgical intervention. The authors cite the need to engage patients in their own rehabilitation as well as consistent monitoring of cognitive changes. The study was limited, however, in that subjects were all cognitively well (Mini Mental State Exam  $>23$ ) and may have experienced a protective factor in this regard.

### Specific to Cardiac Surgery

Delirium after cardiac surgery has been reported for many years, but has recently been shown to be a strong independent predictor of mortality for up to 10 years postoperatively, even in younger individuals and in those without prior stroke. Coronary artery bypass graft or valve surgery is also associated with risk of functional decline at 1 month after discharge, with this outcome independent of comorbidity, baseline function, and cognition.

Operative risk factors include impaired left ventricular ejection fraction, time on cardiopulmonary bypass, high perioperative transfusion

requirement, and postoperative hypertension. Microemboli, common to all cardiac surgical procedures, has not, to date, been specifically associated with delirium although it continues to be considered a potential contributor when it occurs in combination with other risk factors such as hypoperfusion.

There may be specific modifiable risk factors for delirium after cardiopulmonary bypass (CPB). In a group of individuals receiving standardized surgery, anesthesia, and postoperative pain management protocols, and daily delirium evaluations, Burkhart and colleagues (2010) identified that delirium risk factors were: (1) the dose of fentanyl per kilogram of body weight administered during the operation, (2) the duration of mechanical ventilation, and (3) maximum value of C-reactive protein measured postoperatively (Burkhart et al. 2010). The authors pose that fentanyl, with questionable anticholinergic effects, may be a modifiable risk factor; alternatives such as remifentanyl or other opioids may be worth considering for intervention trials. Duration of mechanical ventilation requires sedation and therefore may be a consequence of the specific drugs used to maintain sedation. Sedation depth may also be worth considering. Postoperative rates of C-reactive protein suggest a systemic inflammatory response to surgery. This may indicate a relationship to endotoxin, a common consequence of coronary artery bypass grafting (CABG) and trauma-induced intraabdominal infections. Burkhart and colleague's (2010) C-reactive protein findings coupled with others findings that cortisol levels also correlate with postoperative delirium suggest that these areas need further investigation. Clearly, there is a specific need for intervention trials with potentially modifiable risk factors in cardiac patients.

### **Considerations for Anticholinergic Medications and Anesthesia**

Anticholinergic drugs and/or interaction of these drugs with anesthetic agents is a probable factor for postoperative delirium. Anticholinergic drugs compete for acetylcholine receptor subtypes

(nicotinic and muscarinic). They impair memory performance by antagonizing the neurotransmitter acetylcholine and muscarinic receptors in the brain. High serum anticholinergic levels of anticholinergic drugs are associated with delirium and cognitive impairment. Unfortunately, these medications are commonly taken by older adults over the counter for sleep aids (any “*pm*” medication). Common anticholinergic medications include tricyclic antidepressants used to treat mood but also pain and sleep (i.e., amitriptyline), antihistamines, and antibiotics (e.g., cephalosporin, third generation). Anesthesiologists should identify patients on anticholinergic medications prior to surgery. One potential mechanism for anesthetic action is via the suppression of cholinergic cells (i.e., isoflurane and sevoflurane suppress acetylcholine release). Thus, there is potential for increased depletion of cholinergic activity. Randomized prospective studies are needed to identify the extent to which presurgery anticholinergic medications interact with anesthesia to increase vulnerability to delirium and even postoperative cognitive dysfunction. There have been attempts to prevent postoperative delirium with cholinesterase inhibitors (e.g., rivastigmine) in randomized treatment trials. Unfortunately, to date, these have been largely unsuccessful for both elective total joint replacement and cardiopulmonary bypass. Large intervention trials appear needed.

### **Considerations for Postsurgery Dementia Development or Progression**

#### **Threshold and Brain/Cognitive Reserve**

The concept of a threshold and brain/cognitive reserve is often mentioned when attempting to explain why certain individuals may: (1) develop delirium or (2) proceed to dementia.

Martin Roth and colleagues (Roth 1971) first introduced the concept of a “threshold” in their postmortem Newcastle upon Tyne studies. These researchers observed patterns in senile plaque counts and measures of disease/dementia severity. For example, in Parkinson's disease, clinical Parkinsonism does not appear until 85% of the cells of the nigrostriatal system are depleted and

dopamine has declined in a similar proportion. A similar pattern has been reported in Alzheimer's disease with regard to neurofibrillary plaques and tangles.

Paul Satz contributed significantly to the concept of a threshold by formally providing some general properties for a threshold theory and reserve (Satz 1993). Satz outlines two postulates: A) how greater brain reserve (as measured by premorbid intellectual abilities, academic abilities, or current intelligence) serves as a protective factor to a lesion or pathology and B) how lesser brain reserve serves as a vulnerability factor to lesion or pathology. He also provides subpostulates discussing the effects of aggregate lesions, disease progression, and challenge. Satz' (1993) postulates apply to the topics of delirium.

Unfortunately, it is difficult to define and measure reserve and use the concept to predict risk for delirium. Some researchers propose that education is a surrogate marker for cognitive reserve. The concept of education is multifold, however. Education may signify more neuronal connections, but also it may simply mark better test taking abilities, better social networks, and healthcare. For these reasons, reserve has been extensively studied beyond that of education alone. According to Yacob Stern, Ph.D. at Columbia University, a leader on the topic of cognitive reserve, there are at least two forms of reserve. Reserve can be characterized: (1) as simply "brain reserve" (essentially brain structure) or (2) "as cognitive reserve" represented by neural reserve and neural compensation. Unfortunately, operationally defining both brain and cognitive reserve remains challenging and are topics worthy of longitudinal investigation. Familiarization with the topic of reserve subtypes, as well as discussions on reserve and postoperative disorders is encouraged.

## Conclusion Statement

There is growing evidence that delirium can result in reduction of acute and long-term function for some individuals, especially older adults. Delirium can therefore be interpreted as representing an

insult to the brain. The development of interventions to prevent and treat delirium and postoperative cognitive dysfunction is essential with our ever-increasing older adult population.

## Cross-References

- ▶ [Cognitive and Brain Plasticity in Old Age](#)
- ▶ [Dementia and Neurocognitive Disorders](#)
- ▶ [End of Life Care](#)
- ▶ [Frailty in Later Life](#)
- ▶ [Palliative Care](#)
- ▶ [Physiological Effects on Cognition](#)

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## Dementia and Neurocognitive Disorders

Kamini Krishnan<sup>1</sup> and Glenn E. Smith<sup>1,2</sup>

<sup>1</sup>Mayo Clinic, Rochester, MN, USA

<sup>2</sup>University of Florida College of Public Health and Health Professions, Gainesville, FL, USA

### Synonyms

Dementia and major neurocognitive disorder; Mild cognitive impairment and minor neurocognitive disorder

### Definition

Dementia and neurocognitive disorder: In the latest edition of the Diagnostic and Statistical Manual Fifth Edition (DSM-5), the American Psychiatric Association panel subsumed the term “dementia” and its etiologies under the category “major neurocognitive disorder” (MND) or “minor neurocognitive disorder” (mND) based on disease severity (Ganguli et al. 2011; American Psychiatric Association 2013).

### Introduction

The American Psychiatric Association retired the term “dementia” and introduced “major neurocognitive disorder” in the fifth edition of the Diagnostic and Statistical Manual (DSM-5) to emphasize the neurological origin of the degenerative disorders (i.e., presence of known structural or metabolic brain disease). Furthermore, authors proposed this amendment to differentiate neurodegenerative diagnoses from other illness with cognitive sequelae (such as psychiatric Axis I disorders), because a temporal relationship between psychiatric illness and cognitive deficits is an exclusion criterion for the diagnosis of dementia (Ganguli et al. 2011).

Recent advances especially in the field of genetics and neuroimaging modalities have generated a variety of potential biomarkers that may predict the presence of a neurodegenerative disease years before diagnosis or full manifestation of the clinical symptoms. Consequently, reformulation of diagnostic criteria for neurodegenerative disorders is underway. For example, in recognition of underlying disease biomarkers, the National Institute on Aging (NIA) and the Alzheimer’s Association have proposed new syndromic stages of Alzheimer’s disease (AD) including preclinical and prodromal stage of AD, which will be discussed in detail in this chapter (Jack et al. 2011).

This entry will include a review the general criteria for neurocognitive disorders (major and minor). The next section will discuss updates to research criteria based on biomarkers to delineate

between syndromic presentations (i.e., preclinical state, mild cognitive impairment [MCI], and dementia). Finally, a brief overview of etiology specific criteria for neurocognitive disorders is included. For detailed etiology (e.g., Alzheimer's disease) review, we encourage readers to refer to that entry in this encyclopedia (also cross-referenced with this entry).

## Diagnostic Clinical Criteria

In the latest revision of the DSM (American Psychiatric Association 2013), “major neurocognitive disorder” (MND) replaced dementia while “mild neurocognitive disorder” (mND) was elevated from research criteria only to full clinical use. Etiologies related to the syndrome are included as specifiers for both MND and mND (e.g., due to Alzheimer's disease, Parkinson's disease, frontotemporal lobar degeneration, vascular disease, Lewy body disease, or traumatic brain injury). Delirium remains as a separate category under neurocognitive disorders (American Psychiatric Association 2013).

### Minor Neurocognitive Disorder (mND)

The DSM-5 criteria (American Psychiatric Association 2013) are:

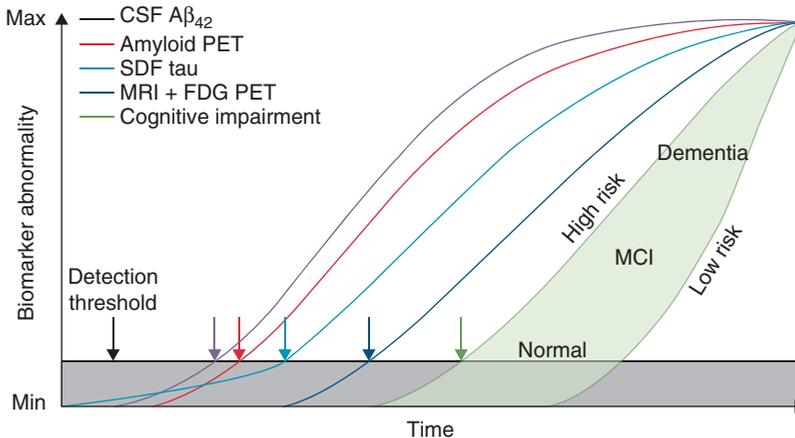
1. Evidence of *modest cognitive decline from a previous level of performance* in one or more cognitive domains (complex attention, executive ability, learning and memory, language, visual constructional-perceptual ability, or social cognition) based on both the criteria listed below.
  - (a) Report or concern for possible cognitive decline by patient, a knowledgeable informant, or by the clinician
  - (b) Quantifiable documentation of cognitive deficits, preferably with standard neuropsychological testing, typically 1.0–2.0 standard deviations (SD) below the mean (or 2.5th–16 percentile) based on a reference population (i.e., comparable with respect to age, gender, education, premorbid functioning, and cultural background)
2. The subtle but measurable cognitive deficit does not impede the individual's independence in instrumental activities of daily living (i.e., complex activities such as driving, medication and financial management, employment), but may require greater effort or compensatory strategies to maintain an independent level of functioning.
3. The cognitive deficits do not occur exclusively in the context of a delirium.
4. The cognitive deficits are not wholly or primarily attributable to another Axis I disorder (e.g., Major depressive disorder, schizophrenia).

Clearly, mND criteria comport with early suggestions for recognizing MCI (Smith et al. 1996; Petersen et al. 1999) but eliminates previously delineated subtypes: amnesic MCI-single domain (primary deficit in memory), amnesic MCI-multiple domains, nonamnesic MCI-single domain, and nonamnesic MCI-multiple domains based on the nature of the cognitive impairment (Petersen et al. 1999).

### Major Neurocognitive Disorder (MND)

The DSM-5 criteria (American Psychiatric Association 2013) are:

1. Evidence of significant cognitive *decline from a previous level of performance* in one or more cognitive domains (complex attention, executive ability, learning and memory, language, visual constructional-perceptual ability, or social cognition) based on both the criteria listed below.
  - (a) Report or concern for significant cognitive decline by patient, a knowledgeable informant, or by the clinician
  - (b) Quantifiable documentation of cognitive deficits, preferably with standard neuropsychological testing, typically > 2.0 standard deviations (SD) below the mean (or below the 2.5th percentile) based on a reference population (i.e., comparable with respect to age, gender, education, premorbid functioning, and cultural background)
2. The documented cognitive impairments significantly interfere with the individual's ability to



**Dementia and Neurocognitive Disorders, Fig. 1** Model integrating Alzheimer's disease biomarkers and immunohistology.  $A\beta$  amyloid  $\beta$ . *FDG-PET* fluorodeoxyglucose Positron Emission Tomography, *CSF* Cerebrospinal Fluid, *MCI* mild cognitive impairment. The gray area denotes abnormal pathophysiological changes below the biomarker detection threshold (black line). In this model, tau pathology precedes other markers at a sub-threshold level.  $A\beta$  deposition occurs independently and rises above the biomarker detection threshold (purple and

red arrows), which accelerates detection of tauopathy and *CSF tau* (light blue arrow). Later still, *FDG PET* and *MRI* (dark blue arrow) rise above the detection threshold. Finally, cognitive impairment becomes evident (green arrow) depending on the individual's risk profile (light green-filled area) (Reprinted from *The Lancet Neurology*, 12, Jack, Clifford R., et al. *Tracking pathophysiological processes in Alzheimer's disease: an updated hypothetical model of dynamic biomarkers*, 210(2013), with permission from Elsevier)

independently manage instrumental activities of daily living (ADLs) (i.e., complex activities such as driving, medication, and financial management).

3. The cognitive deficits do not occur exclusively in the context of a delirium.
4. The cognitive deficits are not wholly or primarily attributable to another Axis I disorder (e.g., Major depressive disorder, schizophrenia).

## Research Criteria

The National Institute on Aging (NIA) and the Alzheimer's Association have spearheaded research criteria updates based on burgeoning information regarding utility of biomarkers in preclinical detection, tracking disease burden, and evaluating efficacy of treatment interventions in AD (Albert et al. 2011). While these updates have been made to AD research criteria, the pattern of differentiation between the syndromic presentations (preclinical, MCI, and dementia) will be common to most etiologies of dementia.

The following section outlines the criteria for these syndromes. Figure 1 is a model demonstrating the temporal pattern of involvement of biomarkers across clinical diagnoses (Jack et al. 2013).

## Preclinical Stage

It is now possible to identify the presence of biomarkers of neurodegenerative disease years before clinical detection of symptoms or syndromes. Biomarkers for AD include genetic, molecular, neuroimaging modalities, and neurocognitive assessment (Knopman 2013; Fields et al. 2011; Smith and Bondi 2013). For AD, genetic markers include causative genetic mutations (Sherrington et al. 1995), as well as susceptibility genes such as apolipoprotein E (APOE) gene (Knopman 2013). Neuroimaging biomarkers include positron emission topography (PET) for amyloid detection and phosphorylated tau accumulation in the brain (Knopman et al. 2013), MRI for hippocampal volume loss, and accumulation of  $a$ -beta42 in the cerebrospinal fluid are typically used in AD (Jack et al. 2011). However, presence of neuroimaging biomarkers

is not definitive for future cognitive impairment as shown in a population based sample where over 50% of older adults demonstrated neurodegenerative findings on neuroimaging but demonstrated cognitive normality (Knopman et al. 2013).

### Mild Cognitive Impairment

The NIA-Alzheimer's Association work group on MCI (Albert et al. 2011) proposed core criteria for MCI followed by characterization of biomarker data to identify level of certainty for presence of AD etiology. The core MCI features are comparable to mND diagnostic criteria and include:

1. Concern or report of change in level of cognitive function by patient, a knowledgeable informant, or a skilled clinician.
2. Presence of decline from estimated premorbid level of functioning in one or more cognitive domains including memory, executive function, attention, language, and visuospatial skills. If serial cognitive evaluations are present, there must be a progressive decline in scores.
3. Preservation of independence in functional abilities. Patients with MCI may struggle with complex activities such as managing finances and preparing a meal but are generally able to function independently with minimal aids or assistance.
4. Absence of dementia: Observed changes should not significantly impede social or occupational activities.

### Dementia

Similar to MCI core symptoms, the NIA-Alzheimer's Association work group provided diagnostic guidelines for core dementia criteria (McKhann et al. 2011):

1. Interfere with the ability to function at work or at usual activities
2. Represent a decline from previous levels of functioning and performing
3. Are not explained by delirium or major psychiatric disorder
4. Quantifiable impairment in two or more cognitive domains

The guidelines elucidate on criteria for prominent cognitive and behavioral symptoms observed in dementia (minimum of two of the following (McKhann et al. 2011)):

- (a) Memory: Impairment in encoding and recall of recent information. Individuals may ask repetitive questions, frequently misplace belongings, forget appointments, or get lost on a familiar route.
- (b) Executive function: Impaired reasoning and difficulty completing complex tasks. Individuals may demonstrate poor decision-making, poor understanding of safety risks, and may be unable to manage finances or plan complex activities.
- (c) Visuospatial functioning: Individuals may have object agnosia, impaired face recognition, simultanagnosia and alexia, difficulty operating simple implements, or demonstrate difficulty finding objects despite good acuity.
- (d) Language (speaking, reading, and writing): Individuals may have word retrieval difficulty while speaking, speech may be hesitant, and writing may involve spelling or grammatical errors.
- (e) Changes in personality, behavior, or compartment – symptoms include: Individual demonstrates uncharacteristic mood fluctuations such as agitation, impaired motivation, initiative, apathy, loss of drive, social withdrawal, and decreased interest in previous activities, loss of empathy, compulsive or obsessive behaviors, and socially unacceptable behaviors.

### Role of Neuropsychological Assessment

The strongest predictive power for progression to dementia is demonstrated by cognitive biomarkers (Fields et al. 2011). Neuropsychological assessments can provide measurable data regarding cognitive performance comparing the individual to a normative sample (ideally based on age, education, gender, and ethnicity) and accounting for confounding factors such as preexisting areas of cognitive weakness, preexisting mood disorder, and motivational factors. Neuropsychological evaluation can assist with diagnostic clarification

and to establish a baseline evaluation of cognitive function, should clinical features in the future warrant a reevaluation. These tests may be of greatest value in mild cognitive impairment or early dementia states as cognitive performance in most domains deteriorates due to eventual disease encroachment on neighboring neural structures and can be difficult to differentiate etiology at later stages of the disease.

Neurocognitive assessments may broadly use the heuristic “cortical” or “subcortical” to classify dementia syndromes based on typical pattern of cognitive impairment (Whitehouse 1986; Salmon and Filoteo 2007). A typical “cortical” dementia such as AD can be characterized by deficits in memory, language, and visuospatial and executive functioning. “Subcortical” dementias (vascular dementia or Parkinson’s disease) typically present with motor dysfunction in addition to reduced processing speed and prominent early deficits in executive function, visuosperceptual and constructional abilities. However, from a neuropathological perspective, these profiles are often mixed as patients with “cortical” dementia will often demonstrate abnormal neuropathology in “subcortical” regions, which speaks to the potential presence of neuropathological biomarkers before clinical symptom presentation as seen in Fig. 1. Neurocognitive performance in frontotemporal dementia and dementia due to Lewy body disease (LBD) may demonstrate a mixed cortical/subcortical pattern.

## Etiologies

### Alzheimer’s Disease

Majority of individuals diagnosed with dementia will demonstrate etiology consistent with AD. Neuropathology reveals neuronal loss associated with presence of neuritic plaques (deposition of amyloid) and neurofibrillary tangles (accumulation of tau abnormalities) (McKhann et al. 2011).

#### MCI or mND due to AD (Research Criteria)

The individual meets criteria for MCI or minor neurocognitive disorder as outlined previously

(Ganguli et al. 2011; American Psychiatric Association 2013). A majority of patients with MCI due to AD demonstrate prominent impairment in episodic memory (i.e., amnesic MCI), but other patterns of cognitive impairment can also progress to AD over time (e.g., multidomain MCI, executive dysfunction/nonamnesic MCI, or visual spatial impairments in the posterior cortical atrophy variant of AD). Presence of a positive topographic (e.g., MRI evidence of medial temporal atrophy, or FDG PET evidence of age-adjusted temporoparietal hypometabolism) or molecular neuropathology of AD (e.g., lower CSF A $\beta$ -42 and raised CSF tau measures) when available can further characterize the pattern of MCI (Albert et al. 2011). To further classify patients based on level of certainty of etiology, the following research criteria for AD are proposed (Albert et al. 2011):

1. MCI of a neurodegenerative etiology: Low confidence of AD etiology
  - (a) Core features of MCI are present.
  - (b) Negative or ambiguous biomarker evidence (topographic or molecular biomarkers).
2. MCI of the Alzheimer type: Intermediate confidence of AD etiology
  - (a) Core features of MCI are present.
  - (b) Presence of one or more topographic biomarkers (MRI evidence of medial temporal atrophy or FDG PET pattern of hypometabolism in the temporoparietal region).
  - (c) Absence of molecular biomarker information.
3. Prodromal Alzheimer’s dementia: High confidence of AD etiology
  - (a) Core features of MCI are present.
  - (b) Presence of molecular neuropathology of AD (e.g., lower CSF A $\beta$ -42 and raised CSF tau measures).
  - (c) Further increased certainty with presence of a topographic biomarker. However, absence or equivocal findings are still consistent with the highest level of certainty that the individual will progress to AD dementia over time.

### Dementia due to AD (or MND Due to AD)

The most common syndromic profile of AD dementia is an amnesic presentation. The deficits should include impairment in learning and recall of recently learned information in addition to significant impairments in other cognitive domains as outlined in the dementia criteria described above. McKhann and colleagues (2011) also proposed levels of certainty in AD diagnosis characterized by neuropathological biomarkers, primarily used in research settings (McKhann et al. 2011).

#### 1. Probable AD dementia:

Meets clinical and cognitive criteria for dementia given above with primary amnesic presentation. There is no evidence of alternative diagnoses, specifically, no significant cerebrovascular disease. In these individuals, presence of any *one* of the three features increases certainty of AD:

- (a) *Documented decline*: Subsequent evaluations demonstrate progressive cognitive decline based on a knowledgeable informant or cognitive testing (brief mental status screens or neuropsychological testing).
- (b) *Biomarker positive*: Has one or more of the following supporting biomarkers.
  - (i) Low cerebrospinal fluid A $\beta$ 42, elevated cerebrospinal fluid tau or phospho tau
  - (ii) Positive amyloid PET imaging
  - (iii) Decreased FDG uptake on PET in temporoparietal cortex
  - (iv) Disproportionate atrophy on structural MR in medial temporal lobe (especially hippocampus), basal and lateral temporal lobe, and medial parietal isocortex
- (c) *Mutation carrier*: Meets clinical and cognitive criteria for AD dementia and has a proven AD autosomal dominant genetic mutation (PSEN1, PSEN2, and APP).

#### 2. Possible AD dementia.

- (a) *Atypical course*: Evidence for progressive decline is lacking or uncertain but meets other clinical and cognitive criteria for AD dementia

- (b) *Biomarkers obtained and negative*: Meets clinical and cognitive criteria for AD dementia but biomarkers (CSF, structural or functional brain imaging) do not support the diagnosis

- (c) *Mixed presentation*: Meets clinical and cognitive criteria for AD dementia but there is evidence of concomitant cerebrovascular disease; this would mean that there is more than one lacunar infarct; or a single large infarct; or extensive and severe white matter hyperintensity changes; or evidence for some features of dementia with Lewy bodies (DLB) that do not achieve a level of a diagnosis of probable DLB.

#### 3. Not AD Dementia

- (a) Does not meet clinical criteria for AD dementia.
- (b) Has sufficient evidence for an alternative diagnosis such as HIV, Huntington's disease, or others that rarely, if ever, overlap with AD.

- 4. *Pathologically proven AD dementia*. Meets clinical and cognitive criteria for probable AD dementia during life AND is proven AD by pathological examination.

### Vascular Dementia

In 2011, the American Heart Association and American Stroke Association workgroup jointly published consensus definitions and recommendations for the vascular contributions to mild cognitive impairment and dementia (Gorelick et al. 2011). Vascular pathology includes ischemic and/or hemorrhagic cardiovascular disease (CVD), other cerebrovascular insults (subclinical brain infarction [SBI]), multiple small vessel disease, or cerebral autosomal dominant arteriopathy with subcortical infarcts and leukoencephalopathy (CADASIL).

#### Vascular MCI

##### 1. Probable VaMCI:

- (a) Meets core MCI criteria (Albert et al. 2011).
- (b) Presence of clear temporal relationship between a vascular event (e.g., clinical stroke) and onset of cognitive deficits.

- (c) Onset of cognitive deficits or relationship in the severity and pattern of cognitive impairment and the presence of diffuse, subcortical cerebrovascular disease pathology (e.g., as in CADASIL).
  - (d) No history of gradually progressive cognitive deficits before or after the stroke that suggests the presence of a nonvascular neurodegenerative disorder.
2. Possible VaMCI:
- (a) Meets core MCI criteria (Albert et al. 2011).
  - (b) Presence of cognitive impairment and imaging evidence of cerebrovascular disease.
  - (c) *No* clear relationship (temporal, cognitive pattern or severity) between the demonstrated vascular disease (e.g., silent infarcts, subcortical small-vessel disease) and onset of cognitive deficits.
  - (d) There is insufficient information for the diagnosis of VaMCI (e.g., clinical symptoms suggest the presence of vascular disease, but no CT/MRI studies are available).
  - (e) Severity of aphasia precludes proper cognitive assessment. However, patients can be classified as probable VaMCI with documented normal cognitive function (prior cognitive evaluations) before the vascular event that resulted in aphasia.
  - (f) There is evidence of other neurodegenerative diseases or conditions in addition to cerebrovascular disease that may affect cognition, such as:
    - (i) A history of other neurodegenerative disorders (e.g., Parkinson disease, progressive supranuclear palsy, dementia with Lewy bodies).
    - (ii) The presence of Alzheimer's disease pathology is confirmed by biomarkers (e.g., PET, CSF, amyloid ligands) or genetic studies (e.g., PS1 mutation).
    - (iii) A history of active cancer or psychiatric or metabolic disorders that may affect cognitive function.
3. Unstable VaMCI:
- Subjects with the diagnosis of probable or possible VaMCI whose symptoms revert to

normal should be classified as having “unstable VaMCI.”

#### Vascular Dementia (VaD)

Individuals meet criteria for core features of dementia (decline in cognitive function and deficit in two cognitive domains) (McKhann et al. 2011) with sufficient severity to affect a person's ADLs. In addition, the impairments in ADLs are independent of the motor/sensory sequelae of a vascular event (Gorelick et al. 2011). Criteria for probable and possible VaD are similar to those stated for VaMCI, but these individuals demonstrate significant impairment in activities of daily living to meet criteria for dementia (vs. MCI criteria).

#### Lewy Body Disease (LBD)

Lewy bodies are intraneuronal inclusions primarily made of alpha-synuclein (McKeith et al. 2005). High concentration of inclusions in substantia nigra are associated with Parkinsonism (e.g., idiopathic Parkinson's disease), where subsequent onset of dementia is termed Parkinson's disease dementia (PDD). On the other hand, presence of inclusions in the cortex can lead to Lewy body disease (LBD), which can refer to any syndromic presentation of Lewy body (preclinical, MCI, and dementia). Dementia with Lewy Body (DLB) refers solely to the dementia syndrome due to LBD.

#### Mild Cognitive Impairment of LBD

Presence of REM Sleep Behavior disorder (RBD), which was included in the last revision of DLB criteria (McKeith et al. 2005), has demonstrated 52.4% increased 12-year risk of developing DLB (Postuma et al. 2009) and is thought to be associated with presence of synucleinopathy (McKeith et al. 2005). Therefore, presence of RBD and cognitive decline can be a type of MCI due to LBD and may include other cardinal symptoms such as Parkinsonism or visual hallucinations. The cognitive profile of MCI with LBD shows prominent visuospatial and/or attention deficits, nonamnestic profile.

#### Dementia with Lewy Body Disease (DLB)

International diagnostic criteria (McKeith et al. 2005) include:

1. Central feature (for diagnosis of possible or probable DLB): Presence of dementia (i.e., progressive cognitive decline which significantly interferes with daily functioning)
  - (a) Prominent or persistent memory impairment may not necessarily occur in the early stages but is usually evident with progression.
  - (b) Deficits on tests of attention, executive function, and visuospatial ability may be especially prominent.
2. Core features (Probable DLB: 2 features, Possible DLB: 1 core feature)
  - (a) Fluctuating cognition with pronounced variation in attention and alertness
  - (b) Recurrent visual hallucinations that are typically well formed and detailed
  - (c) Spontaneous features of Parkinsonism
3. Suggestive features (Probable DLB: at least 1 suggestive feature and at least 1 core feature while possible DLB includes: at least 1 suggestive feature in the absence of core features)
  - (a) REM sleep behavior disorder
  - (b) Severe neuroleptic sensitivity
  - (c) Low dopamine transporter uptake in the basal ganglia demonstrated by SPECT or PET imaging
4. Supportive features (commonly present but not proven to have diagnostic specificity)
  - (a) Repeated falls and syncope
  - (b) Transient, unexplained loss of consciousness
  - (c) Severe autonomic dysfunction, e.g., orthostatic hypotension, urinary incontinence
  - (d) Hallucinations in other modalities
  - (e) Systematized delusions
  - (f) Depression
  - (g) Relative preservation of medial temporal lobe structures on CT/MRI scan
  - (h) Generalized low uptake on SPECT/PET perfusion scan with reduced occipital activity
  - (i) Abnormal (low uptake) MIBD myocardial scintigraphy
  - (j) Prominent slow wave activity on EEG with temporal lobe transient sharp waves
5. A diagnosis of DLB is less likely:
  - (a) With evidence of cerebrovascular disease (focal neurologic signs or on brain imaging)
    - (b) In the presence of any other physical illness or brain disorder sufficient to account in part or in total for the clinical picture
    - (c) If the parkinsonism only appears for the first time at a stage of severe dementia
6. Temporal sequence of symptoms:
 

DLB should be diagnosed when dementia occurs before or concurrently with parkinsonism (if it is present). The term Parkinson disease dementia (PDD) should be used to describe dementia that occurs in the context of well-established Parkinson disease. In a clinical practice setting, the term that is most appropriate to the clinical situation should be used and generic terms such as LB disease are often helpful.

### Frontotemporal Lobar Degeneration

Frontotemporal lobar degeneration (FTLD) is a heterogeneous collection of diagnoses (Pick's disease or Primary Progressive Aphasia) and syndromes (FTD with motor neuron disease, corticobasal degeneration), and etiologies (e.g., tauopathies versus TDP-43 proteinopathies) (Smith and Bondi 2013; Josefs 2008).

Frontotemporal dementia (FTD) refers to the dementia phase of FTLD. Currently, the three main recognized phenotypes of FTD are: behavioral variant-FTD (bvFTD), semantic dementia (SD), and primary progressive aphasia (PPA). Furthermore, PPA can be subclassified into three variants: logopenic (lvPPA), semantic (svPPA), and agrammatic (agPPA) or nonfluent progressive aphasia (PNFA) (Gorno-Tempini et al. 2011). Pathology for semantic and agrammatic variants of PPA are largely consistent with tauopathies and TDP-43 suggestive of FTLD spectrum disorders, while the lvPPA variant is strongly associated with AD pathology (Josefs 2008). The diagnosis of FTD is challenging due to the complexity and heterogeneity in FTLD. Individuals may be misdiagnosed as psychiatric disorder or AD early in the disease course.

Preclinical stage of FTD involves being a carrier of genetic mutations associated with FTD such as MAPT, GRN, and C9ORF72 genes (Rohrer et al. 2013). The behavioral variant FTD presents with impairments in "social cognition"

including behavioral disinhibition, apathy, loss of empathy, perseverative or compulsive behavior, and hyperorality or dietary changes early in the disease process (Piguet et al. 2011). Other variants of FTD demonstrate predominant language or speech deficits. Core features of semantic PPA include impaired naming and single-word comprehension. Logopenic variant of PPA is characterized by hesitant speech (impaired single-word retrieval in speech) and impaired repetition of complex sentences. Core features of the agrammatic variant of PPA are agrammatism in speech or written output and reduced comprehension (Gorno-Tempini et al. 2011).

## Conclusion

Recent advancements in biomarkers in varied scientific fields including molecular genetics, neuroimaging, behavioral neurology, and neuropsychology have accelerated research and shifted nomenclature in neurodegenerative disease. Identification of these biomarkers has led to a clear articulation of the distinction between syndromic phases of neurodegenerative disease across most dementia etiology (preclinical or asymptomatic phase, mild cognitive impairment, and dementia). It is now possible to have biomarkers of neurodegenerative disease without being (and possibly never becoming) symptomatic. These changes will be instrumental in future research focused on prevention, early detection, or delayed progression to dementia (Smith and Bondi 2013).

## Cross-References

- ▶ [Alzheimer's Disease, Advances in Clinical Diagnosis and Treatment](#)
- ▶ [Delirium](#)
- ▶ [Frontotemporal Dementia \(FTD\)](#)
- ▶ [Geriatric Neuropsychological Assessment](#)
- ▶ [Lewy Body Disease](#)
- ▶ [Mild Cognitive Impairment](#)
- ▶ [Primary Progressive Aphasia](#)

- ▶ [Vascular and Mixed Dementia](#)
- ▶ [Young-Onset Dementia, Diagnosis, Course, and Interventions](#)

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## Cognition

Thinking skills or abilities that include attention, processing speed, working memory, language, visuospatial skills, language, and executive functioning

## Introduction

As an age group, older adults have a smaller prevalence rate for depression compared to middle-aged adults that continues to decrease with advancing age (e.g., Byers et al. 2010). Although the prevalence of depression is lower with older age, the effects of depression in the daily life of patients may be greater with advancing age due to other factors that make older adults a more vulnerable population (e.g., decrease in physical health, cognitive changes due to normal aging, comorbidity with other health/mental health disorders). In particular, cognitive declines due to age-related changes in the brain may compound the effects of depression on the daily functioning of older adults.

A review of the rate of comorbid depression and cognitive impairment in older adults estimated it to double every 5 years after the age of 70, with over 25% of community dwelling 85-year olds living with comorbid MDD and cognitive impairment (Ellen and David 2010). Lee et al. (2007) noted that a high number of depressed older adults present with “mild cognitive impairment,” defined in the literature as the stage between normal aging and dementia. Moreover, these cognitive impairments that accompany an acute depressive episode continue long after the remission of depressive symptoms (Ellen and David 2010; Lee et al. 2007). Furthermore, in a recent review and meta-analysis by Diniz et al. (2013), they determined that late-life (geriatric) depression is in fact associated with a higher risk of dementia, including vascular and Alzheimer's disease.

This encyclopedia entry will first review the neurobiological effects of depression in older adults. Then it will describe the effects of

## Depression and Cognition

Rowena Gomez and Garima Jhington  
Pacific Graduate School of Psychology, Palo Alto  
University, Palo Alto, CA, USA

## Synonyms

Mood disorder; Neuropsychology

**Depression** A psychiatric disorder that includes symptoms of sad mood, hopelessness, poor sleep and appetite, guilt or worthlessness, low energy, and severe suicidal thoughts

depression on global cognitive functioning as well as specific cognitive domains including attention and working memory, processing speed, spatial skills, language, memory, and executive functioning. Afterward, the special considerations of age moderating the impact of depression on cognition, dementia/pseudodementia, and the effects of antidepressants on cognition will be covered.

## Neurobiology of Depression in Older Adults

The impact of depression on cognition in older adults and in other age groups has been hypothesized to be mediated by the neurobiological effects of depression in the brain. In fact, there are several different hypotheses about how this mediation occurs. For instance, there is evidence that older adults with depression have a higher prevalence risk for cardiovascular disease and dementia. There is a “vascular depression hypothesis” (e.g., Sneed and Culang-Reinlieb 2011) that theorizes that heart disease may cause, be a result of, or prolong depression in older adults. Furthermore, this link has also been connected to brain-related changes. For instance, MRI studies have found significant relations between ischemic lesions in the brain and depression severity or diagnosis (Sneed and Culang-Reinlieb 2011). Specifically, for late-life depression, the vascular depression hypothesis is specific regarding the location of deep white matter hyperintensities (DWMH) within frontostriatal circuits that are involved in executive functioning (Sneed and Culang-Reinlieb 2011). In the update by Sneed and Culang-Reinlieb (2011), the authors reported other MRI studies that have found DWMH, reduced volume in frontal and sub-cortical areas, neuronal abnormalities within the prefrontal cortex, and reduced neuronal density in the dorsolateral and ventromedial areas of the caudate nucleus. Sneed and Culang-Reinlieb concluded that neuronal abnormalities in some LLD are present in the frontal and striatal brain regions, which is consistent with the vascular depression hypothesis.

In a review by Byers and Yaffe (2011), they reported several other neurobiological factors related to how depression can impair cognition

through changes in the brain in older adults. These factors include increased levels of cortisol and hippocampal atrophy, increased deposition of  $\beta$ -amyloid plaques, inflammatory changes, and deficits of nerve growth factors. In relation to greater cortisol, higher levels of depression would cause the HPA axis to increase glucocorticoid production that would damage the hippocampus and result in a downregulation of glucocorticoid receptors ultimately resulting in a vicious cycle leading to impairments in cognition. As for beta-amyloid relationships, Byers and Yaffe hypothesized that depression may increase  $\beta$ -amyloid production due to a stress response to depression resulting increase of cortisol. Although the research findings are mixed, they reported some evidence that depression with a high ratio of plasma  $\beta$ -amyloid peptide 40 (A $\beta$ 40) to A $\beta$ 42 has been associated with memory, visuospatial abilities, and executive function deficits. As for the inflammation hypothesis, Byers and Yaffe stated that depression is associated with increased levels of cytokines that can lead to a decrease in inflammatory and immunosuppressant regulation, resulting in inflammation of the central nervous system that would ultimately result in cognitive impairment and an increase risk of dementia. The increase in cytokines may also interfere with serotonin metabolism that can lead to decrease in synaptic plasticity and hippocampal neurogenesis. Lastly, they mentioned problems with nerve growth factors, specifically, such as brain-derived neurotrophic factor (BDNF). They stated that impairments in BDNF functioning have been found in animal and human models of depression that have been linked to declines in cognitive functioning.

In all, there seems to be multiple pathways of how neurobiological changes due to depression can then impact cognitive functioning and increase the risk of cognitive disorders, including dementia. More research is needed in this area to determine which pathways are most related to cognitive decline in geriatric depression.

## Depression on Cognition in Older Adults

### Mental Status

Mental status is also commonly referred to as global cognitive functioning as is typically

measured using the mini mental status exam. Older adults with depression have been found to have lower MMSE scores than healthy older adults (Pantzar et al. 2014). But this may also be related to the depressed group being older (healthy control age mean = 72.6 years, mild depression mean = 78.6 years, and moderate-severe depression mean = 75.9 years) and having less years of education (healthy control education mean = 12.1 years, mild depression mean = 10.7 years, and moderate-severe depression mean = 10.5 years). However, in a study by Rapp et al (2005), they also found significantly lower MMSE scores in the older adults with recurrent or late-onset depression versus those with no history of or current depression. These diagnostic groups did not significantly differ in age, years of education, nor gender.

In a 13-year longitudinal study, depression at baseline predicted decline in general cognitive functioning using the MMSE even after controlling for covariates that include age, sex, and years of education (van den Kommer et al. 2013). Using the Cognitive Abilities Screening Instrument (CASI) as a measure of global cognition, greater depression severity is related to poorer cognitive performance even after controlling for age and education in elderly Chinese males (Tzang et al. 2015).

Thus, research indicates substantial evidence that global cognitive functioning is impaired in older adults with depression.

### Attention and Working Memory

Simple attention can be defined as the limited capacity to passively hold information in the mind such as repeating a list of numbers in the same order spoken as in Digit Span Forward from the Wechsler Adult Intelligence Scale. For this task, no effects of depression on attention were found in American (Pantzar et al. 2014) and Chinese older adult samples with depression (Tzang et al. 2015).

Working memory is related to general attention but includes active (versus passive) manipulation specifically reversing the order of digits, such as in Digit Span Backward. In Digit Span Backward, no effects of depression were found in American (Pantzar et al. 2014) and Chinese older adult

samples (Tzang et al. 2015). In another study that used the N-back task as a measure of working memory, the depression group performed worse than healthy older adults (Nebes et al. 2000). This deficit was also seen in older adults whose depression remitted compared to older adults without any history of depression (Nebes et al. 2000).

### Processing Speed

Processing speed is broadly defined as the rate at which an individual can process incoming information in order to carry out a task (e.g., Nebes et al. 2000). While normal aging has been known to slow down the speed of information processing for a majority of older adults (Salthouse 1996), this cognitive domain is significantly more impaired in older adults with depression (Dybedal et al. 2013; Ellen and David 2010; Pantzar et al. 2014) compared to healthy older adults. Using the trail-making task, Rapp et al. (2005) found no significant processing speed differences in the easier task of Trail A but did find differences in diagnostic groups on a harder task of Trail B, where older adults with no history or no current depression were faster than older adults with recurrent depression and slowest with older adults with late-onset geriatric major depression (when the age of onset for a first episode of depression occurs is 65 years old or older). Another study also concluded slowed speed of information processing persist even after the clinical symptoms of depression remit in older adults (Thomas and O'Brien 2008). Butters et al. (2004) and Dybedal et al. (2013) also determined that late-life depression is associated with a slower speed of information processing. In fact, Sheline et al. (2006) concluded that processing speed has emerged as the most salient cognitive impairment in older adults diagnosed with depression.

Longitudinal studies have also found associations between depression and slower processing speed in older adults. For instance, a 9-year longitudinal study examined the impact of depression on cognitive functioning in older women (Rosenberg et al. 2010) found that baseline depression ratings were strongly associated with impairments on measures of psychomotor speed. Another longitudinal study examining a large

cohort of older adults found that the level of depression at baseline predicted the rate of decline in speed of information processing, such that more severe depression led to slower speed consistently during the 13-year follow-up period (van den Kommer et al. 2013). These results remained even after controlling for age, sex, and education. Notably, the slower processing speed at baseline also predicted worsening of depression severity over time.

Salthouse has theorized that the effects of declines in cognitive functioning such as memory and executive functioning are mediated by slowed processing speed in older adults (Salthouse 1996). This also appears to be true in older adults with depression. For instance, Nebes and colleagues (2000) conducted hierarchical regression analyses that depression explained a significant amount of neuropsychological variance on global cognition, visuospatial construction, and verbal and visual memory. However, when processing resources (working memory as measured by then-back task and processing speed as measured by digit symbol substitution test) were removed first, depression no longer accounted for a significant amount of neuropsychological performance. Butters et al. (2004) also determined that late-life depression is associated with a slower speed of information processing, which then impacts all other cognitive domains including memory, language, visuospatial skills, and executive functioning. In addition, Sheline et al (2006) found that processing speed mediated the impact of other factors including age, education, race, depression severity, and vascular risk factors on working memory, episodic memory, language processing, and executive functioning (Sheline et al. 2006). However, in a relatively more recent 4-year longitudinal study, Köhler et al. (2010) found that although processing speed partially mediated some of the deficits in their depressed older adult participants, it did not adequately account for the differences between them and the normal control group participants.

### Visuospatial Ability

In general, there are only a few studies that examined spatial ability in geriatric depression. Using

simple drawings and block design, Butters et al. (2004) found significant differences between older adults with late-life depression and healthy older controls. Nebes and colleagues (2000) found depression group differences (recurrent/current depression, remission from depression, and no history of depression) on a block design task. Notably, when controlling for working memory or processing speed, the effects of depression on the visual-construction task were no longer significant. In a timed, visual pattern-matching task, there was no difference in correct responses between older adults with depression and those without depression, but those with depression had overall slower reaction time compared to the controls (Hofman et al. 2000). Incidentally, when controlled for MMSE scores, the older adults with depression had similar reaction times on this task as those with dementia. In a mental rotation task, no differences were found between older adults with depression and were not on antidepressants compared to healthy older adults (Pantzar et al. 2014).

In sum, these studies indicate limited evidence of the association of depression with impairments in visuospatial and visuo-construction skills.

### Language

As in visuospatial ability, relatively less research has been conducted in examining the relation of depression and language, compared to other cognitive domains in older adults. Dybedal and colleagues (2013) found that after controlling for age, there were no differences between the older adults with versus those without depression on animal or letter fluency. Similarly, Butters et al. (2004) found impaired language performance of older adults with late-life depression compared to healthy older adults for a task of verbally naming pictures but no differences on letter or animal fluency. Furthermore (Rapp et al. 2005), no diagnostic group differences were found between older adults with recurrent depression, late-onset depression, remitted depression, and no history of depression. In conclusion, the limited research in this cognitive domain indicates that there is generally little to no relationship between depression and language ability.

## Learning and Memory

Memory has been one of the most studied cognitive domains for depression in older adults as well as other age groups. Many studies have focused on verbal memory and most commonly used word lists or stories to measure learning, short- and long-term recall, and recognition. In older adults, many studies have found poorer memory performance in depressed groups versus healthy controls (Butters et al. 2004; Pantzar et al. 2014). For instance, Rapp et al. (2005) used a 10-item list learning task and found that older adults with no history of depression and no current depression performed significantly better on learning, delayed recall, and recognition compared to older adults with recurrent depression and those with late-onset depression.

Studies have also found that poorer verbal memory performance is related to increased severity levels of depression. A relatively recent study (Mesholam-Gately et al. 2012) examined learning and memory performance in older adults with two severity types of depression using the California Verbal Learning Test. The study compared older adults with minor depression (defined as “subsyndromal depression that meets duration criteria but not symptom count criteria for Major Depressive Episode”) (Mesholam-Gately et al. 2012, p. 197), to those meeting criteria for major depressive disorder, and healthy control participants. The findings indicated individuals with major depressive disorder performed significantly worse than older individuals with minor depressive symptomatology, who in turn performed comparably to normal control participants. Similarly, a population-based study found that only older adults with moderate to severe levels of depressive symptomatology had verbal memory impairments compared to healthy controls (Pantzar et al. 2014). However, no differences were found between the older adults with mild depression from the healthy controls.

Longitudinal studies have also indicated a predictive relationship between depression and verbal memory. For instance, in a 9-year longitudinal study examining the impact of depression on cognitive functioning in older women, Rosenberg et al. (2010) found that baseline depression ratings

were strongly associated with greater verbal memory declines in a list learning task, over time.

However, not all studies have reported significant results. For example, Butters et al. (2004) found no group differences with older adults with late-life depression compared to healthy older adults on verbal memory performance for story and list learning tasks. Consistent with this, Dybedal et al. (2013) conducted a more recent study that also found no verbal memory differences on a list learning task between those with late-life depression and healthy older adults after controlling for age.

In comparison to verbal memory, there are relatively fewer studies that examined the relation between depression and spatial memory in older adults, compared to verbal memory. Burt et al. (2000) found that within a group of patients diagnosed with major depressive disorder, patients older than 60 years showed significantly greater impairments on a delayed memory task of visuospatial construction and organization (Rey complex figure test) compared to younger patients. Additionally, depression severity was significantly associated with poor delayed recognition. In contrast, Dybedal et al. (2013) found no visual memory differences between those with late-life depression and healthy older adults after controlling for age.

In sum, while there are substantial evidences that depression and depression severity impair verbal memory in older adults, the findings are not always consistent. Conflicting findings can be due to differences in sample size, medication, types of memory task, and use of covariates in the data analyses. In visual memory, the research is relatively sparse and indicates further need of more research in this area.

## Executive Functioning

Executive functioning is a broad term used to refer to higher-order cognitive skills involved in carrying out goal-directed behavior. The skills involved in executive, goal-directed behavior include, but are not limited to, identifying future goals, developing a plan, reasoning, solving complex problems, choosing among various alternatives, and inhibiting irrelevant responses. Many studies have found executive function to be one of

the most profoundly impacted cognitive domains in depressed older adults (Lockwood et al. 2002; Pantzar et al. 2014; Rapp et al. 2005).

There are many studies that have found significant relationships between depression and poorer executive functioning in older adults. In particular, the performance of older adults with depression on executive measures revealed impairments in response to initiation and inhibition (e.g., Dybedal et al. 2013), active switching (e.g., Butters et al. 2004; Dybedal et al. 2013; Pantzar et al. 2014), and problem solving using error feedback (Lockwood et al. 2002). Longitudinal studies have also shown declines in executive functioning in geriatric depression such as in a 9-year longitudinal study that examined the impact of depression on cognitive functioning in older women. Rosenberg et al. (2010) found that, in terms of subtypes of depression, both early and late onset of depression in the elderly, has also been linked to executive functioning deficits (e.g., Butters et al. 2004). However, the decline in executive functioning has been found to be greater for older adults with late-onset than the early-onset cohort (Herrmann et al. 2007).

Notably, antidepressant treatment and remission studies have also found that executive dysfunction can still occur in older adults. Dybedal et al. (2013) found that older adults with late-onset depression were still significantly impaired executive function compared to healthy older adults even after controlling for processing speed. Similarly, Elderkin-Thompson et al. (2007) found that older adults continued to show residual deficits in executive functioning even after successful treatment of depression. Interestingly, even when the depression is in full remission, Thomas and O'Brien (2008) found declines in executive functioning in older adults.

In all, there is substantial evidence that depression impairs executive functioning in older adults and may continue to persist despite the use of antidepressants.

### **Special Considerations: Pseudodementia Versus Depression**

Understanding the cognitive sequelae of geriatric depression is especially challenging because of

the age-related changes in the brain that may contribute to cognitive deficits or to the etiology of the depression itself. Moreover, many of the affective, behavioral, and cognitive issues among the elderly are often the result of an interaction between multiple psychiatric, neurological, and medical conditions (Ellen and David 2010).

A critical clinical question is whether cognitive deficits associated with depression resolve following remission of the depressive episode. A growing body of evidence suggests the presence of a syndrome of cognitive impairment that is reversible after the successful treatment of depression in older adults. This syndrome, popularly termed "pseudodementia" or "reversible dementia," can masquerade as dementia and, as such, is an important consideration in the differential diagnosis of dementia in the aging population (Ellen and David 2010). It is estimated that 18–57% older adults with depression present with a reversible syndrome of dementia that resolves upon alleviation of depressive symptoms (Alexopoulos and Meyers 1993). However, it is extremely challenging to reliably differentiate between geriatric depression and reversible or irreversible dementia.

This issue becomes more complicated because cognitive impairments that can result from dementia can manifest with depressive symptoms as well (Kang et al. 2014). Some researchers have suggested that depressive pseudodementia may be a transient state that eventually progresses to dementia. For example, a recent review suggested that late-life depression is a strong predictor for the progression of reversible dementia to an irreversible one (Kang et al. 2014). This is also consistent with the meta-analysis of 23 studies conducted by Diniz and colleagues (2013), which found that geriatric depression was significantly associated with higher risk of all-cause dementia, including vascular and Alzheimer's disease.

Thus, the question of pseudodementia and depression remains unclear. While some researchers have concluded that depression can mimic dementia, others state that it can also be a risk factor for dementia in late life and that depression is likely an early manifestation of dementia

rather than a risk factor for the neurodegenerative disease Panza et al. (2010).

### **Age Moderating the Impact of Depression on Cognition**

In the adult depression literature, researchers have reported greater relationships between depression and cognitive impairment in the older adult groups compared to the younger adult age groups. Sparse research indicates some evidence that this pattern also exists in the old age group. For instance, Pantzar et al. (2014) found that the effect size of depression on cognitive performance in depressed sample was greater for old-old age group (85 years and older) than young-old age group (60–84 years old).

Although there are several hypotheses of how depression causes neurobiological changes that can result on cognitive decline, there is sparse data of how chronicity of the depression affects the brain and cognitive performance in older adults. Perhaps part of that problem is because chronicity is so intimately related to age and age is a significant factor of the relation between depression and cognition, especially in old age.

### **Effects of Antidepressants on Cognition in Geriatric Depression**

In general, typical pharmacological intervention for depression includes the use of tricyclic antidepressants (TCAs) and monoamine oxidase inhibitors (MAOIs). Additionally, newer classes of antidepressant drugs including selective serotonin reuptake inhibitors (SSRIs), serotonin-norepinephrine reuptake inhibitors (SNRIs), and medications acting on noradrenergic and dopaminergic neurotransmission [e.g., bupropion (Wellbutrin)] are increasingly being used for treatment. However, when treating late-life depression, it is important to pay special attention to aging considerations for this patient population. There is evidence to suggest that age-associated changes can alter the pharmacodynamics and pharmacokinetics of drugs and dictate the type of medication and dosage that will be safe and effective for the elderly.

Researchers generally agree that the newer antidepressants including SSRIs and SNRIs have

been shown to be relatively safer for older adults (e.g., Culang et al. 2009). Some researchers postulate that the use of antidepressants in elderly patients can improve memory and other cognitive domains through their effects on improving the depressive symptoms and by the pharmacodynamic effects that are mediated by neurophysiological changes in the brain (Bali et al. 2016). For instance, Doraiswamy and colleagues (2003) pooled data from two double-blind 12-week studies that included 444 older adults with depression comparing sertraline, fluoxetine, and nortriptyline. They found that there was an improvement for short-term memory and psychomotor speed for those patients whose depression improved (responders) and had lower anticholinergic side effects. In order of the highest correlations between depression improvement and cognitive improve, it was sertraline, then nortriptyline, and then fluoxetine.

In contrast, other studies have shown that cognitive deficit either persists or still ensues after successful treatment for depression. For instance, Nebes et al. (2003) conducted a randomized double-blind design examining the effects of an SSRI (paroxetine) or a tricyclic antidepressant (nortriptyline) on cognition in older patients with depression. They found that after 12 weeks of treatment, their cognitive functioning did not improve more than the control group, suggesting that the impairment in cognition due to depression still persists despite response to antidepressants. Culang et al. (2009) conducted an 8-week, double-blind, placebo-controlled study that examined the effects of SSRI, specifically, citalopram, on neuropsychological functioning on older adults with late-life depression. They found that those who did not respond to the citalopram (depression symptoms did not improve), declines were found on verbal learning and memory and in psychomotor speed. For those who did respond to the medication, they improved in visuospatial functioning compared to nonresponders but not better than those in the placebo group.

In a recent longitudinal study by Saczynski and colleagues (2015), over 3000 adults from the National Health and Retirement Study (mean age 72) were followed for 6 years on their use of

antidepressants, depression symptoms, and cognition, as measured by a battery of cognitive test that included memory, working memory, and naming. The researchers found that those taking the antidepressants declined on cognitive tasks at the same rate as those who were not on antidepressants after controlling for baseline cognition, age, and duration of antidepressant use.

In sum, there is little evidence that antidepressant usage can improve cognitive functioning even if they improve depression severity in older adults. There is evidence that the cognitive impairments due to depression persist whether or not the older adults respond to the medications. Furthermore, there is evidence that the use of these medications will not decrease the rate of cognitive decline over time in geriatric depression.

## Conclusions

Some cognitive domains seem to be not or minimally affected by depression in older age such as attention and working memory, visuospatial skills, and language, while other cognitive domains seem to be consistently and negatively impaired by depression and/or depression severity such as processing speed, memory, and executive functioning. Mediating factor of processing speed (with but sometimes without working memory) seems to be the way depression affects higher-order or more complex cognitive functioning such as memory and executive functioning. In addition, age and medication seem to also moderate the effects of depression on some of the cognitive domains. All these studies point to a relationship between depression and cognitive functioning; however, there are diverging hypotheses about whether depression causes cognitive declines or if the relationship is bidirectional.

## Cross-References

- ▶ [Cognition](#)
- ▶ [Comorbidity](#)
- ▶ [Dementia and Neurocognitive Disorders](#)
- ▶ [Depression in Later Life](#)

- ▶ [Executive Functioning](#)
- ▶ [Executive Functions](#)
- ▶ [Memory, Episodic](#)
- ▶ [Mental Health and Aging](#)
- ▶ [Working Memory in Older Age](#)

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## Depression in Later Life

Geir Selbaek<sup>1</sup> and Tom Borza<sup>2</sup>

<sup>1</sup>National Norwegian Advisory Unit on Ageing and Health, Vestfold Hospital Trust and Oslo University Hospital, Oslo, Norway

<sup>2</sup>Centre for Old Age Psychiatric Research, Innlandet Hospital Trust, Oslo, Norway

## Definition

The term depression can have different meanings. It can be regarded as a “symptom” (low mood), a

“syndrome” (a set of symptoms with various definitions), or as a medically defined diagnosis according to a classification system. Depressive symptoms can be viewed dimensionally, from more or less normal reactions to pathologically severe depressive symptoms. The symptoms occur on a continuum of severity from mild reactions to complete disablement. The classification systems have traditionally viewed depressive symptoms and depression categorically (Baldwin 2014).

There is no defined biomarker for depression; the diagnosis is based on a clinical interview, observation, and supplemental information from relatives and caregivers. A diagnosis of depression is made according to two main classification systems: the American Psychiatric Association’s Diagnostic and Statistical Manual, Fifth Edition (DSM-5), or the International Classification of Diseases, Tenth Revision (ICD-10). To fulfill the criteria for a diagnosis of a depressive episode in ICD-10, four depressive symptoms must be present. To fulfill the criteria for a major depressive disorder (MDD) in DSM-5, at least five depressive symptoms must be present. In both systems, the symptoms have to be present for at least 2 weeks, causing clinically important impairment in daily life function, and one (DSM-5) or two (ICD-10) of the symptoms should be among the core symptoms, which are depressed mood, loss of interest or pleasure (DSM-5 and ICD-10), or decreased energy (ICD-10). DSM-5 and ICD-10 comprise similar criteria but may differ in the identification of people fulfilling the criteria for depression (Table 1).

A substantial proportion of older persons can have clinically important depressive symptoms but not fulfill the DSM-5 or ICD-10 diagnostic criteria for depression. Only DSM-5 includes specific criteria for depressive episodes with insufficient symptoms, also termed minor depressive disorder or subsyndromal or subthreshold depression. Subthreshold depressive symptoms persisting for more than 2 years may be diagnosed as dysthymia in both classification systems. In DSM-5, persistent depressive disorder also includes persistent MDD. Finally, the DSM-5

**Depression in Later Life, Table 1** Diagnostic criteria of depression according to DSM-5 and ICD-10 (abbreviated)

	DSM-5	ICD-10
Core symptoms	Depressed mood	Depressed mood
	Loss of interest or pleasure	Loss of interest or pleasure
		Decreased energy or increased fatigability
Other symptoms	Weight loss or weight gain, increased or decreased appetite	Decreased or increased appetite with corresponding weight gain
	Insomnia or hypersomnia	Sleep disturbance of any type
	Psychomotor agitation or retardation	Psychomotor agitation or retardation
	Fatigue or loss of energy	Loss of confidence and self-esteem
	Feelings of worthlessness or excessive or inappropriate guilt	Unreasonable feelings of self-reproach or excessive and inappropriate guilt
	Diminished ability to think or concentrate or indecisiveness	Diminished ability to think or concentrate
	Recurrent thoughts of death, suicidal ideation, attempt, or plan	Recurrent thoughts of death or suicide or suicidal behavior

*DSM-5* Diagnostic and Statistic Manual, Fifth Edition  
*ICD-10* International Classification of Diseases, Tenth Revision

and ICD-10 have specific criteria for bipolar depressive disorder, including different kinds of mania as part of the depressive disorder. It is important to keep in mind that DSM-5 and ICD-10 have been developed mainly in younger populations without cognitive impairment or substantial physical disease, and it has been argued that this makes the classification systems less valid in older people, particularly in the presence of cognitive impairment.

Depression in later life (DLL), also termed late-life depression or geriatric depression, is traditionally defined as depression occurring in

persons older than 65 years, but other age cutoffs have been suggested, such as 60 years and even 55 years. Conversely, it has been suggested that the DLL should use a higher age cutoff than 65, because older people now experience better health and everyday function than they did in earlier times. Older persons can have DLL as part of a previously established mood disorder, or the depression can arise for the first time in late life. DLL is sometimes subdivided according to the age of the first lifetime depressive episode. Studies have used different age cutoffs (e.g., 50, 60, or 65 years) to distinguish between depression beginning in early life (early-onset depression [EOD]) and depression with the first manifestation in later life (late-onset depression [LOD]).

There is a complicated interplay between DLL and dementia. Some important issues are summarized in Table 2.

**Epidemiology**

Depressive disorders are debilitating health problems and important causes of death for adults. Depression among adults across the life span is projected to be the leading cause of disability in middle and higher income countries by 2030. As the population of those aged 65 and over grows, DLL will become a major health problem worldwide. The prevalence estimates of DLL vary according to which diagnostic criteria have been applied, but overall the prevalence rates do not seem to be higher in older persons than they are in younger age groups. However, in subgroups of older persons, the prevalence rates are considerably higher. As in younger age groups, women are more likely to experience depression than men. Compared to the younger group of old adults, depression seems to be more common among the oldest old, often defined as 85+, as most studies find an increasing prevalence of depression with a higher age. However, the association between depression and increasing age seems to disappear when adjusting for physical disease and increased disability in older age. In

**Depression in Later Life, Table 2** Depression and dementia

Depression increases the risk of dementia	There is an association between early-life depression and risk for dementia. It is less clear whether DLL is an independent risk factor for dementia
Depression and dementia share biological pathways	Vascular disease, hippocampal atrophy, pro-inflammatory states, decreased neurotrophic factors are potential biological mechanisms linking depression and dementia
Depression as a prodromal feature of dementia	Patients with depression and substantial cognitive impairment are at an increase risk for developing dementia
People with dementia are at a higher risk of having depression	Almost one in four individuals with dementia experience significant depressive symptoms. Depression is more common in vascular dementia or dementia with Lewy bodies than in Alzheimer’s disease
Symptoms of dementia and depression overlap	Diminished interest in activities that were once enjoyed, sleep changes, psychomotor changes, and problems concentrating are common symptoms in both depression and dementia
Symptoms of depression can present different in older adults with versus without dementia	Aphasia in dementia can impede reporting of subjective depressive feelings. Thus, provisional diagnostic criteria for depression in dementia have been suggested, which include observable symptoms such as withdrawal, irritability, and agitation
Treatment of depression with antidepressants is less effective in patients with dementia	The efficacy of antidepressants for treating depression in dementia is uncertain suggesting different biological pathways in depression in patients with dementia



community-based samples, the point prevalence of MDD in older people has been reported to be between 1 and 6%, but rates for subthreshold depression seem to be two to three times higher (Meeks et al. 2011). Higher prevalence rates of depression are found among old individuals in institutions, such as residential care or nursing home care facilities. Depression is also more prevalent in individuals with somatic disease, particularly brain disorders. Depression may occur in up to half of those who suffer from Parkinson's disease or in those who have had a stroke. The prevalence estimates of depression in dementia are high but vary widely, reflecting the difficulty in defining and diagnosing depression in the context of dementia. To improve the diagnosis of depression in dementia, provisional diagnostic criteria for depression have been suggested, but their validity remains uncertain. Overall, depressive episodes in later life are more likely to be a recurrence rather than a first-time episode.

## Etiology

Several biological, psychological, and social factors can interact and thus contribute to the development of depression. A biopsychosocial model of etiology seems to be particularly appropriate to DLL, highlighting that the causes of DLL are multiple and range across all three domains (Blazer 2003). It is useful to consider both predisposing and precipitating factors when putative causes of depression in an individual are assessed. There is still limited knowledge about why some older adults develop depression and others do not, even though they seem to be affected by the same set of risk factors.

### Biological Factors

DLL regularly arises in the context of medical illness. There are several well-established physical risk factors like ischemic heart disease, chronic obstructive pulmonary disease, diabetes, malignancy, chronic pain, and organic brain diseases.

In addition, the use of drugs may play a central role in the development of depression in older adults. The role of alcohol is especially important

to consider in the etiology of DLL given that the rates of alcohol consumption have risen among older adults, and it is well established that alcohol use is linked to lower mood and depression. Older individuals also use more medication more often than younger individuals, and it has been suggested that polypharmacy may be associated with the risk of depression. However, empirical evidence is not consistent, and the results are difficult to interpret because the condition for which the medication is taken often confers an increased risk of depression. Finally, substance dependence can also be a factor in the etiology of DLL and can be easily missed if not assessed in an older patient.

### Brain Anatomy

Research indicates that certain areas or circuits of the brain are relevant to the etiology of DLL (Naismith et al. 2012). These areas include the dorsolateral prefrontal cortex, orbitofrontal cortex, anterior cingulate cortex, subcortical white matter, basal ganglia (especially striatum), and the hippocampus. Dysfunction in frontal-subcortical neural networks involving these areas seems to be associated with the onset and prognosis of DLL.

### Neurotransmitter Dysfunction

The monoamines, namely, serotonin, noradrenaline, and dopamine, are important modulating neurotransmitters for mood and behavior. Dysfunction in serotonergic and noradrenergic neurotransmission and, to a lesser extent, dopaminergic transmission has been demonstrated in DLL (Thomas 2013). An association between abnormalities in these neurotransmitters and depression is also supported by the fact that antidepressant medication targeting serotonin and noradrenaline function improves depressive symptoms. Dysfunction in other neurotransmitters associated with the occurrence of depression includes gamma-aminobutyric acid (GABA) and glutamate. All of these neurotransmitters have widespread projections to the prefrontal cortex. Even though dysfunction of monoaminergic transmission is shown in DLL, it is not completely clear how aging affects the neurotransmitters.

Some evidence suggests, however, that the age-related changes of the neurotransmitters can make older persons more vulnerable to mood disorders.

### Genetics

Hereditary factors could predispose some older persons to depression. There has been great interest in genetic susceptibility across the life cycle, but specific genetic markers for DLL have not been identified. Heritability appears to be related to multiple loci of the genetic material (DNA) with small effects rather than few loci with large effects. Genetic factors have been found to have a greater impact in DLL with EOD. Recent genetic research has focused on the serotonin transporter (5HTTLPR) gene, apolipoprotein E (ApoE) gene, brain-derived neurotrophic factor (BDNF) gene, and 5-methylenetetrahydrofolate reductase (MTHFR) gene and has found that these genes may be involved in the development and treatment response of DLL (Naismith et al. 2012).

### Immune System

Scientific knowledge regarding the interplay among the nervous, endocrine, and immune system has expanded immensely in recent years. It is suggested that these systems should be regarded as a single network that gives rise to the new discipline of psychoneuroimmunology (Thomas 2013). Research has shown that aging can lead to an increased peripheral immune response, impaired communication between the immune system in the central nervous system (CNS) and peripheral nervous system (PNS), and a shift toward a pro-inflammatory state of the immune system in the CNS. Raised levels of pro-inflammatory cytokines, such as IL-1 $\beta$ , IL-6, and TNF- $\alpha$ , have been reported in studies of DLL. It is probable that aging and comorbid diseases may alter neuroinflammation and predispose individuals to DLL (Alexopoulos and Morimoto 2011).

Dysregulation of the HPA (hypothalamic-pituitary-adrenal) axis has been suggested as a cause of depression in older and younger adults. The associated high glucocorticoid levels may have a toxic effect on the brain, particularly the hippocampus. This has been forwarded as an

explanation for the increased risk of dementia in people with depression, although findings linking high glucocorticoid levels with hippocampus atrophy are conflicting.

### Vascular Disease

There is a well-established bidirectional association between vascular disease and depression. This includes coronary heart disease as well as cerebrovascular disease (i.e., stroke). The white matter of the brain is composed mainly by myelinated nerve fibers. Lesions to the white matter identified on MRI, or white matter hyperintensities (WMH), have been studied extensively in relation to depression. It is presumed that WMH are caused by chronic hypoperfusion of the white matter and the disruption of the blood–brain barrier. WMH are related to vascular risk factors, the risk of depressive episodes, poorer remission, and cognitive impairment. The strong relationship between cerebrovascular disease and depression has led to the “vascular depression” hypothesis, which postulates that cerebrovascular disease can predispose, precipitate, and perpetuate depressive syndromes in later life by damaging frontal-subcortical circuits (Alexopoulos 2005). However, the concept of a vascular depression has received some criticism and it has proved difficult to reliably identify such a subgroup. Nevertheless, vascular disease is likely to be an important factor in about 50% of people with DLL (Thomas 2013).

### Psychosocial Factors and Personality

It is a common view that psychosocial factors are most important in mild to moderate depression, whereas biological factors play a greater role in severe depression. The scientific evidence for this view is rather limited, and the evaluation of possible psychosocial etiological factors should be part of the assessment regardless of the severity of depression.

Several psychological factors are associated with depression. Relatively little research on the association between personality and depression has been done, and the interpretation of the results is difficult. Most studies are cross-sectional or retrospective, and the recall of earlier personality

traits may be influenced by the present situation. It is also difficult to establish what came first, the depressive disease or the presumed personality trait. Furthermore, it is complicated to disentangle the contribution of the personality traits from the social situation of the person as risk factors for depression.

There is some evidence that a high level of neuroticism is linked to DLL. Neuroticism is a personality trait characterized by worry, fear, anxiety, guilt, and moodiness. People with a high level of neuroticism can be sensitive to life stressors and may interpret minor situations as threatening or hopelessly difficult. It has been suggested that older persons with depressive syndromes can display cognitive distortions, where they generally overrate their own mistakes and exaggerate negative outcomes of life events and where loss and defeat are core themes.

High levels of mastery of one's environment and self-efficacy have been shown to provide protection against DLL. A higher sense of control, an internal locus of control, and more active strategies have been found to be associated with fewer depressive symptoms (Bjorklof et al. 2013).

Learned helplessness is the idea that individuals behave according to the expectation that acting in continually stressful situations has no meaning. Older adults frequently encounter circumstances such as chronic physical illness and disability that may lead to learned helplessness, and this notion has been linked to the occurrence of DLL (Aziz and Steffens 2013).

### Life Events

Stressful life events can be seen as an integral part of becoming old, but some types of stressful life events, such as divorce or criminality, are less common in old age. It could also be argued that stressful life events are more often expected in late life, making it easier to deal with them.

As a person grows older, he or she will inevitably deal with different types of loss. For example, these losses include loss of position in society, loss of a job, loss of financial and functional independence, and loss of a social network and loved ones. These losses may produce grief that develops into depression.

Social support may act as a buffer to stressful life events, and it is documented that impaired social support is related to DLL. However, it is important to bear in mind that the majority of people who experience significant losses in old age do not develop depression. Hence, the meaning of loss has to be interpreted in the context of the person's mastery style, social situation, and other predisposing factors (Aziz and Steffens 2013).

### Clinical Picture

Several studies have shown that clinicians at various levels fail to recognize depression in older persons. There may be a tendency to attribute depressive symptoms to the normal aging process. This may also explain the reluctance of some old people to view their symptoms as signs of depression. It is important to stress the fact that depressive symptoms are not a consequence of normal aging. The most plausible reason for the low detection levels of depression is probably the rather complicated interplay between normal age-related changes, symptoms of somatic disorders and depressive symptoms. This may cause clinicians to miss the diagnosis or also hinder insight by the person with depressive symptoms.

The ICD-10 criteria for depressive episode and DSM-5 criteria for MDD are identical for both younger and older patients (Table 1). The core symptoms of depression are depressed mood, loss of interest or pleasure, and decreased energy (the latter only in ICD-10). Additional symptoms defined in the diagnostic criteria are loss of confidence, an excessive feeling of guilt or worthlessness, difficulty concentrating, change in psychomotor activity, disturbance of sleep, change in appetite with corresponding weight change, and suicidality.

The clinical presentation of depression in old people differs from what is seen in younger age groups. The aging process, cognitive impairment, reduced physical health, polypharmacy, and disability can contribute to a more heterogeneous presentation of a depression syndrome in older individuals. Older adults may be less likely to

describe their suffering in ways that match up to common depressive symptoms. For instance, older persons with frank depression rarely describe experiencing feelings of sadness. This has led to the term “depression without sadness.” More recent research, however, has challenged the view that there is a specific phenotype in depression among old people, suggesting that the key symptoms of depression are the same, irrespective of age (Thomas 2013).

However, it seems that some symptoms are more prominent in DLL, with cognitive impairment being the most important. Various expressions have been used to describe cognitive impairment in depression, with pseudodementia being the most common. Pseudodementia refers to depression that is misdiagnosed as dementia due to marked symptoms of cognitive impairment. This term has fallen out of use, however, given the persistent nature of cognitive deficits in depression, even after the depression has been successfully treated and recent evidence suggesting that depression is a risk factor for dementia (Butters et al. 2008). The characteristic pattern of cognitive impairment in depression includes impaired attention and executive and amnesic impairment, whereas apraxia, visuospatial impairment, and aphasia may indicate that the cognitive impairment stems from a comorbid dementia disorder. People with a substantial cognitive impairment as part of their depressive episode should be followed-up closely, even if the cognitive impairment is reversed after the treatment of depression, because the risk of developing dementia in the following year is higher in this group.

Other patterns of the symptom profile in DLL are somatization or hypochondriasis, psychomotor retardation, anxiety, and agitation. It should be noted that some of these symptoms are also common in other diseases that frequently occur in old age, such as chronic obstructive pulmonary disease and coronary heart disease.

Psychotic symptoms seem to be more common in DLL compared to depression in younger adults.

There is evidence that for many patients with dementia, the depression syndrome may differ

from the diagnostic criteria in the ICD-10 and the DSM-5. Thus, provisional criteria for depression in patients with Alzheimer’s disease have been suggested. These criteria require fewer symptoms for a diagnosis of depression and the symptoms do not have to be present nearly every day. In addition to the depressive symptoms described in ICD-10 and DSM-5, the criteria for depression in Alzheimer’s disease also include social withdrawal or isolation and irritability (Olin et al. 2002).

### Assessment of Depression

In addition to a thorough disease history that considers biological and psychosocial risk factors, the use of a structured assessment scale for depression is recommended. A few scales have been developed for use in old people, such as the Geriatric Depression Scale (GDS) and the Cornell Scale for Depression in Dementia (CSDD); the latter is also used in people without dementia. Other well-known scales, such as the Montgomery-Åsberg Depression Rating Scale (MADRS), the Hamilton Depression Rating Scale (HAM-D), the Beck Depression Inventory (BDI), the Patient Health Questionnaire (PHQ), and the Hospital Anxiety and Depression Rating Scale (HADS), are frequently used, and the psychometric properties of most of these scales are found to be acceptable in the assessment of DLL. Reporting depressive symptoms may be hampered by cognitive impairment and the assessment may have to include a proxy-based assessment, such as the CSDD. Given the large proportion of people with DLL who experience impaired cognition, a structured assessment of cognition should be included in the diagnostic process, whether or not a dementia disorder is suspected.

### Suicidality

The suicide rates in older adults, particularly in men, have risen. Older men have few suicide attempts per completed suicide, i.e., they choose more lethal methods. An assessment of suicidality should be part of all assessments of DLL. As with any patient population, the older patient must be approached sensitively. Nevertheless, an explicit and specific exploration of suicidal thoughts

should be carried out during the assessment. Older men who commit suicide often seek medical help prior to the attempt, but symptoms of depression or suicidal thoughts are rarely mentioned. Practitioners need to be aware of this and have suicidality in mind when older men seek advice about other conditions, particularly issues concerning pain management. Established risk factors for suicide among old people are bereavement, social isolation, earlier attempts, chronic painful illness, disability or the threat of increasing disability, drug or alcohol use, and sleep problems (Manthorpe and Iliffe 2010). Despite the concern about the high rate of suicide among old people, this issue has received little attention, particularly when compared to the attention toward suicidality in younger people. Practice guidance on how to reduce the risk is lacking, and intervention studies are scarce.

### **LOD and EOD**

Some researchers suggest etiological and clinical differences between EOD and LOD. EOD is associated more with a family history of depression, personality dysfunction, and severe disorders. EOD is regarded as a risk factor for the later development of dementia. LOD is associated more with WMH on MRI, prominent cognitive impairment, and it relates more to systemic vascular risk and neurodegenerative disorders. There is a debate as to whether the symptom profile of depressive symptoms defined in the classification systems is different in EOD and LOD patients.

### **Bipolar Disorders in the Late Life**

The number of people seeking care for bipolar disorders is increasing. Bipolar disorders can develop early, i.e., onset before 50 years of age, or can arise with a late onset, i.e., after 50 (different cutoffs between 50 and 65 have been used). Bipolar disorders in late life include both early and late onset. Due to the complexity and heterogeneity in the classification of the disease, prevalence rates vary. Among older patients with bipolar disorder, most have their first episode of mania or depression early in life; in the minority, a bipolar

disorder may present itself for the first time in old age. In that case, the diagnostic process may be challenging due to the extensive medical comorbidity. Medical comorbidity in bipolar illness is associated with a more disabling course of the illness and a higher risk of suicide (Sajatovic and Chen 2011). Psychiatric comorbidity, such as anxiety disorders or substance use disorders, is often less common among older people than younger people with bipolar disorder. Patients with a late onset of bipolar disease tend to have less history of mood disorders in their family. About half of all older patients with bipolar disorder have depression as their first mood episode.

### **Treatment**

Before starting treatment, a careful assessment focusing on the biopsychosocial aspects of DLL is needed. The assessment should not be restricted to counting symptoms in order to establish a diagnosis; the meaning or the impact of the depressive symptoms to the individual person needs to be taken into account. Functional limitations and disability, disease history, and the duration of symptoms are key issues to keep in mind when weighing the benefits of treatment against risks. Earlier treatment experiences and preferences of the patient should be taken into account. A careful explanation of the treatment plan involving the patient – and if appropriate a family caregiver – is mandatory for treatment success, as low treatment adherence has been reported among old people.

A stepped care approach, identifying the least restrictive and least costly intervention that will be effective for a person's presenting problems, is recommended (NICE 2010). People with sub-threshold depression without a significant impact on everyday life should be offered supportive and psychosocial interventions, but they should normally not be offered medical treatment. In milder forms of depression or persistent subthreshold depression, more intensive psychotherapeutic approaches are advocated. Drug treatment should still not be a first-line treatment option, but should be considered if other alternatives fail to produce

substantial improvement. In moderate or severe depression, drug treatment should be offered, often in combination with intensive psychotherapeutic treatment.

In the treatment of depression, it is important to aim for remission (i.e., patients do not meet the diagnostic criteria for depression or they have no more than minimal depressive symptoms according to a depression assessment scale) and not merely for response (i.e., significant symptom reduction), because residual symptoms after treatment are strongly associated with a risk for relapse. Once in remission, a plan for the continuation of treatment should be established. There is reason to believe that maintenance therapy should be offered more liberally in DLL than in younger age groups, due to a greater risk of relapse.

### Psychosocial Interventions

Older patients with minor or mild depression can benefit from participating in various types of social activities to prevent isolation and loneliness, e.g., befriending services and attending day centers and local community events. Physical exercise includes bodily activity that enhances overall health and wellness. There is evidence that structured exercise programs can help older patients with milder depressive syndromes. Different kinds of exercises can be beneficial, but results are most consistent from aerobic exercise. However, there are also studies that have failed to find a positive effect of physical exercise in DLL.

### Psychotherapy

Research indicates that psychotherapy can be an effective treatment for DLL even though the quality of studies is relatively low (Wilson et al. 2008). There is a variety of therapies that may be applied, such as supportive therapy, life-review therapy, cognitive-behavioral therapy (CBT), interpersonal therapy (IPT), and problem-solving therapy (PST). Psychotherapy can be offered to individuals (in- or outpatients), couples, families, and as group therapy. Supportive treatment and adding structure to the day can be effective in patients with minor depression syndromes. CBT focuses on here-and-now situations as well as the link between negative thought patterns and mood and

behavior and is often structured in sessions and length. CBT is widely studied and applied in DLL with mild to moderate severity. IPT is also based on here-and-now situations, but emphasizes interpersonal relationships. PST is based on CBT principles, but is a more focused treatment approach. PST aims to teach patients to better define their problems and goal, and the strategies to cope with the problems, carry out the strategies, and then evaluate them. PST has shown strong results for depressed patients with executive dysfunctions. As a result, it has been suggested as a key treatment approach in “vascular depression,” where it has been implicated that the dysfunction of frontostriatal circuits gives rise to executive impairment (Espinoza et al. 2014).

Psychotherapy, in combination with medical treatment, may be more efficacious than any of the two modalities alone in the treatment of DLL, both in the acute phase and as maintenance therapy.

### Medication

A number of issues need consideration when prescribing antidepressive medication to older adults. As noted earlier, polypharmacy is common in older individuals. Medication with negligible side effects in healthy young people may cause serious side effects in older adults who take many prescribed drugs, especially when several of those drugs could have direct effects on the brain. An example is the rather weak anticholinergic effect of a drug like paroxetine; in combination with other drugs with weak anticholinergic effects, it may cause confusion or delirium in susceptible individuals. Pharmacokinetic changes, such as increased distribution volume, reduced hepatic metabolism, and reduced glomerular filtration rates, may lead to higher plasma and brain levels of the drug. However, there is great variation among older adults in these changes. The slogan “start low, go slow” that was often voiced in old-age psychiatry may be appropriate, but should not prevent older patients from being treated with adequate doses. When evaluating dosing regimens, the polymorphisms of key enzymes of the cytochrome P450 system involved in the metabolism of several psychopharmacological

substances should be taken into account. A considerable proportion of individuals can have polymorphisms that may cause great variation in the plasma level of a medication. In cases of unusual side effects at low doses or treatment resistance, an analysis of P450 enzymes may be indicated.

Most studies regarding drug treatments for depression have been done in samples with MDD. Hence, the results cannot readily be extrapolated to people with mild depression or subthreshold depression. The effect of antidepressants in treating DLL is well documented (Nelson et al. 2008). However, there is great variability among studies. The older tricyclic antidepressants (TCAs) have a comparable effect to the new ones but a higher prevalence of side effects – particularly anticholinergic and antiadrenergic effects – that have made them less useful in treating DLL.

Contrary to the positive treatment effect in older adults without substantial cognitive impairment, most of the studies concerning the use of antidepressive treatment in patients with dementia have failed to show an effect (Nelson and Devanand 2011). This may be because of an inability to define homogenous patient groups with depression and dementia. Symptoms of depression and dementia partially overlap and cognitive impairment may prevent any verbalization of the depressive symptoms. Furthermore, people with dementia may be more susceptible to adverse events. Taken together, there is not enough evidence to suggest antidepressive therapy as a first-line treatment in people with dementia except in specific cases, such as very severe depressive symptoms or a history of earlier episodes that have responded to treatment.

There are a large number of antidepressive drugs to choose from, but selective serotonin reuptake inhibitors (SSRIs) are the first choice in most instances, in line with most clinical guidelines. These drugs are generally well tolerated and they have a predictable interaction profile. Nonetheless, recent studies indicate that SSRIs may also be associated with serious adverse outcomes, such as increased QT interval, falls, and hyponatremia. SSRIs may be combined with

other antidepressants; combining SSRIs with mirtazapine or mianserin can be particularly useful for patients with sleeping problems and low appetite. Serotonin and noradrenaline reuptake inhibitors (SNRIs) have adverse event profiles similar to SSRIs and are a useful second-line treatment option because of their somewhat broader receptor profile. Because older adults with depression constitute a heterogeneous group, the prescription of antidepressive medication should be individualized based on the side effect profile of the drug, previous medication history, somatic diseases, and the use of other drugs.

Monotherapy is preferred, but in cases of treatment resistance, augmentation therapy with other drugs may be tried. The best evidence is for augmentation with lithium, used for bipolar disorder (Cooper et al. 2011). However, lithium serum levels have a very narrow therapeutic window and require careful observation in order to avoid potentially serious adverse events.

### **Electroconvulsive and Neuromodulation Therapies**

Electroconvulsive therapy (ECT) is well tolerated and efficacious in treating DLL (Riva-Posse et al. 2013). It should be an option in people with severe depression when other treatment alternatives have failed. In many countries, ECT is reserved for severe depression with psychosis, suicide risk, or life-threatening refusal of food or fluids. Concerns about using ECT in DLL have been raised, especially the fear of precipitating delirium or memory impairment. Recent studies demonstrate a faster remission in patients treated with ECT than patients treated with antidepressants, without extra side effects. This suggests that the indication for ECT could be broader. The high relapse rate after ECT is a therapeutic challenge; maintenance therapy may be indicated. Other stimulation therapies, such as transcranial magnetic stimulation, vagal stimulation, or deep brain stimulation, have been tried out in selected patient groups, but these alternatives are not easily accessible and there is limited evidence to date to justify their use in clinical practice.

## Prognosis

DLL is associated with a number of negative outcomes, such as disability, cognitive impairment, poorer outcomes of physical disorders, and an increased risk of mortality. Remission rates of DLL after treatment are not different from those in younger age groups; however, relapse rates are higher (Mitchell and Subramaniam 2005). The risk of relapse is highest for the first 6 months. Hence, it is important to continue treatment for at least 6–9 months. Even after the first depressive episode in old age, the relapse rate is high after the treatment has been discontinued. This has led many to recommend lifelong maintenance treatment even if the first depressive episode has a later onset, particularly if it was an episode of great severity. This recommendation has to be weighed against risks associated with polypharmacy, side effects, and other risk factors for relapse, such as cerebrovascular pathology, other physical diseases, and cognitive impairment.

## Conclusion

DLL is a disease with vast consequences for affected individuals and society as a whole. The symptoms are well characterized and there is a huge knowledge base around epidemiology, etiology, and treatment. However, a substantial part of the knowledge relates to younger age groups, which has been extrapolated to DLL. There is reason to believe that there are important etiological and clinical issues that apply to DLL, which differ from what we see in younger age groups. Yet, there is probably greater diversity among older versus younger age groups. This calls for a careful assessment and consideration of biological and psychosocial issues common with advancing age. Particular attention should be paid to comorbid physical diseases, cognitive impairment, and distressing life events. The increased vulnerability of some older adults to depression in itself and treatment side effects, the uncertain efficacy of treatment in subgroups, and the high relapse rate in DLL call for close follow-up. Lastly, the high

risk of suicide, particularly in older men, warrants special attention among all health workers providing care for older individuals.

## Cross-References

- ▶ [Anxiety Disorders in Later Life](#)
- ▶ [Bipolar Disorder in Later Life](#)
- ▶ [Cognitive Behavioural Therapy](#)
- ▶ [Comorbidity](#)
- ▶ [Dementia and Neurocognitive Disorders](#)
- ▶ [Grief and Bereavement: Theoretical Perspectives](#)
- ▶ [Mental Health and Aging](#)
- ▶ [Mild Cognitive Impairment](#)
- ▶ [Problem-Solving Therapy](#)
- ▶ [Psychological and Personality Testing](#)
- ▶ [Subsyndromal Psychiatric Disorders](#)
- ▶ [Suicide in Late Life](#)

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## Disability and Ageing

Fiona Kate Barlow<sup>1</sup> and Nicole Walker<sup>2</sup>

<sup>1</sup>School of Applied Psychology and Menzies Health Institute Queensland, Griffith University, Brisbane, QLD, Australia

<sup>2</sup>School of Psychology, The University of Queensland, Brisbane, QLD, Australia

## Synonyms

Age-related disease; Age-related impairment; Chronic disease; Functional change and loss; Impairment

## Definition

Disability is a broad term that has multiple definitions. The World Health Organization (World Health Organization 2012) defines disability as encompassing:

1. Impairments: a problem or problems with bodily structure or function
2. Activity limitations: a problem or problems experienced by an individual when attempting to carry out an action or task
3. Participation limitations: a problem or problems in dealing with life situation (e.g., social, vocational)

The term disability, however, is not limited to health conditions. In fact, the International Classification of Functioning, Disability, and Health views *disability* as an umbrella term (World Health Organization 2012). In their definition, disability is the interaction between environmental and personal factors (e.g., stigmatization, access to healthcare, social support) and a health condition (e.g., schizophrenia, cardiovascular disease). This means that experiencing a disability is really the combination of *both* some health

condition and how you are treated and/or limited as a result of it (World Health Organization 2012).

Disability is not an inevitable part of aging, but the odds of experiencing a disability or living with a disability increase with age. As this entry will show, many age-related changes are associated with disability (e.g., age-related eye degeneration resulting in cataracts leading to visual disability) (Hoyer and Roodin 2009).

### **The Nature and Causes of Disability for Older People**

As of 2010, approximately a billion people (around 15% of the world's population) were estimated to live with some form of disability. Among these, 2–4% were estimated to have severe disability that dramatically impaired functioning (e.g., quadriplegia, blindness). Rates of disability (i.e., experiencing difficulty in performing activities), and severe disability (i.e., being prevented from performing activities), increase with age (World Health Organization 2011). We can use the USA as an example here. In the USA, fewer than one in five people aged under 65 report a disability (2010 US Census data) (Brault and United States. Bureau of the Census 2012). This increases to about 50% in adults aged 65 years and over. In this age bracket, one in two will report a disability. Over a third will live with a severe disability. For people in their 80s, rates of disability are close to 75% and severe disability 60% (Brault and United States. Bureau of the Census 2012).

The way that disability is assessed and recorded, however, differs country to country. This means that it is hard to accurately estimate how many people are disabled, let alone how many older people are disabled. According to best estimates, however, approximately 30% of adults aged 60 years and over in higher-income countries have a disability, and approximately 45% of adults over 65 in lower-income countries live with a disability. For example, the rates of

disability are substantially higher in African and Southeast Asian nations than they are in the Americas or Europe (World Health Organization 2012). International differences notwithstanding, with an expanding older population, globally, there are more people living with disability today than there have been in the past.

In general, part of the reason that we are living longer is because we are better at preventing and treating communicable disease. Communicable diseases are those that can be spread between people or between people and animals. Vast reductions in infectious and parasitic disease have resulted from effective and available immunization, attempts to manage poverty, and improvements in diets and infrastructure. Thus, at present, in developed or high-income countries, the leading causes of disability (as well as disease and death) are noncommunicable (e.g., arthritis, cancer, mental health disorders). The same is true of middle-income countries – it is only in developing countries that the leading cause of disease and death remains communicable disease (alongside maternal, perinatal, and nutritional conditions). It is estimated that by 2030 this will change – noncommunicable disease will be the leading cause of disability, disease, and death worldwide (World Health Organization 2011).

To some extent, this represents a challenge to the way that disability is traditionally conceptualized. When we think about disability in aging, we often draw on standard stereotypes – imagining someone in a wheelchair or someone who is vision impaired. The reality is that disability is varied, not only in its nature, but also in the extent to which it affects or limits people.

The most common disability-related health conditions in Australia and Canada are arthritis, back problems, and hearing problems (World Health Organization 2011, 2012; Australian Bureau of Statistics 2012). Others include heart disease, hypertension, asthma, diabetes, stroke, depression, dementia, speech disorders, and vision disorders. In the USA, rheumatism and heart problems represent the most common causes

of disability among adults 65 or older (World Health Organization 2011; Centers for Disease Control Prevention 2009). As of 2011, the most common health conditions in developing countries were heart disease, stroke, cancers (breast, prostate, and lung), sensory problems (cataracts and glaucoma), hearing loss, and musculoskeletal impairment (osteoarthritis and osteoporosis) (World Health Organization 2011).

Older people with disability can either enter old age with a preexisting disability or develop a disability in later life (either due to age-related factors or other factors such as communicable disease or accident). As highlighted above, however, rates of disability increase with age, in part due to biological change. For example, as we age, visual deterioration is common. This includes declines in accommodation (the ability of the lens to focus), contrast sensitivity, and sensitivities to glare (Hoyer and Roodin 2009). Changes in the eye give rise to visual pathologies. Approximately 70% of adults aged 80 or over have cataracts, with 20% and 7% of the same age group experiencing age-related maculopathy and glaucoma, respectively (Resnikoff et al. 2004). Similarly, with age comes a predictable breakdown of cells in the inner ear (albeit at different rates for different people). This can result in hearing impairment, with approximately 35% of men and 22% of women aged 70–74 experiencing such impairment, and this rises to 58% of men and 49% of women at 85 years or older (Mathers et al. 2000). Taste, smell, and touch sensitivities also decline. In the case of touch, this can be particularly problematic – as insensitivity to touch and pain can lead to accidents and subsequent disability (Hoyer and Roodin 2009). Finally, loss of bone density and muscle mass, circulation, and respiration are also part of the normal aging process (Deschenes 2004). As this highlights, many factors contribute to disability and all can hinder effective participation in many activities of daily living (Hoyer and Roodin 2009).

### Factors Exacerbating Disability

While age increases the risk of developing diseases and disabilities, the cumulative effects of

adverse lifestyle or environment can expedite disability in later life (World Health Organization 2011, 2012). One of the most consistent predictors of disability is socioeconomic disadvantage. Poor nutrition, and inability to access healthcare, increases the risk of developing a disability (World Health Organization 2012). At the international level, rates of disability in the USA are high when compared to other developed countries. The reason for this is largely assumed to be ready and equal access to healthcare provided by governing bodies. Similarly, healthcare is often difficult to access in low-income countries. Just as there are higher rates of disability within low-income countries than within high-income countries, so too are there higher rates of disability in people of low socioeconomic status (SES). Poverty has a cumulative effect, and this becomes more evident in later life. Further, poverty is more evident among the elderly (World Health Organization 2011). Those born into poverty are more likely to develop a disability – and if they survive into old age, carry it with them. The prognosis and quality of life for those with a disability who experience poverty are worse than for those with a disability who do not experience poverty. Thus, there appears to be a cycle of disability – where poverty breeds disability and also exacerbates it. Gender also interacts with poverty. As women live longer than men, on average they are more likely to experience poverty in old age (Hoyer and Roodin 2009).

### The Impact of Disability on Older Adults

The most obvious impact of disability on older adults is in the realm of self-care. Physical disability in older adults can prevent them from being able to independently move in and out of bed, leave the house, and engage in house maintenance (Brault and United States. Bureau of the Census 2012). In fact, as of 2010, at least one in ten American adults aged 65 or older reported needing assistance in leaving the house, with a similar proportion reporting needing assistance with housework (Brault and United States. Bureau of the Census 2012). When we consider the fact that

many people with disabilities require doctor or hospital visits, as well as pharmacy medication, any disability that prevents them from leaving the house would exacerbate challenges associated with disability management should they not have access to assistance.

Disability can impact on basic activities of self-care or *activities of daily living*. These include the ability to bathe, dress, and toilet independently. *Instrumental activities of daily living* – like paying bills, shopping and food preparation, and taking medications appropriately – require some degree of planning and intellectual engagement (Cavanaugh and Blanchard-Fields 2014). In the USA, of Medicare enrollees 65 years or older, approximately 41% needed some assistance with these activities. Twelve percent of adults aged 65 years or older needed help with instrumental activities only, with the remaining 29% also requiring assistance with at least one activity of daily living (Cavanaugh and Blanchard-Fields 2014). The most common problems include difficulties in walking, bathing, dressing, using the toilet, getting in and out of bed, and eating (Cavanaugh and Blanchard-Fields 2014). Impairments in these areas increase with age. In the case of walking, approximately 15% of adults aged 65–74 years are having difficulty in doing so, compared to almost 50% of adults aged 85 years and older. Around 20% of adults aged 65 or over require either the use of a walking aid (e.g., cane, walker, crutches) or wheelchair for mobility (Centers for Disease Control Prevention 2009). Importantly, when an older person becomes restricted in some capacity, their decline is more rapid and recovery protracted, thus increasing the likelihood of additional disability that further limits their ability to live independently (World Health Organization 2011; Hultsch et al. 1999)

Chronic disabilities are a robust predictor of falls in the elderly (as can be assumed with over 50% of adults 85 and older reporting difficulties walking). Further, in the USA, accidental injury is the fifth leading cause of death in older adults after cardiovascular disease, cancer, stroke, and pulmonary disease (Rubenstein 2006). Falls themselves account for approximately 60% of these deaths. As a consequence, data in the USA reveals that

falls are the most common causal factor of restrictions of activities of daily living (Rubenstein 2006). The more chronic health conditions an elderly person reports, the more likely they are to fall and fall recurrently (Tinetti et al. 1986). Thus, we can see that disability in and of itself puts people at the risk of future disability (World Health Organization and Ageing Life Course Unit 2008).

### Participation in Society

Disability in the elderly often puts limits on their ability to live happy, fulfilled lives. This is not just because of problems associated with activities of daily living (e.g., walking, getting dressed); rather, impairments can also impose barriers to social and vocational interactions. For example, difficulties in vision can prevent older adults from driving (Hoyer and Roodin 2009). Mobility difficulties can prevent catching public transport, as can the availability or affordability of public transport (Gilhooly et al. 2002). Thus, disability can lead older adults to withdraw from social activities or cease attending gatherings or going on outings.

Physical and/or cognitive disability may also prevent older adults from engaging in work-related activities. There are a number of reasons for this. Firstly, physical disability may prevent someone from performing a job that they previously held (e.g., problems with walking may prevent a farmer from farming). However, potent misconceptions about the disabled elderly (including those held by the elderly themselves) can also prevent older adults with disabilities who desire employment from seeking and attaining it (World Health Organization 2012). For example, older adults with a disability are often excluded from disability services that aim to provide rights and opportunities to those living with a disability (Jönson and Larsson 2009). In Sweden, for example, a system of long-term support (personal assistance) has been introduced for those living with a disability who are *under the age of 65* (Jönson and Larsson 2009). Researchers argue that ageism affects disability here – whereby many conflate disability and aging (i.e., assume that disability is a normal and natural part of aging) (Jönson and Larsson 2009). Thus, older adults with a disability

often are not able to take advantage of programs designed to support them in pursuing paid work, among other things.

As prefaced above, older adults with disabilities are likely to face discrimination. Some researchers have argued that the recent focus on “positive,” “successful,” or “healthy” aging has meant that older adults with a disability are stereotyped as people who age “badly” or “unsuccessfully” (Minkler 1990). When looking at specific prejudices, mental disabilities are stigmatized, and physical disabilities are often assumed to extend to cognitive impairment. Those with dementia are sometimes seen as “less than human” and consequently are not afforded time and companionship.

Whether through physical barriers, or social exclusion, isolation can have a severe negative impact on older adults with a disability. A primary predictor of longevity is the strength and quality of our social relationships (often marriages (Tucker et al. 1996)). Older adults with strong social networks thrive – especially when they enjoy close and meaningful relationships (Hoyer and Roodin 2009). When disability limits this, either through preventing socializing or through increased incidents of discrimination, older adults with disability are likely to experience declines in health and quality of life.

### **Societal Impact and Management of Disability in Aging**

Given the rising number of people with a disability, there is a considerable burden experienced globally – both in terms of health and finances. Financial costs are borne by the disabled themselves, governments, and individual carers (and families). One report estimated that, in the period between 2006 and 2015, the financial cost of heart disease, stroke, and diabetes in 23 low- and middle-income countries approached \$US100 billion (World Health Organization 2011). In 2009, the cost associated with new cancer cases in the USA was estimated at \$US286 billion. The worldwide cost of dementia in 2010 was estimated to exceed \$US600 billion (World Health Organization 2011). Note that this figure includes

nonprofessional care provided by family members. In fact, the majority of older adults with a disability do not live in aged care facilities. In Australia, one in ten people reports being a carer for a person with a disability (Australian Bureau of Statistics 2012). The majority of carers are female (70% of primary carers), and of carers themselves, approximately a third have a disability. Labor force participation is lower for carers, who often spend more than 40 h a week in their caretaking roles (Australian Bureau of Statistics 2012).

The cost of caring for older adults is not just financial; it is also emotional. Carers are typically overworked and often unpaid. They face substantive stress, especially because their role often involves negotiating and managing the current impairment and the future consequences of the impairment (palliative care and death), which is often not recognized publically (Hoyer and Roodin 2009).

The costs detailed above, both to societies and individuals, highlight the importance of looking at disability in older adulthood at national, and global, levels. When it comes to disability, generally, the World Health Organization recommends that multiple environmental changes should be implemented to improve the lives of those with disabilities (World Health Organization 2011, 2012). For example, it is recommended that policies concerning accessibility of education and healthcare be designed with specific reference to meeting the needs of disabled people. Funding and the provision of services for those with disability need to be increased. At a very basic level, built environments should be designed to be accessible to all. Negative attitudes and poor standards of care need to be combated. In each case, it is recommended that extensive consultation with people with disabilities is undertaken and that any programs instituted are rigorously documented and evaluated (World Health Organization 2012).

When it comes to programs specifically designed to help older adults with disabilities, multiple successful examples can be found. For example, in Japan, free social exercise classes are made readily available to older adults living in large cities (Hoyer and Roodin 2009). Indeed,

exercise programs in the USA have been shown to reduce disability and pain for older adults with knee osteoarthritis (Ettinger et al. 1997). Community-based programs in the USA aimed at preventing disability in older adults, as well as promoting disease self-management, have been shown to reduce functional decline and length of hospital stays (Wagner et al. 1998).

On an individual level, managing disability in older adulthood – much like disability itself – is complex. Several factors have been identified, however, that reliably delay the onset of disability. Most importantly, exercise is a factor that has been shown to increase both physical health and mental health and is effective in delaying the onset of dementia (Cotman and Berchtold 2002) and preventing physical disability (see above). Cognitive stimulation is also important. Older adults who remain in the workforce until later in life display better cognitive integrity than those who retire early, and it is likely that cognitive challenge is protective (World Health Organization 2011). Finally, a strong social network is vital. Older adults do not necessarily benefit from having a large social group. Rather, they are most healthy when they report close, developed, and deep friendships (Hoyer and Roodin 2009). A reduction in smoking, drinking, and drug taking also reduces the chance of disability (Hoyer and Roodin 2009; Cavanaugh and Blanchard-Fields 2014).

## Conclusion

Disability is multifaceted. The current statistics on rates of disability vary country to country, in large part due to differences in definition and measurement. Despite this, it is clear that disability increases with age. This is largely due to biological changes that are associated with aging, such as reduction in bone and muscle density. Much of this, at present, is unchangeable – we cannot stave off the process of aging. What is malleable, however, is how we treat and support older adults with a disability, and how we prepare for old age ourselves. At present, the bulk of the caring for older adults with a disability is undertaken by partners

and relatives – who are often unpaid and under-resourced. Further, older adults with a disability attract substantive discrimination. They are often treated as if they are childlike or impaired beyond their disability. Increases in support to caregivers, better government and aged care services, as well as improvements in attitudes toward older adults with a disability would lead to improved quality of care and life for older adults with a disability (as well as their caregivers). Finally, while avoiding disability in later life is probably unrealistic, it can be delayed and managed more positively. Specifically, regular exercise and social interactions have both been shown to be protective, as has income equality. Some changes can be made at a personal level, such as adherence to an exercise program. Others will need to be tackled at a societal level. Income inequality, for example, is to a large degree a product of public expenditure, taxation, laws, as well as government provision of healthcare and education. With an aging population, it is clear that changes must be considered, if we are to reduce the global burden of disability.

## Cross-References

- ▶ [Age Stereotyping and Discrimination](#)
- ▶ [Aging, Inequalities, and Health](#)
- ▶ [Loneliness and Social embeddedness in Old Age](#)
- ▶ [Social Cognition and Aging](#)
- ▶ [Social Connectedness and Health](#)
- ▶ [Stress and Coping in Caregivers, Theories of](#)

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## Distance-to-Death Research in Geropsychology

Oliver K. Schilling  
 Department of Psychological Ageing Research,  
 Institute of Psychology, Ruprecht-Karls-  
 Universität, Heidelberg, Germany

### Synonyms

Distance-to-death and time-to-death; Terminal changes and time-to-death-related changes; Terminal decline and terminal drop; Time-to-death-related trajectory and time-to-death-related growth curves

### Definition

In the broadest sense, distance-to-death research in geropsychology includes all kinds of examinations of associations between facets of psychological functioning and time-to-death. In a narrower sense, however, the term refers to the study of terminal changes in psychological functioning, that is, intraindividual changes that occur time-to-death related at the end of the individual's lifespan. Up to the present, geropsychological distance-to-death research for the most part consists of studies of terminal decline and terminal drop in cognitive functioning and subjective well-being.

## Distance-to-Death Research in Geropsychology

Across the past decades, research in geropsychology increasingly considered distance-to-death as indicator of psychological changes that unfold at the end of the human lifespan. That is, this research is based on the rationale that crucial changes in psychological functioning may occur in late life as individuals approach their death, meaning that the occurrence of these changes is closely related to biological processes of deterioration that precede and will finally precipitate the death of the individual. Historically, this approach was initiated in the field of geropsychological research on cognitive functioning early in 1960s by Robert Kleemeier, who presented evidence of an association between late-life declines in intellectual function and mortality, suggesting *the existence of a factor, which might be called terminal drop or decline, which adversely affects intellectual performance and is related to impending death of the aged person* (Kleemeier 1962, p. 293). Such terminal change might unfold late in people's life over some time period before death, hence timely associated with distance-to-death, rather than with calendar age (i.e., distance-to-birth). To put this reasoning simply, if humans are not hit by lethal developments that unfold short termed (such as accidents or severe acute illnesses), crucial changes driven by end-of-life degradations may not occur "normatively" in terms of age related, but "terminally" in terms of time-to-death related.

Thus, in the broadest sense, geropsychological distance-to-death research includes all kinds of empirical studies that examine associations between psychological functioning and time-to-death. In a narrower sense, however, the key objectives of such research refer to terminal change. This distance-to-death research was largely driven by the concepts of *terminal decline* and *terminal drop*. The latter term has been used to differentiate time-to-death-related processes

that unfold rapidly and accelerated aggravation or loss of functionality prior to death (i.e., "drop") from processes that run in a more steady and less accelerated way (i.e., "decline"). This distinction has been grounded on theoretical considerations regarding the causal processes driving the terminal changes in psychological functioning: *Terminal decline reflects a gradual accumulation of underlying biological and environmental causes, whereas terminal drop implicates a threshold model with an acute precipitating mechanism* (Bäckman and MacDonald 2006, p. 227). However, both terms are often used interchangeably in distance-to-death research, supposedly because clear-cut empirical criteria to distinguish terminal decline from terminal drop in observations of time-to-death-related changes are hard to establish. That is, any notion of changes that occur uniquely time-to-death-related at the end of individuals' lifespans implies some kind of acceleration, in that these changes occur after the onset of the terminal process, adding to ongoing normative age-graded (or otherwise time-graded) changes or stability. Therefore, the remainder of this chapter will not follow a strict distinction between slow-running and fast-running terminal changes, but rather deal with terminal change in general, including both dynamics of terminal decline and terminal drop.

Doing so, this chapter will mainly focus on conceptual and theoretical aspects of distance-to-death research. Thus, only a brief overview on empirical findings on terminal change will be given first. Second, methodological concepts that are key constituents of distance-to-death research will be outlined. Third, the relevance and potentials of distance-to-death research will be considered: Which insight about late-life development *does* – or *could* – distance-to-death research provide to geropsychology?

### Empirical Evidence: Terminal Decline in Cognition and Subjective Well-Being

Starting with Kleemeier's investigation, gerontologists' interest in phenomena of terminal decline

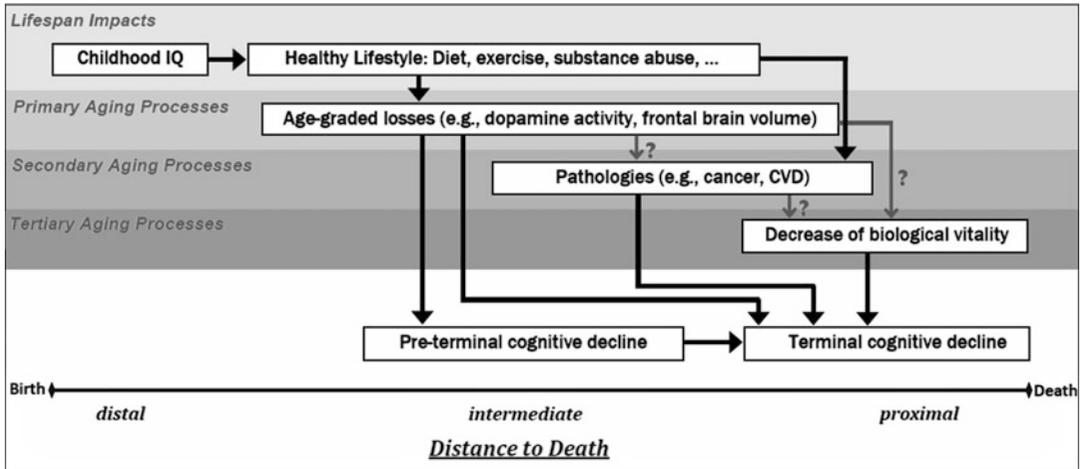
has long been focused on cognitive functioning (e.g., Kleemeier 1962; Riegel and Riegel 1972; Siegler 1975; White and Cunningham 1988). This “early” research revealed manifold and strong evidence that (a) levels of cognitive function predicted subsequent survival (for review Small and Bäckman 1999) and (b) intraindividual declines of cognitive performance were associated with distance-to-death (for review, see Bosworth and Siegler 2002). Overall, these findings suggested that terminal change accounts for a substantial portion of the differences in cognitive performance among older individuals, leading to questions on the nature of the phenomenon, particularly concerning the causal processes underlying terminal change and the pervasiveness of such distance-to-death-related changes across different – including also “non-cognitive” – facets of psychological functioning. With the terminal decline paradigm well established in aging research, more recent investigations in the broadest sense dealt with these questions.

The further progress of distance-to-death research up to the present may be summarized with respect to two predominant topics, namely, (a) increasing evidence of distance-to-death-related changes not only in cognitive functioning but also in indicators of subjective well-being (SWB) and (b) the provision of more and in-depth insights about the course and predictors of terminal decline. Up to the present, a large body of research provides massive evidence of terminal decline in cognitive functioning, unfolding in a dedifferentiated manner across various cognitive abilities (Wilson et al. 2012). Moreover, broadening the distance-to-death perspective beyond the focus on cognitive functioning, SWB emerged as important field of terminal changes in recent years. An increasing body of studies provided evidence of changes in SWB associated with time-to-death – showing patterns of terminal decline of cognitive (i.e., life satisfaction) and affective components of SWB (e.g., Gerstorf et al. 2008a, b, 2010; Palgi et al. 2010; Schilling et al. 2013; Vogel et al. 2013; Windsor et al. 2015).

Given its historical “forerun,” in particular cognitive distance-to-death research revealed

manifold hints toward proximal and distal influences across the lifespan that might impact on the onset and speed of terminal declines (for review, see Bäckman and MacDonald 2006; for more recent findings, see, e.g., Gerstorf and Ram 2013; Muniz-Terrera et al. 2013; Cadar et al. 2015). Overall, terminal decline in cognitive functioning appears as developmental dynamic not fully mediated by specific diseases, but a phenomenon determined by multiple impacts, including some “core” of time-to-death-related change that still could not be attributed to particular causes and might be understood in terms of a “deterioration of global biological vitality” (Bäckman and MacDonald 2006, p. 225). Figure 1 summarizes proximal and distal impacts of terminal cognitive decline, adapted from Bäckman and MacDonald’s (2006) respective summary (leaving out predictive pathways from genes and early environment to childhood IQ and also direct links from childhood IQ and normative age-graded influences to death that were part of their figure). The original figure has been modified by adding potential causal pathways among impacts, which Bäckman and MacDonald did not include in their model, but may be considered at least hypothetically.

Thus, keeping this chapter’s conceptual focus, empirical distance-to-death research up to the present might briefly be characterized as a process moving from mere evidence of terminal change in psychological functioning toward an understanding of these terminal changes as driven by proximal and distal impacts across the individual’s lifespan. This course of the investigation of the phenomenon – from disclosure to causes – seems also implied in Gerstorf and Ram’s (2013, see also for more review of empirical findings) suggestion to organize objectives for future research on terminal decline according to five basic rationales (Baltes and Nesselroade 1979), namely, (a) identification and description of terminal changes and (b) the interindividual differences in terminal changes, (c) analysis of interrelationships between terminal change in different attributes or multiple aspects of functioning, and (d) identification of the causes of terminal change and (e) of the interindividual differences in



**Distance-to-Death Research in Geropsychology, Fig. 1** Distal and proximal impacts on terminal cognitive decline (Note. Modified figure adapted from Bäckman and

MacDonald, *European Psychologist* 2006, 11(3), p. 229. *Black arrows* denote impacts considered originally by Bäckman and MacDonald)

terminal change. It could be expected, hence, that ongoing and future distance-to-death research will increasingly focus on the causes of terminal change in psychological functioning.

However, crucial to such understanding of causes, research on terminal decline in cognitive functioning suggests that psychological changes preceding one's death are driven by impacts which do not all unfold distance-to-death-related, but differentially timed within the individual's life course. The "classic" distinction of primary, secondary, and tertiary aging processes – also added in Fig. 1 to the model adapted from Bäckman and MacDonald (2006) – has been suggested as conceptual framework to disentangle this temporal overlay and interplay of the driving forces of late-life changes (Ram et al. 2010): Primary aging denotes processes that are intrinsic to aging (i.e., unfolding regularly and irreversibly within individuals at certain ages), whereas secondary aging refers to pathological changes that do not occur age-graded and may be preventable or reversible (Busse 1969), and tertiary aging denotes biological degradations that unfold under impending death (Birren and Cunningham 1985). Thus, processes that unfold normatively age-related, or nonnormatively across some limited time period in one's life, or uniquely distance-to-death-related might impact on terminal

changes in the psychological functioning observed at the end of the lifespan. However, key to distance-to-death research, this rationale implies that *unique* statistical association of intraindividual change with time-to-death (controlling for age- and pathology-related time metrics, such as time since diagnosis) means strong evidence for the effectivity of tertiary aging processes.

## Methodological Concepts of Distance-to-Death Research

### Time-to-Death as Predictor of Change in Psychological Functioning

Across the past decades, distance-to-death research gained tremendous inspiration from appearance of longitudinal growth curve methodologies (e.g., Curran et al. 2010). Growth curve modeling of time-to-death-related trajectories – mostly done by means of longitudinal mixed/multilevel models employing time-to-death as within-subject predictor (e.g., Vogel et al. 2013; Sliwinski et al. 2003) – is a suitable and effective tool to analyze the association between intraindividual changes and time-to-death, meaning evidence for terminal *change* in a strict sense. Since the 1990s, studies of terminal change increasingly used longitudinal data

to model time-to-death-related trajectories of the variable under study.

By means of time-to-death-related growth curve modeling, fundamental objectives concerning terminal change can be addressed. For instance, the abovementioned objectives suggested by Gerstorf and Ram (2013) can be linked to model parameters of a time-to-death-related growth curve model (e.g., terminal change may be identified in terms of the fixed level and slope effects and described by the “curvature” of a growth curve model, whereas interindividual differences in terminal change are mirrored statistically in the random level and slope variances) or could easily be operationalized by more elaborate growth curve model specifications (e.g., latent dual growth curve models may be used to analyze interrelationships between terminal declines in different attributes and potential causes of terminal change might be included as predictors of time-to-death-related slopes; McArdle 2009).

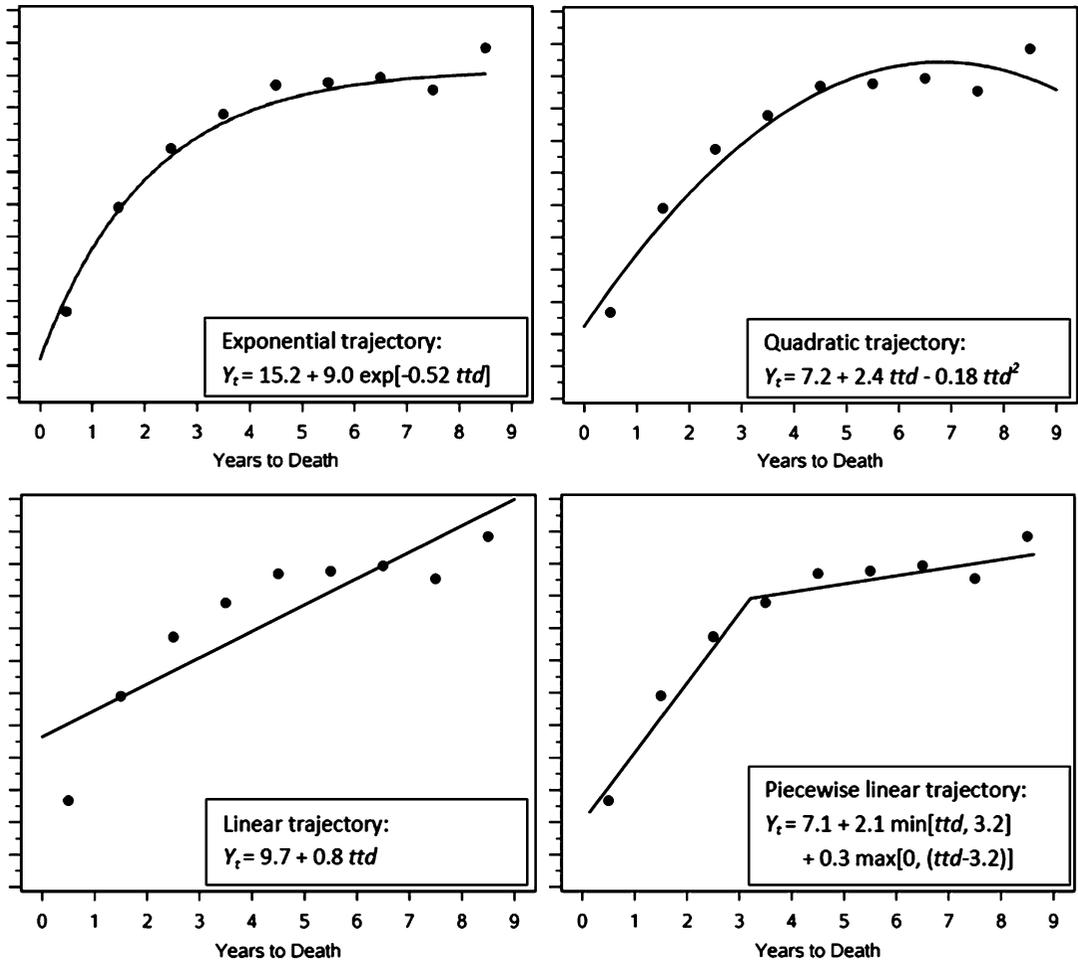
By now, the longitudinal growth curve modeling approach has become key to the analysis of terminal change and therefore is essential for geropsychological distance-to-death research. However, a methodological drawback often present in these analyses of terminal change should also be noted: In the typical scenario of distance-to-death research, using data from longitudinal samples to model time-to-death-related trajectories, only those participants can be included that had deceased (and those time of death had been recorded) when the analysis is conducted. Thus, the participants still alive at the last mortality follow-up are excluded from these analyses. This practice could lead to considerable selectivity of the subsample used for analysis, as participants from early birth cohorts that survived to very old age are excluded and/or only these from the younger birth cohorts that died already at rather young ages are included. Concerning, for instance, that the terminal processes of the long-living could differ systematically from those that die at rather early ages, such selectivity could lead to biased evidence of terminal change.

### Trajectories of Terminal Change

Piecewise growth curve models (also referred to as multiphase models, change point models, or

transition point models, e.g., Cudeck and Harring 2007) have become a particularly relevant tool to model time-to-death-related trajectories: As an implication of the concept of terminal change, trajectories of psychological functioning in late life might typically be shaped such that they mirror some kind of transition from a phase of preterminal change – which might show only minor change or change unfolding normatively age graded – into the phase of increased terminal change prior to death. That is, the typical end-of-life growth curves might appear as compound of two pieces, namely, the preterminal trajectory showing relatively low rates of change and the terminal trajectory showing higher, accelerated change. For illustration, Fig. 2 shows different widely used distance-to-death-related trajectory functions, including a piecewise growth curve, fitted to the hypothetical values observed from one individual at varying temporal distance-to-death. Piecewise growth curve models hence are the statistical “translation” of this implicit characteristic of distance-to-death-related processes and have been used in many studies of terminal changes (e.g., Gerstorf et al. 2008a, b, 2010; Vogel et al. 2013; Wilson et al. 2003; Sliwinski et al. 2006).

An alternative to modeling piecewise trajectories are growth curve models employing a nonlinear growth function that also may reflect the transition from a preterminal phase of moderate changes into a terminal phase of accelerated change – for instance, curvilinear (quadratic) trajectories showing accelerating trends toward the end of life, or exponential growth functions that could follow a pattern of high stability across a period more distant from death, turning into rapid change as death comes close. These nonlinear functions may be more realistic in that they do assume a continuous transition from preterminal to terminal change, instead of a sudden onset of the terminal phase at a single point in time. However, it is this “coarseness” of the piecewise growth curve model that makes it attractive for research on terminal change: Fitting a series of measures obtained at decreasing distance-to-death to a piecewise trajectory with a distinct change point includes an estimation of the onset and



**Distance-to-Death Research in Geropsychology, Fig. 2** Illustration of widely used time-to-death-related growth curve functions

duration of the terminal process. That is, even if one does not assume that terminal change will start suddenly within a short temporal range (say, a day or a week), an estimate of the change point in time provides valuable evidence of the timing of the terminal phase, indicating at about which time-to-death the terminal processes began to evoke perceptible and observable changes in the study variable. For example, for the individual depicted in Fig. 2, the onset of the terminal phase would be estimated at about 3.2 years before death.

Moreover, comparing the growth curves depicted in Fig. 2 it should also be evident that

the choice of a growth function is relevant with respect to the distinction of terminal drop versus terminal decline. Piecewise or exponential growth functions are better suited than the polynomial functions (linear or quadratic) to fit a terminal drop pattern of sharp and steep decrease within a shorter time period before death.

**Psychological Functioning as Predictor of Time to Death**

In contrast to the longitudinal approaches that employ time-to-death as predictor of psychological functioning, time-to-death is also a widely used outcome variable mainly in epidemiological

research. These studies apply event history analyses to predict time-to-death (Yamaguchi 1991), for instance, using cognitive abilities measured in a sample as predictor of survival. Thus, this approach could be classified as cross-sectional, in that it models the statistical association between time-to-death and the interindividual differences in the predictor at a given point in time (e.g., White and Cunningham 1988; Smits et al. 1999). Cross-sectional survival analytic findings of time-to-death-related variability in a variable under study might be taken as indirect evidence of time-to-death-related *changes* that could have caused these differences. However, these analyses do not provide clear-cut evidence of terminal changes, leaving it unexplored whether and when intraindividual changes did generate the interindividual differences that are analyzed. For example, interindividual differences in cognitive abilities that predict survival might have persisted stably since early phases of the lifespan (Deary et al. 2004).

While it presents a weakness of the cross-sectional approach to distance-to-death research that survival analytic findings cannot provide evidence of terminal *change* in a strict sense, it should also be noted that this procedure is not affected by the potential selectivity problems due to the exclusion of study survivors (which may affect longitudinal analysis of terminal change, as explained above). In cross-sectional event history analyses, time-to-death can be treated as right-centered variable. That means that participants that have not deceased until the last mortality follow-up are included in these analyses, with their time-to-death considered as unknown but above the maximum value observed in the sample.

## **Distance-to-Death Research in Geropsychology: What Is It Good For?**

### **Terminal Versus Age-Graded Changes in Late life?**

In very general terms, gerontological research deals with changes in biological, psychological, and social functioning that unfold with some

regularity as humans approach and traverse the old age period of life. Therefore, analyses of age-related change had always played the important role to provide gerontologists with basic knowledge of such regularity, in terms of normative changes which are to be expected at certain ages, as well as the interindividual variability of such changes, pointing at the plasticity of aging processes. A great deal of research interest in psychological development in late life has focused on the losses and hardships that accumulate in old age, considering in particular how psychological functioning – such as cognitive performance, subjective well-being, etc. – gets affected by fundamental biological degradations that must occur in old age at least among those that prevented acute lethal diseases and other causes of premature death. With regard to this question, the analysis of age-related changes in psychological outcomes could be understood as an application of chronological age as indicator of such accumulation of loss: The older, the worse the physical health and other “objective” living conditions; hence, age may predict decline in psychological functioning. However, distance-from-birth may not be the optimal predictor of old age development driven by the biological degradations and the losses that tend to accumulate toward the end of the human lifespan. Taking into account that the occurrence, onset, and speed of such late-life aggravations are to some extent driven by nonnormative developmental influences, which may or may not affect individuals’ development more or less strongly at different times of their life course, a great deal of late-life development may come in old age, but not strictly age-graded (Baltes and Nesselroade 1979). Thus, chronological age might be unreliable indicator of impacts that promote changes in psychological functioning in old age.

In contrast, distance-to-death may do a better job in indexing the accumulation of crucial biological degradations (and other kind of loss) late in an individual’s life, considering that this accumulation itself marks the process that will end up in the individual’s death. That is, the health status of a 75-year-old who will not survive until age 80 could be expected worse compared to another

75-year-old who will live another 20 years, but might rather resemble the health status of a 90-year-old who will die before age 95. Following this reasoning, a focus on distance-to-death-related changes seems promising to add to the traditional age-related perspective in research on psychological late-life development in threefold respects, namely, (a) enabling the disclosure of non-age-graded developmental late-life dynamics, (b) promoting insights in the nature of processes that drive psychological late-life development, and (c) advancing geropsychological reasoning with paradigms of terminal phase of life and psychological terminality.

### **Disclosure of Non-age-graded Late-life Developments**

The distance-to-death perspective can provide some “instrumental” value for the empirical detection of change dynamics unfolding at the end of the human lifespan. That is, using time-to-death as a metric of time-graded changes in psychological variables under study could reveal changes that occur frequently and with some regularity in late life, which otherwise, grading change to age or calendar time of measurement, would not be detected.

Such added value gained from shifting the focus from an age-related to a distance-to-death-related perspective became apparent in recent years from studies that examined longitudinal changes in subjective well-being (SWB) using both time metrics, chronological age, and time-to-death (Gerstorff et al. 2008a, b, 2010; Palgi et al. 2010; Schilling et al. 2013; Vogel et al. 2013; Windsor et al. 2015). These studies reported changes in SWB associated with time-to-death – showing patterns of terminal decline of life satisfaction and affective components of SWB – but weaker (or no such) associations with age. This evidence of time-to-death-related decline is inconsistent with the notion of a “stability-despite-loss paradox” of SWB in old age (e.g., Kunzmann et al. 2000): Age-graded longitudinal SWB trajectories or cross-sectional age-SWB associations showed no age-related decline – or even some age-related improvement – in many studies, suggesting that SWB in general is maintained largely stable

across large parts of the old age period (noticing, however, reports of accelerated age-graded declines in the oldest-old ages; e.g., Pinguart 2001; Schilling 2005). Such apparent stability has been taken as evidence of old people’s overall high resilience toward the losses they are confronted with in late life (e.g., Kunzmann et al. 2000; Charles and Carstensen 2009). However, rather than “paradoxical” stability of SWB, the absence of age-related decline might mirror effects of differential survival, in that those who suffer from severe health losses that could aggravate their SWB will soon die or otherwise be prevented from study participation. Evidence of time-to-death-related decline in SWB supports this latter interpretation. Thus, shifting the focus from age-graded to time-to-death-graded changes in SWB was “instrumental” in drawing a more clear-cut picture of SWB development toward the end of the human lifespan, disclosing late-life change dynamics that imply a correction of a widespread notion of stability built on the age-related perspective.

### **Insights in Processes Driving Psychological Late-life Development**

Disentangling time-to-death-related changes from age-graded developments (or other intraindividual changes that unfold neither age- nor time-to-death-graded), could be essential to deepen the insights in the driving forces that impact on late-life psychological functioning. Usually, the time metric used to index changes in developmental studies is not considered a causal variable, but a proxy variable representing a set of processes covarying with the index time, considered causally linked with the change in the developmental variable under study. Interest in distance-to-death-related changes in psychological functioning follows an inherent rationale that these changes are driven by (or might even drive reciprocally) those “fatal” processes that will end in the loss of the individual’s biological capability needed to survive. Thus, psychological changes that unfold in association with distance-to-death are usually considered as linked with tertiary aging processes, denoting the biological degradations that unfold under impending death (Ram et al. 2010; Birren and Cunningham 1985).

Disentangling time-to-death-related change in a given psychological study variable from changes that unfold age-related and or related with the duration of some pathological conditions provides insight in the nature of the developmental process, telling the researcher whether the respective psychological changes are driven by terminal degradations or could be considered as consequence of biological aging in a strict sense or of the individual's particular pathological conditions (Ram et al. 2010; Sliwinski et al. 2003).

However, stressing such conceptual relevance of the distance-to-death perspective, some principal limitation of every time metric used to grade developmental changes should also be kept in mind. Regarding the study of age-related change, Wohlwill stated that *age is at best a shorthand for the set of variables acting over time, most typically identified with experiential events or conditions, which are in a direct functional relationship with observed developmental changes in behavior; at worst it is merely a cloak for our ignorance in this regard* (Wohlwill 1970, p. 50). This rather critical view might also apply to the use of time-to-death as time metric in developmental studies. That is, evidence of time-to-death-related psychological changes – such as terminal decline in cognitive performance or affective well-being – points at tertiary aging processes underlying such change, but of course it does not include an identification and confirmation of the particular causal impacts that drive this terminal change. Thus, in the quest for an in-depth understanding of late-life psychological development, evidence of time-to-death-related change does not mark the final destination, but rather a stopover, directing further scientific inquiry toward the specification of and the causal interplay between particular variables involved in the underlying process of tertiary aging.

Moreover, the clear-cut distinction of changes uniquely related with the timing of primary, secondary, and tertiary aging processes – by means of statistical modeling with given longitudinal data – might be an ideal hardly met. In particular, primary, secondary, and tertiary aging processes may not only co-occur and overlap but also interact in determining the course of individual

developmental trajectories. Obviously, mortality and pathology risks increase with age, and “secondary” pathology processes might also increase mortality risks. That is, the onset of tertiary aging processes cannot be considered independently from the onset and course of secondary aging processes, and both might depend on the course of the primary aging (considering plasticity of aging in terms of interindividual differences in the severity of age-graded changes). Thus, an interplay, rather than mere co-occurrence, of primary, secondary, and tertiary aging processes should be considered (for illustration see again Fig. 1).

Concerning statistical analyses that employ specific time metrics as proxy variables representing the impacts of these different processes, this consideration should take into account the “uniqueness” of the separation of time-to-death, age, or other time metrics’ effects on the developmental outcome variable studied: Most of the findings on terminal decline in cognitive performance or SWB published over the past decades rested upon some kind of longitudinal analysis of intraindividual differences in the outcome predicted by time-to-death and/or chronological age (commonly done by running multilevel or latent growth models). Typically these studies focused on evidence of unique time-to-death-related change that may not be accounted for by normative age-graded development, by either comparing separate models of age- versus time-to-death-related change in terms of model fit or intraindividual variance accounted for (e.g., Gerstorf et al. 2008a, b, 2010; Windsor et al. 2015), or by employing both time metrics simultaneously in one model in order to estimate their “unique” effects mutually controlled for the other time metric (e.g., Vogel et al. 2013; Sliwinski et al. 2003). If primary, secondary, and tertiary aging processes *interact* to some degree in causing the interindividual changes in the psychological outcomes studied, the estimates of time-to-death-related variability obtained with these statistical designs would not be perfectly “freed” from primary age-graded or secondary pathological processes. The potential interplay between such differentially time-graded processes might

be modeled statistically by inclusion of respective interaction effects between different time metrics in growth models (see, e.g., the statistical strategy proposed by Ram et al. 2010).

However, regarding the conceptual meaning of the statistical effects, the crucial point is that time-to-death-effects found in empirical data do not strictly correspond with tertiary aging processes and hence do not strictly discriminate the impacts of terminal degradations on late-life development from those of normative aging and “nonterminal” pathology. Thus, again, evidence of time-to-death-related psychological changes marks an important stopover on the pathway to an in-depth understanding of end-of-life development, pointing at terminal degradations of the human system that affect psychological functioning, but proceeding further on this pathway will need a specification and confirmation of the processes “proxied” by the time-to-death metric.

### **Considering Paradigms of Terminal Phase and Psychological Terminality**

In view of the so far massive evidence of intense changes in many domains of human functioning that co-occur and accelerate over individuals’ final years of life, the distance-to-death perspective in the study of late-life development may be driven further theoretically, considering psychological terminality and the terminal phase of the human lifespan as theoretical paradigms that might inspire and enrich future research on late-life development.

As a basic conclusion drawn from the large body of distance-to-death research, individuals approaching their end of life frequently undergo changes in psychological functioning along with physical health degradations, which did not unfold in some continuous manner across the adult lifespan, but occur specifically over some limited time period preceding the end, at whatever age it occurs. Therefore, the aging person’s “final years” might be considered distinct from previous life phases: An individual might pass on to the terminal phase of life when the accumulation of losses caused by primary and secondary aging processes sum up to a critical mass, triggering dynamics of physical and psychological change

specifically related with impending death. The co-occurrence and interaction of these particular dynamics might activate causal linkages which are not effective at “earlier” stages of the human life course, but particularly involved in the degradation of the human system in the approach of death.

For instance, research on nutritional health effects in very old subpopulations indicated a “risk factor paradox,” in that mortality risks implied by the nutritional status in the general adult and young-old population were reversed (e.g., obesity seems protective against mortality and decline of physical function; Kaiser et al. 2010), also adding to other findings of so-called reverse epidemiology (Kalantar-Zadeh et al. 2005). Though “nonpsychological” and not taken from distance-to-death research, this denotes an exemplary case of specific causalities – different from those found in the healthy general population – that emerge under conditions of aggravated physical health and biological degradations. Similarly, the severe physical and functional loss conditions typically met in the terminal phase of life might interact in triggering consequences that will reveal causal dynamics not only quantitatively more intense, but qualitatively different from those driving preterminal development. Therefore, the terminal phase of life might be viewed conceptually as a period of unique meaning, to be distinguished from age-graded segmentations of the lifespan such as the “third” and “fourth” ages.

Furthermore, a crucial aspect which could hold particular importance for psychological functioning in this terminal phase is the individual’s subjective perception of distance-to-death-related accumulations and accelerations of degradative changes. These might generate a sense of impending death, provoking behavioral and affective responses which could be understood in terms of psychological terminality. The self-regulatory reactions of individuals who “feel it coming” may at least to some extent be directed toward the impending death, serving to facilitate the unavoidable process of dying. Thus, criteria of successful preterminal adaptation – such as maintenance or restoration of goal achievement and primary

control capacities (Heckhausen et al. 2010), protection or optimization of positive SWB outcomes, and so forth – might no longer be sufficient to understand end-of-life self-regulation. Reasoning in such a way about psychological terminality could inspire research on late-life development, at least by creating “paradoxical” views of adaptive changes, conflicting with the motivational constructs assumed as driving forces of adaptation across the lifespan. For instance, it might be asked whether terminal declines of hedonic well-being could be adaptive in supporting the self-regulation of impending death, in that individuals may easier disengage from life when it has become less hedonically rewarding. Similarly, one might even consider some cognitive declines adaptive in the terminal phase of life: For instance, reduced memory function might help to prevent too intense cognitive processing of the loss of life, which otherwise might cause feelings of regret and despair.

The arguments for such uniqueness of the terminal phase of life and psychological terminality unfolding within are quite speculative at this stage of distance-to-death research, as empirical research findings relevant to the particular matter of such uniqueness are barely present in the gerontological publication arena. Thus, these theoretical propositions should be understood as prospective paradigms for the further proceeding of distance-to-death research (noticing also theoretical work that provided at least implicitly some ideas of psychological terminality, such as Joan Erikson’s addition of a ninth stage of development to the Eriksonian psychosocial theory of lifespan development, (Erikson 1997); and the thanatopsychological premise that knowing about their death impacts on human’s attitudes and behavior, (Kastenbaum 2000)). That is, with substantial evidence of time-to-death-related changes in key domains of psychological functioning established, future research might move toward distance-to-death-related changes of structural relationships and dynamic interactions, involving these psychological domains. For instance, key questions that are still hard to answer include: How do people cope with health experiences signaling impending death – do they adapt to the

health aggravations in the terminal phase of life differently than to health problems experienced earlier in a “nonterminal” life situation? Which role do fears of death and dying play for such adaptation in the approach of life’s end?

## Conclusions

Up to the present, distance-to-death research in geropsychology has developed over a period of more than five decades, revealing a body of solid evidence on terminal decline of cognitive functioning and, more recently, in SWB. Altogether, this research suggests that the end of life typically comes with intense and accelerated intraindividual changes of psychological functioning, which reflect the degradation of the biological and psychological systems that drive these changes. In such a way, the terminal phase of life appears as some kind of mirror image of the initial phase of life, in that rapid changes unfold at both ends of the lifespan, driven by causal mechanisms related with the respective endpoint – maturational processes unfolding after birth and terminal processes promoting the degradation of the organism.

However, distance-to-death research at present also appears as a still emerging field of geropsychological inquiry, far from any state of completion. The manifold findings of terminal changes reported so far inspire further questions concerning the interrelationships between time-to-death-related changes in different psychological domains and on the nature and specification of the underlying processes. Also, the generality of the terminal change phenomenon has yet to be explored (Gerstorf et al. 2013): Which other domains of psychological functioning – in addition to cognitive abilities and well-being – undergo time-to-death-related changes? Finally, in view of the co-occurrence and interplay of terminal changes in different psychological attributes, considering the terminal phase of life as a distinctive developmental segment of the human lifespan might be a paradigm advancing research on late-life development. In the terminal phase, the accumulation and acceleration of biological degradations preceding an individual’s death might

make special adaptive demands, not faced so far in previous developmental phases. Distance-to-death-related changes of psychological functioning might then be better understood in regard of their terminality, driven by these demands.

## Cross-References

### ► Life Span Developmental Psychology

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## Dual Sensory Loss

Chyrisse Heine

College of Science Health and Engineering,  
Department of Community and Clinical Allied  
Health, School of Allied Health, La Trobe  
University, Melbourne, VIC, Australia

## Synonyms

Combined sensory loss; Deafblind; Dual sensory impaired; Dual sensory impairment; Vision and hearing loss

## Definition

Dual sensory loss (DSL) is the acquired loss, in various degrees of severity of both vision and hearing acuity, associated with aging and prevalent in older adults.

Dual sensory loss (DSL) is the acquired, combined loss of vision and hearing prevalent in older adults. As adults get older, they often also experience changes in their sensory acuity as well. In particular, significant eye and ear changes occur. Commonly, the sclera of the eye changes in color, the number of mucous cells in the conjunctiva may decrease, the retro-orbital fat atrophies causing the eye socket to recede, eyelid tissue becomes lax and the levator muscle weakens causing the eyelid to droop, deposits of calcium and cholesterol salts often appear, retinal changes take place, and the pupil weakens and changes size (Nigam and Knight 2008). Visual conditions such as cataract, diabetic retinopathy, retinitis pigmentosa, glaucoma, and macular degeneration are common in older adults often leading to devastating visual difficulties (including low vision or legal blindness). The degree of impairment arising from the visual difficulty varies. Early cataract changes often only affect glare, while in more advanced stages, cataracts cause blurred vision and impaired contrast sensitivity and in severe cases blindness may occur, although cataract surgery

often restores functional vision. Diabetic retinopathy usually affects both eyes and results in blurred, distorted vision of the central visual field although laser surgery is sometimes successful in restoring functional vision. Glaucoma results in loss of the visual field and if controlled, sight loss may be minimal. If uncontrolled, impaired vision or blindness often results. Finally, age-related macular degeneration is the progressive loss of reading vision and sharp distance vision. This retinal disorder usually occurs bilaterally and affects the central part of the visual field frequently leaving peripheral vision unaffected. According to the WHO ICD-10 ([World Health Organization](#)), the severity of visual impairment ranges from moderate visual impairment (distance visual acuity worse than 6/18 and equal or better than 6/60), to severe visual impairment (distance visual acuity worse than 6/60 and equal or better than 3/60), to blindness (distance visual acuity worse than 3/60 to no light perception).

Age-related visual loss frequently results in light sensitivity and reduced tolerance for glare. Central or peripheral field losses cause a multitude of problems ranging from intolerance to variations in luminance to dependence on high levels of luminance, reduced contrast sensitivity, the inability to see fine detail of large low contrast objects, difficulty visualizing distant objects, discriminating detail, adapting to darkness, and distinguishing between colors. Additional visual difficulties include the reading of print even when using visual aids (e.g., reading legal documents, notices, magazines, or recipe books) and restricted mobility which frequently interferes with a person's ability to move around safely in the environment. These difficulties are disabling having severe psychosocial ramifications, such as decreased ability to participate in activities of daily living (ADLs) and independent activities of daily living (IADLs) independently, depression, and decreased social interaction.

Likewise, ear changes associated with the aging process occur and include: changes to the external pinna (such as enlargement), loss of elasticity of the external auditory canal, thinning and stiffening of the eardrum, calcification of the ossicles, atrophy of the muscles of the middle ear,

atrophy and diminishing cochlea hair cells, and vestibular and neural changes (Nigam and Knight 2008). Ear conditions that are prevalent in older people are cerumen (earwax) accumulation, conductive hearing loss (e.g., due to middle ear ossification), sensorineural hearing loss (e.g., due to presbycusis, noise-induced hearing loss, or multiple sclerosis). Central auditory processing disorder (CAPD) may occur due to neural changes in the central auditory nervous system. Hearing loss is usually defined according to the corresponding decibel loss consisting of mild, moderate, moderate-severe, severe, or profound hearing loss categories. These acquired hearing disorders are often slow to deteriorate and difficult to identify early due to the subtle changes that develop gradually. The hearing loss is typically more severe in the high frequencies affecting the perception of sounds (such as f, th, sh, and s speech sounds) and speech reception or understanding (particularly in poor listening situations or when there is high background noise or reverberation), difficulty with speech discrimination and the processing of auditory information.

Any combination of vision and hearing loss (even when a mild loss occurs in both vision and hearing) is termed DSL. The impact of DSL is devastating for older people, having significant implications for their health care. These prevalent conditions (vision and hearing loss) need to be recognized and considered by clinicians, researchers, and policy makers, particularly since the prevalence of these conditions is expected to rise in future years.

## Prevalence

In line with global population aging, there will be an increased number of older adults with vision and hearing loss. According to the WHO (2012a), amongst the 285 million people worldwide who are visually impaired, in the 50 year and over age group, 65% are visually impaired and 82% are blind. Similarly, of the 328 million adults with disabling hearing loss worldwide, approximately one-third is aged 65 years and over (World Health Organization 2012b).

Since the prevalence of vision loss and hearing loss is high in the older adult population, it is a rightful assumption that the prevalence of the combined sensory loss (DSL) would be high in this segment of the population and worthy of further investigation and discussion. Research in the prevalence of DSL, however, reflects a relatively small body of work in comparison to other chronic conditions affecting older adults such as diabetes or dementia. Estimates of the prevalence of DSL vary greatly in the literature. This is primarily due to the different methodological approaches used to investigate DSL and the specific population investigated in studies of DSL. The following are two examples of studies that illustrate the disparity in prevalence estimates: Caban et al. (2005) found that the prevalence of DSL in their sample of 1110 community residing people in the USA was 7.3% in those participants aged 69–79 years and 16.6% for those aged 80 years and over. Schneider et al. (2012), however, obtained considerably different results in their longitudinal study of 2015 adults living in the Blue Mountains in Australia. Participants were aged 55 years and older at baseline. Results suggested that the prevalence of DSL (termed DSI in this study) was 6% at baseline, increasing from 0% for ages <60 years to 26.8% for participants aged 80 years and over.

The type of cohort included in studies of DSL also produces different prevalence rates. While Smith et al. (2008) concluded that DSL ranged from 5.0% to 7.4% in the older adult veteran cohort, increasing to 20% in veterans aged 85 years and over, Cacchione et al. (2003) found that 52.6% of their sample of older adults living in rural long-term care facilities were visually impaired; 44.1% were hearing impaired; 24.6% were dually impaired (had DSL); and 23.4% had no sensory impairment.

Gender is also an important factor that influences the prevalence of DSL. The literature shows that moderate and severe vision impairment and blindness have a higher prevalence rate in women than men (West et al. 1997). However, men are at a higher risk for developing hearing loss due to their increased participation in the military (noise exposure) or having worked in noisy occupations during their lifetime. Physically, hearing loss is

associated with different phenomena in men compared to women. In men, hearing loss is associated with high triglyceride levels, high resting heart rate, and a history of smoking, while hearing loss in women is associated with high body mass index, high resting heart rate, fast pulse wave velocity, and low Ankle-Arm Index (Helzner et al. 2011).

A variety of vision and hearing measurement methods (such as self-report, standardized measures or observation) have been used to investigate DSL (Heine and Browning 2015). This use of different measures as well as the above-mentioned factors has made the comparison of studies difficult.

### Consequences of DSL

DSL affects older adult's everyday lives, functioning and participation in activities, and has implications for their health and psychosocial well-being. In particular, difficulty with communication is frequently observed (Heine and Browning 2002). Many older adults with severe visual loss cannot see their communication partner's face clearly and therefore cannot lip-read or perceive cues such as gesture, facial expression, and body posture and thus need to rely heavily on the auditory modality for adequate speech reception (Heine et al. 2002). For people with DSL, auditory acuity is reduced and even if hearing loss is mild, the auditory modality cannot compensate for diminished visual acuity. Communication difficulties such as reduced conversational fluency, adequate reception of a verbal message, and difficulty with identification of verbal and nonverbal cues result in communication misunderstandings or breakdowns (Heine and Browning 2002). In turn, conversational difficulty interferes with performance and confidence in social-communication situations often resulting in diminished psychosocial functioning.

Many older adults with DSL are at risk for developing a multitude of difficulties, including depression and decreased well-being. Kiely et al. (2013) investigated the association between DSL and mental health in 1611 adults aged

65–103 years. They found an association exists between depressive symptoms and DSL that was attributed to adults with DSL experiencing difficulty with completing ADLs and having limited social engagement. In line with these findings, Crews and Campbell (2004) also found that older adults with DSL had difficulty with everyday competence, experienced poorer health, and had decreased social roles.

The consequences of DSL are extensive as was evident in a study by Wallhagen and colleagues (2001) who investigated the relationship between DSL and several comorbidities in 2442 adults aged 50–102 years. These authors concluded that DSL had a strong impact on physical and social functional status.

### Clinical Assessment

To date, there is no consensus regarding the identification and assessment of DSL for either research or clinical purposes. While self-report, questionnaires, and tests such as the Snellen eye test (for vision) and pure-tone air audiometry for hearing have been commonly used in research studies (Heine and Browning 2015), little literature exists regarding the identification of both disorders in one clinical setting. Service providers almost always identify vision and hearing disorders within separate contexts. That is, the vision specialists (such as the optometrist and ophthalmologist) assess vision and evaluate the client's perceptions about their visual loss, while audiologists assess hearing and appraise the client's perceptions about their hearing loss. The identification of DSL clinically is therefore reliant on a collaborative approach between professionals, which assumes that additional education concerning DSL has been provided to all team members working with older adults. For example, the audiologist needs to take into account a client's visual difficulties (such as "blurry" vision) and conducts the audiological consultation by considering the necessary accommodations that are required. These might include: reducing the distance between conversationalists, accounting for mobility needs, and adjusting the room

lighting (e.g., by reducing the glare). Likewise, it is essential for the vision specialist to accommodate a client's hearing difficulties by reducing the distance between conversationalists and using effective communication strategies such as speaking slower, clearer, and louder and repeating or expanding utterances for clarification purposes. The lack of DSL clinical guidelines and professional education programs educating visual specialists about hearing loss and audiologists about vision loss are significant barriers to the early identification of DSL and is thus an area for further investigation.

### Management of DSL

This interdisciplinary area of practice requires the collaboration of a number of medical and allied health professionals including general physicians, ophthalmologists, otolaryngologists, vision specialists (such as optometrists), audiologists and speech-language pathologists (SLPs). Following diagnosis, the vision specialist and audiologist counsel and advise clients about their sensory acuity and provide rehabilitation or management strategies, especially fitting the necessary devices (such as magnifiers to enlarge print for visual enhancement and hearing aids and assistive listening devices for amplification). The SLP is often included as a team member in the rehabilitation program and is in an ideal professional position to provide clients with DSL strategies and practice to improve their communication. Heine et al. (2002) conducted a cross-sectional study at a day center for visually impaired people investigating the communication, situational difficulties and conversational needs of older adults with sensory loss, and their communication partners. Results suggested that older adults with DSL experienced a range of functional vision and hearing and communication difficulties and would benefit from specifically devised training programs.

The management plan for those with DSL needs to take into account the client's unique sensory status, competencies, and barriers. Again, the vision specialist, audiologist, and SLP need to be educated in the area of DSL and its

management in order to delineate and implement an adequate rehabilitation program. For example, as part of the rehabilitation program, when fitting a hearing aid for a client who has DSL, the audiologist needs to consider the client's visual difficulties and possible inability to manipulate small objects such as the battery of a hearing aid or read written instructions. In these instances, visual accommodations such as the use of a magnifier or enlarged font size may be warranted and from an audiological viewpoint a magnetic-tipped device for battery removal may be useful. From a technological perspective, it is imperative that the audiologist considers that a client who has DSL has different audiological needs to a client who has a hearing loss. Simon and Levitt (2007) discussed numerous audiological issues in relationship to DSL including specific recommendations for amplification fittings. These authors proposed that hearing aid fittings should be adjusted for people with DSL (e.g., consider the use of directional microphones) to improve their sound localization and binaural processing which are of primary importance for speech perception and spatial orientation.

Visual and hearing devices are one aspect of the rehabilitation process. Other relevant clinical target areas include speech perception training, communication programs for clients and carers (Heine et al. 2002), and the provision of informational counseling and psychosocial support (Brennan and Bally 2007). Tye-Murray (2009) has been instrumental in researching audiovisual speech perception in people with vision and/or hearing loss. Outcomes of their research suggest that audiovisual speech perception is related to auditory and visual word neighborhoods (context) and multisensory integration. Thus for people with DSL, practice drills including these concepts should be included in the intervention program.

Over the past two decades, communication training has gained popularity as a valuable rehabilitation method for people with DSL. In accordance with a client-centered approach, the person with DSL and if possible, their frequent communication partner/s (family or carer) participate in a communication training program to address the

environmental, situational, and conversational needs of the person with DSL (Heine et al. 2002). In these training programs, the clients and carers practice effective listening skills, situational management (such as being proactive and preselecting a quiet listening environment for a conversation; reducing glare or background noise), and the use and implementation of communication strategies (such as identification of conversational breakdown and the use of communication repair strategies). Communication training programs can enhance conversations, minimize communication breakdown, and increase social confidence thereby improving the social interaction, quality of life, and well-being of older adults with DSL.

A complimentary unique model of intervention is the biopsychosocial model discussed by Brennan and Bally (2007). This model focuses on the coping and adaptation strategies that older adults with DSL can use to improve their functioning, independence, and well-being. Counseling and assertiveness training are beneficial especially since many older adults with DSL often feel vulnerable and have decreased self-esteem and confidence. This emotional reaction in turn often leads to social isolation, depression, and decreased feelings of well-being.

Although DSL is a new field of research and clinical practice, the diverse management programs show promising progress.

## Future Directions

Between 2000 and 2050, the number of people aged 80 years and over in major areas worldwide will more than quadruple (United Nations, Department of Economic and Social Affairs, Population Division 2004). With increasing longevity, and the increase in the size of the older adult population, the prevalence of DSL will increase dramatically.

While DSL in this segment of the population is still under-researched, gains have been made in the recognition of DSL as a clinical entity that is currently being researched more widely. Prevalence studies are more common although they

still reflect disparate findings. Interventions such as enhancing signal processing by modifying the dimensions of hearing aids, (Simon and Levitt 2007) multisensory integration (Tye-Murray 2009), communication strategy usage, and psychosocial adaptations continue to be researched and discussed in the literature. Further research is, however, necessary to increase professional and community awareness, knowledge and understanding of this group's communication and psychosocial needs. In order to achieve an exceptional professional service for older adults with DSL, including methods of early identification of DSL and the use of effective visual and auditory rehabilitation strategies, a richer discussion among researchers and professionals is required. The adoption of an interdisciplinary perspective is imperative, and the development of clinical guidelines to support this collaboration is an essential step in informing clinical practice.

For older adults with DSL, the future looks promising as research continues. Promoting the topic of DSL provides this area with the important recognition it deserves, especially since outcomes of research and clinical studies can contribute to these adults' well-being and improved quality of life.

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## Dynamic Analyses to Optimise Ageing (DYNOPTA)

Kim M. Kiely, Richard A. Burns and Kaarin J. Anstey  
Centre for Research on Ageing Health and Wellbeing, Research School of Population Health, The Australian National University, Canberra, ACT, Australia

### Definition

The Dynamic Analyses to Optimise Ageing (DYNOPTA) project has harmonized and pooled nine epidemiological studies of human aging to examine pathways to compressing morbidity and optimizing healthy aging in the Australian population. Research using the DYNOPTA dataset has focused on four main outcomes that contribute to disease and disability burden among older adults: cognitive function, sensory function, mental health, and mobility or activity limitations.

### Project Background and Aims

DYNOPTA is a cross-institutional and multidisciplinary project that has harmonized and pooled

nine independently designed longitudinal studies of aging, creating a large nationally representative dataset of older adults in Australia. Aggregating data from a number of cohort studies has the advantages of enhancing population coverage (reducing coverage error), increasing sample size of underrepresented groups (such as the oldest old or those with rare medical conditions), facilitating instantaneous replication across studies, allowing cross-population comparisons, and investigating the impact of study idiosyncrasies on research findings. The broad aims of the DYNOPTA project are to identify effective pathways to compress morbidity and optimize aging (Anstey et al. 2010a, 2011a).

The DYNOPTA dataset is rich including the theme areas of cognitive functioning, sensory-motor functioning, mental health, mobility, and functional independence. The pooled dataset also includes background variables that cover sociodemographics, health, lifestyle, medical conditions, carers, and mortality. Within the DYNOPTA dataset, there are over 400 harmonized variables, which, when combined with individual observations, results in excess of 18 million data points. DYNOPTA therefore provides some of the most comprehensive available evidence on the health and well-being of older Australians between the years 1990 and 2006.

### Contributing Studies and Sample Composition

The target population for the pooled DYNOPTA dataset is defined as all Australians born prior to December 1955, resulting in a baseline age range of 45–103. However, the target populations for the individual studies vary by geography and demography. There are study design differences in sample frame, random sampling procedures (simple, stratified, and clustered), data collection procedures (clinical interview, postal, telephone and self-completion questionnaire), baseline year (ranging from 1990 to 2001), age range, sample size, time intervals, and the number of follow-up waves. It is therefore important that analyses account for study design effects either through weighting and/or

**Dynamic Analyses to Optimise Ageing (DYNOPTA), Table 1** Nine studies contributing to the DYNOPTA dataset

Study	Location	N	Baseline age range	Waves	Period
Australian Diabetes, Obesity and Lifestyle (AusDiab) study	National	7,296	45–95	2	1999–2005
Australian Longitudinal Study on Women's Health (ALSWH)					
Middle-aged cohort	National	13,706	45–51	4	1996–2005
Older-aged cohort	National	12,431	68–76	4	1996–2005
Household, Income and Labour Dynamics in Australia survey (HILDA)	National	6,164	45–90+	5	2001–2006
Australian Longitudinal Study of Ageing (ALSA)	Adelaide	2,087	65–103	7	1992–2004
Blue Mountains Eye Study (BMES)	Blue Mountains	3,654	45–100	3	1992–2004
Canberra Longitudinal Study (CLS)	Canberra, Queanbeyan	1,134	70–103	4	1990–2002
Melbourne Longitudinal Study on Healthy Ageing (MELSHA)	Melbourne	1,000	65–94	11	1994–2006
Personality and Total Health (PATH) Through Life	Canberra, Queanbeyan	2,550	60–66	2	2001–2006
Sydney Older Persons Study (SOPS)	Sydney	630	75–97	5	1991–2003

modeling adjustments. The contributing studies include three nationally representative panel surveys and six regional studies that were representative of the local community (see Table 1). The national surveys contribute 65% of participants.

The full DYNOPTA dataset is large and complex, consisting of 50,652 participants who were followed longitudinally, on up to 11 measurement occasions over a 15-year period. Over all studies, there was an average of 4.4 measurement occasions over a period of 9.4 years ( $SD = 2.9$ ) and on average sample members participated in 3.1 measurement occasions. The mean age at baseline was 61.7 years ( $SD = 12.4$ , range = 45–103), and 77% of the sample were women, reflecting the inclusion of the all-female cohorts from the ALSWH and women's greater longevity (excluding participants from the ALSWH, 53% were woman). Study participants were generally community living, but five studies did include adults who resided in institutions such as nursing homes. Further information about each of the contributing studies, full description of the sample, and project background can be found in a cohort profile published in the International Journal of Epidemiology (Anstey et al. 2010a) and a

summary of policy-relevant findings in the Australasian Journal on Ageing (Anstey et al. 2011a).

### Variable Harmonization

Variable harmonization is the rescaling of functionally equivalent measurement instruments onto a common metric. While this process may result in coarse-grained data (information loss), it has the advantage of providing a framework for the direct comparison of data obtained from independently sampled populations. Within DYNOPTA, variables were primarily harmonized retrospectively using the *by fiat* method, which involves identifying common variables and, when necessary, recoding response categories onto the same scale where the possibility of disputing the recode is deemed trivial by a panel of experts. Modeling-based approaches were used to standardize mental health variables such as depression symptoms. Table 2 shows a selection of variables harmonized in each of the content domains. Where possible, variables were harmonized to conform to Australian national standards. Some measures were not collected by all contributing studies, resulting in

**Dynamic Analyses to Optimise Ageing (DYNOPTA), Table 2** Selection of harmonized variables for each domain

Domain	Example measures
Cognitive function	Mini-Mental State Examination (MMSE)
Sensory function	Visual acuity, pure-tone audiometry, self-reported vision and hearing difficulties, hearing aid use, dual sensory loss
Mental health	SF-36, probable depression, psychological distress
Mobility and disability	Activities of daily living, driving
Mortality	Date of death
General health and medical conditions	Diabetes, hypertension, cardiovascular disease, stroke, arthritis, BMI, self-rated health
Sociodemographics	Age, sex, partner status, education, career occupation, labor force status, domicile
Health behaviors	Alcohol consumption, smoking status, physical activity

study censoring. For example, the Mini-Mental State Examination (MMSE) was only collected by the six regional studies. Mortality data were obtained by linkage with the Australian National Death Index. Weights have been calculated to account for design differences in sampling, selection, and response rates. Weighted estimates are intended to reflect the Australian estimated resident population in 1996.

## Profiling the General Health and Population Norms for Older Adults

One of the main contributions of the DYNOPTA project has been the estimation of population prevalence, national trends in behavioral patterns, and calculation of normative data for older adults. Population estimates derived from single studies are often restricted to reporting norms for broad age ranges (e.g., 75+) or may even exclude adults aged older than 85 due to lack of recruitment (Anstey et al. 2010b; Burns et al. 2013a). Of particular importance, data pooling in DYNOPTA has increased the number of participants aged over 80, allowing for more robust and reliable

norms of those in older age. For example, population prevalence has been estimated for chronic disease and medical conditions (Bielak et al. 2012), probable dementia (Anstey et al. 2010b), hearing loss (Kiely et al. 2012a), depressive symptoms (Burns et al. 2012a), self-rated health (Anstey et al. 2007), and driving trends (Ross et al. 2009) in older Australians. Normative data that is representative of the older adult population has been generated for common neuropsychological tests and assessment scales including the National Adult Reading Test (NART) (Kiely et al. 2011) and SF-36 (Bartsch et al. 2011). Population level norms have also been published for health behaviors such as smoking and alcohol consumption (Burns et al. 2013a) and engagement in physical activity (Sims et al. 2014). Burns and colleagues (Burns et al. 2013a) examined period effects by comparing patterns of alcohol and smoking consumption during the years between 1990–1994 and 1996–2002. They reported a decline in the proportion of adults who consumed alcohol at high risk levels or currently smoked tobacco over this period.

By mapping the demographic profile of a number of longitudinal cohort studies, DYNOPTA researchers have been able to reveal public health knowledge gaps by identifying subpopulations with low participation rates. In particular, they have documented the poor representation of Indigenous Australians in longitudinal studies of aging (Anstey et al. 2011b).

## Cognitive Function

There are no existing prevalence data for dementia based on clinical diagnoses in Australia, and other national surveys have limited numbers of participants in ages 75 years and older. To address this, DYNOPTA has provided the most recent national prevalence estimates of cognitive impairment (probable dementia) (Anstey et al. 2010b). Cognitive impairment was defined by an MMSE score of 23 or less. A cut point of 23 on the MMSE was reported to have a specificity of 0.96 and 0.91 and sensitivity of 0.75 and 0.60 for dementia diagnoses in the Canberra Longitudinal Study (CLS) and

Sydney Older Persons Study (SOPS), respectively. Cognitive impairment was estimated to occur in 15.8% (95% CI: 14.0–17.7) of adults aged 75 years and older, increasing to 41.4% (95% CI: 31.3–50.8) of adults aged 90 years and older. These estimates were highly consistent with results from meta-analyses of European studies. There were no significant sex differences in the prevalence of cognitive impairment, although higher education was associated with higher MMSE scores.

Healthy life expectancy research on cognition had previously focused on social inequalities in cognitive impairment-free life expectancies, by demonstrating differentials in years lived with cognitive impairment by level of educational attainment. DYNOPTA data has been used to extend this literature by investigating the effects of modifiable risk factors for dementia. Multistate models were used to estimate the impact of obesity, smoking, and sedentary behavior on cognitive impairment-free life expectancies (Anstey et al. 2014). Smoking was associated with the largest reductions in total life expectancy and years lived without cognitive impairment for men and women, regardless of their education level. However, with the exception of obesity in men, all risk factors were also associated with fewer years lived with cognitive impairment. The key conclusion from this analysis was that although healthy lifestyle behaviors delayed the onset of cognitive impairment, they did not necessarily prevent it. Crucially, as age is the strongest risk factor for dementia, and dementia risk reduction also increases longevity, risk reduction strategies may result in more years lived with cognitive impairment at a population level. This finding has important implications for statistical modeling of the impacts of dementia risk reduction and projections of future dementia prevalence.

## Sensory Function

The DYNOPTA dataset includes measures of self-rated vision and hearing loss as well as clinically assessed measures of visual acuity and pure-tone

audiometry. To date, most DYNOPTA studies of sensory function have focused on age-related hearing loss. Notably, over 70% of adults aged 80 years and older were estimated to have at least a mild degree of hearing impairment as defined by a pure-tone average of speech frequencies (0.5–4 kHz) greater than 25 dB in the better ear (Kiely et al. 2012a). An evaluation of the utility of self-reported hearing loss in comparison to hearing loss defined by pure-tone audiometry demonstrated that the prevalence of hearing loss based on self-report data was likely to be overestimated for adults younger than 75, but underestimated for older age cohorts (Kiely et al. 2012a).

Another significant study modeled longitudinal trajectories of audiometric hearing thresholds in 3,526 adults. Importantly, these analyses examined an extensive range of risk factors for hearing loss not elsewhere investigated, including sociodemographics, noise exposure, medical conditions, and cognitive impairment. It was found that age, cognitive impairment, and hypertension were associated with faster rates of decline in hearing thresholds. However, many other factors commonly associated with differences in hearing levels did not predict rates of decline in hearing thresholds (Kiely et al. 2012b). A currently active stream of research on sensory functioning involves calculating sensory impairment-free life expectancies. These analyses demonstrate that in addition to being highly prevalent, hearing and vision impairment can affect older adults for substantial periods of their remaining life.

## Mental Health

The burden of psychological distress of older adults, particularly those living in the community, is unclear; some findings purport an increase in depression risk with increasing age; others suggest a decline in depression risk. However, many of these findings are confounded by increasing heterogeneity with age and small sample sizes. This is particularly the case for older men with some suggestion that men are at greater risk of reporting depression in late life. Analyses with DYNOPTA indicate a pattern of increasing

depression risk in men although this failed to reach a level of statistical significance (Burns et al. 2012a, 2013b). More robust evidence was found for increasing levels of depressive symptomatology among older men (Burns et al. 2013b); this appears to mirror rates of suicide in older Australian men. Gender differences in mental health in late life have also been reported when examining terminal mental health decline. That is, in both men and women, there is evidence that depressive symptoms increase substantially in the years preceding death. Findings from DYNOPTA indicate this association is more strongly pronounced in men and that most of the effect in women can be accounted for by comorbid physical health states (Burns et al. 2013c).

With increasing interest in dimensions of positive mental health and well-being, DYNOPTA has provided substantial evidence of the need to examine dimensions of psychological health and well-being that are not necessarily captured in clinically relevant dimensions of psychological distress. For example, in contrast to measures of psychological distress, vitality – a sense of vigor, energy, and engagement – has been implicated as a stronger predictor of self-rated health (Burns et al. 2014a), falls (Burns et al. 2012b), and mortality (Burns et al. 2014b, c).

Another study examined age differences in high- and low-arousal positive and negative affect. Lower levels of negative affect and higher levels of low-arousal positive affect were reported by older adults relative to those in midlife (Windsor et al. 2013). Interestingly, physical function suppressed the association of older age with reduced high-arousal positive affect and lower negative affect. In other words, age differences in affect were amplified after additionally accounting for covariation with physical function. These findings were interpreted as being consistent with the notion that older adults tend to restrain high-arousal emotions in order to avoid uncomfortable levels of physiological arousal and provided further evidence that age differences in the expression of negative and positive affect are underpinned by lower levels of physical functioning among older adults.

## Driving

DYNOPTA has been used to provide national trends in driving rates and predictors of self-reported driving and to investigate the proportion of older drivers with low levels of cognitive and/or sensory functioning (Ross et al. 2009). In this study it was reported that 46% of adults over the age of 65 were nondrivers. The proportion of nondrivers was greater for women and for older age groups, such that for those aged 85 years and older, 37% of men and 5% of women reported that they were current drivers. Discontinued driving was more likely to be reported by participants who were women, older, not married, had careers in lower-skilled occupations, were living with impaired levels of visual acuity, and had poorer health. Although people with suspected cognitive impairment (MMSE < 23), and visual impairment (visual acuity > 0.3 logMAR) did generally reduce or cease driving, there remained substantial numbers of men who continued driving with cognitive or visual impairments.

By combining data from a number of state jurisdictions across Australia, Ross and colleagues were able to evaluate the implications of differing licensure policies for older adult driving rates (Ross et al. 2011). They compared differentials in driving rates between state jurisdictions with and without mandatory age-based license testing. It was reported that mandatory age-based testing for renewal of driving licenses was associated with lower rates of driving, but was not effective in reducing the proportion of older drivers who had either a visual or cognitive impairment.

In summary, the pooling of existing datasets to create DYNOPTA has produced the largest dataset on aging in Australia. This resource has enabled both population-based research of a descriptive nature and developmental research on trajectories, trends, and patterns of characteristics at ages for which Australia previously lacked large datasets. The process of developing the pooled dataset has demonstrated the feasibility and utility of this approach.

## Cross-References

- ▶ [Australian Longitudinal Study of Aging \(ALSA\)](#)
- ▶ [Mental Health and Aging](#)

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## Early and Unplanned Retirement

Gwenith G. Fisher<sup>1</sup>, Amanda Sonnega<sup>2</sup> and Dorey S. Chaffee<sup>1</sup>

<sup>1</sup>Department of Psychology, Colorado State University, Fort Collins, CO, USA

<sup>2</sup>Health and Retirement Study, Survey Research Center, Institute for Social Research, University of Michigan, Ann Arbor, MI, USA

norms. Unplanned retirement refers to a retirement process or decision that was not anticipated. Because retirement has been increasingly conceptualized as a process rather than a discrete event, it has become more challenging to conceptualize early and unplanned retirement. Early and unplanned retirement combines the timing of retirement as well as the extent to which the process of retirement was anticipated.

## Synonyms

Early retirement age

## Definition

Early retirement refers to the timing of leaving the labor force, but the notion of early is relative, and therefore, there is not one single definition of what constitutes early retirement. One definition of early retirement is economically driven (e.g., earliest age of eligibility for pension plan benefits). The exact age that defines early retirement varies across countries due to differences in public policies. In the United States, early retirement is currently considered prior to age 62, because age 62 is the earliest age of eligibility for Social Security benefits. The second definition is early relative to one's own expectations regarding the timing of retirement. The third definition is based on societal, cultural, or institutional

## Introduction

Given the rapid aging of the large baby boom generation and global aging generally, understanding the retirement transition and its impact on retirement well-being is more important than ever. A key factor in this transition is whether retirement is planned or unplanned. Another important distinction is whether retirement occurs at an early age or a normal retirement age. What constitutes "early" retirement is relative. This entry addresses issues around early and/or unplanned retirement. The study of early and unplanned retirement has implications for determining when and how workers may depart from the workforce, as well as for understanding consequences, including adjustment and well-being postretirement.

A great deal of research in the 1980s and 1990s focused on retirement timing and particularly decisions to retire early (e.g., Feldman 1994) because studies of labor force participation clearly

documented a trend toward increasingly younger average age at retirement. For a variety of reasons, that trend now appears to have reversed, yet a significant proportion of workers in their late 50s and early 60s continue to leave the labor force, both voluntarily and involuntarily. Therefore, understanding the antecedents and consequences of early and unplanned retirements remains an important research and policy focus. A variety of antecedents to retirement have received research attention, including characteristics of workers (e.g., health status, sociodemographics, preferences), characteristics of their families (e.g., spouse's health status and other caregiving needs), and characteristics of the work environment. Each of these is described below (see "[Antecedents](#)"). Other researches direct attention to the consequences of early and unplanned retirement such as impacts on mental and physical health, family, and financial well-being (see "[Consequences](#)"). Lastly, a growing literature addresses the variety of paths workers are now taking as they exit the labor force. The traditional model of moving from full-time employment to full and permanent retirement is growing less common. Retirement is seen as a process rather than an abrupt transition (Shultz and Wang 2011). Implications for this trend on early and unplanned retirement are discussed (see "[Bridge Employment](#)").

## Background

The concept of early retirement is relatively new historically. As far back as 1850, approximately 75% of men age 65 or older were in the US labor force (Zickar 2013). When the US Social Security program was introduced in 1933, approximately 58% of men were still working at age 65 (Costa 1998). Combined with Social Security and other pension incentives, most American workers began retiring when they could afford to do so.

Retirement timing is driven to a large extent by economic circumstances. This includes government- as well as employer-provided pensions. For example, two notable peaks in retirement at ages 62 and 65 in the United States (the

ages of early eligibility and full Social Security retirement benefits) are evident (Gustman and Steinmeier 2005). This provides evidence that pension eligibility is a powerful retirement incentive. Although the early retirement age in the United States currently remains at 62, the age of eligibility for higher monthly benefits has increased from 65 to older ages determined by birth date, with additional incentives to delay retirement benefit claims to age 70. In addition, the financial penalty for continued work while receiving Social Security benefits has decreased (Gruber and Wise 1998). Many other countries (e.g., Germany, Italy) have recently modified public policies to increase the age of eligibility for government pensions, thereby modifying the age that constitutes early retirement (Gruber and Wise 2007). In terms of private pensions, the shift from defined benefit plans to defined contribution plans beginning in the 1990s has provided stronger incentives to continue working (i.e., disincentives for early retirement).

Other changes in public policy have changed the retirement landscape as well. For example, the US Age Discrimination in Employment Act (ADEA) was passed in 1967 to protect workers age 40 and older from discriminatory employment practices. In 1986 it was amended to eliminate mandatory retirement ages for all but a few occupations (e.g., those involving public safety, including airplane pilots and federal law enforcement).

Even though policy has moved toward a focus on extending working lives, a considerable number of workers depart the labor force early for a variety of reasons. Thirty percent of retirees indicate that their retirement was forced (Szinovacz and Davey 2005). Others choose to leave the workforce at relatively young ages despite substantial work capacity. Here a range of factors that influence both voluntary and involuntary early work force departure have been described.

## Theory

Psychologists studying retirement trends have sought to provide theoretical grounding. Multiple

theories have been offered in the psychological literature to facilitate understanding of retirement behavior and retirement decisions. Theories relevant to early and unplanned retirement include continuity theory (Atchley 1999), role theory (Kahn et al. 1964), the life course perspective (Elder 1994), and the push/pull model of retirement (Shultz et al. 1998; Barnes-Farrell 2003).

Continuity theory indicates that maintaining continuity or stability is related to positive outcomes. This theory would suggest a negative relationship between early and unplanned retirement and outcomes because by its very nature early and unplanned retirement may disrupt or significantly modify one's life.

Role theory proposes that life is comprised of multiple sets of roles or expectations, such as work, family, and community (Kahn et al. 1964). Early and unplanned retirement involves a change in roles in which an individual who worked must now adjust to retirement, perhaps having more of an opportunity to develop nonwork roles. Unplanned retirement in particular likely involves a more abrupt role change, particularly as work may provide an individual with a source of identity with a work role, and one must adjust to no longer working.

Related to role theory, the push/pull model of retirement indicates that some workers will retire because they are pushed out of the work role, whereas others will be pulled toward retirement for nonwork reasons. Unplanned and early retirement may result from push factors (e.g., declines in worker health, organizational incentives for early retirement) or pull factors (e.g., caring for a spouse, receiving a financial windfall, or desiring leisure more than work). Barnes-Farrell (2003) described four factors related to the retirement decision process beyond health and wealth: job attitudes, job conditions, organizational climate, and societal pressures. Negative job attitudes (e.g., low job satisfaction), poor job conditions, a negative or unsupportive organizational climate, and societal pressures (e.g., norms regarding retirement age or retirement timing) may lead to early retirement.

Recently, Kanfer et al. (2012) proposed an organizing framework for understanding work

motivation among older adults. They developed a person-centered approach, explaining goals for individuals at work, to work, and to retire. These goals take into account multiple reasons for working or retiring, including financial, social, personal, and generative, as well as fluctuations in motivation to work and motivation to retire.

## Antecedents

While not an exhaustive review, this section highlights major findings from research exploring reasons for, or antecedents to, early and unplanned retirement. Although each of these reasons is described separately, reasons for retiring early interact in important ways. Many of the studies mentioned investigate several retirement antecedents simultaneously.

## Health

One of the most widely studied potential reasons for early workforce departure is poor health. Much of what is known about the impact of health on retirement decisions in the United States comes from studies using rich information from the Health and Retirement Study (HRS) (see the chapter “► [Health and Retirement Study, A Longitudinal Data Resource for Psychologists](#)” by Sonnega and Smith, 2015). As a whole, these studies reveal that health plays a large role in the timing of retirement (e.g., Aaron and Callan 2011; Cahill et al. 2013), especially in early and unplanned labor force exit (Dwyer 2001) and perceptions of forced retirement (Szinovacz and Davey 2005). HRS data include widely used questions about expected age at retirement, which have been shown to relate closely to actual retirement. McGarry (2004) studied how changes in health affect retirement expectations, finding large effects of self-rated health on when workers expected to retire. Importantly, she also showed that changes in retirement expectations were affected to a much greater degree by changes in health status than by changes in income or wealth.

Similar findings emerge in other countries as well. Studies in Canada (Park 2010) and Europe (García-Gómez 2011; van Rijn et al. 2014)

revealed that a leading cause of early and unplanned retirement is poor health that results in a diminished capacity to work. Results from the well-known Whitehall II study showed that health is a strong predictor of early retirement in British civil servants (Mein et al. 2000). More recently, the Survey of Health, Ageing and Retirement in Europe (SHARE) showed that poor self-reported health is a strong predictor of labor force exit even after controlling for factors predictive of poor health such as obesity, problem use of alcohol, job control, and effort-reward balance (van den Berg et al. 2010). Jones et al. (2010) examined the effect of health on early retirement in 12 waves of the British Household Panel Survey. In the sample of men age 50–65 and women age 50–60, health was a highly significant risk for early retirement. Interestingly, however, the relatively low incidence of health problems in this age group means that relatively few retirements result from poor health. Other studies consider alternate paths to retirement potentially affected by poor health. A recent meta-analysis of longitudinal studies found poor health is a major cause of workforce exit, especially through disability, unemployment, and early retirement (van Rijn et al. 2014).

Finally, research in this area distinguishes particular aspects of health that may affect the timing of retirement. For example, although some workers with chronic health conditions expect to retire at younger ages (Dwyer 2001), others may experience an unexpected health event that causes them to have to leave work (McGeary 2009). Health conditions that commonly lead to early retirement include musculoskeletal conditions (e.g., back pain or problems), cardiovascular conditions (e.g., heart problems, stroke), circulatory problems, and mental illness (e.g., anxiety or depression) (e.g., Karpansalo et al. 2004).

### Marital Status

The decision regarding whether and when to retire is often made collaboratively among spouses/partners, and research has shown that spouses often coordinate the timing of their retirement with one another (Gustman and Steinmeier 2000). Although marital status and having children have not been shown to predict early retirement,

Kim and Feldman (1998) found that individuals with an employed spouse are less likely to take early retirement incentives compared to individuals whose spouse is not working. Perceived pressure from spouses (i.e., the antithesis of support) impacted individuals' intentions to retire early. In fact, perceived spousal pressure for early retirement was the strongest predictor of early retirement (van Dam et al. 2009).

Men with a working spouse were much less likely to exit the labor force themselves, accounting for health and other demographics (Ozawa and Lum 2005). How much spouses enjoy spending time together is a strong predictor of whether or not they time their retirement to coincide (Gustman and Steimeier 2004). The timing of retirement among couples is also related to gender and marital quality, with higher levels of marital conflict taking place when one individual retires while the other is still working (Moen et al. 2001).

### Family Caregiving

In addition to early retirement due to one's own health, workers may also depart early to care for a family member (Matthews and Fisher 2013). This may take the form of caring for an infirmed family member or providing care to children or grandchildren.

### Spousal Caregiving

Pienta and Hayward (2002) found that women were more likely to take their partner's health status into account when formulating a decision to retire than they are to consider their own health status. In fact, personal health status was not a significant predictor of retirement decisions for women, but was for men.

Dentinger and Clarkberg (2002) found that when women were required to provide physical care to their disabled husband, these women were significantly more likely to retire early. Conversely, though, men who were required to provide physical care to their disabled wife were more likely to delay retirement. Such results could be interpreted using a sex-role perspective wherein men may be more likely to perceive a need to shoulder the financial burden of having an ill spouse, whereas women more frequently

assume the caregiving role. The stress associated with family care demands may be exacerbated by the suddenness with which such demands may develop.

#### Children and Grandchildren

Other caregiving responsibilities related to early and unplanned retirement include taking care of grandchildren (Matthews and Fisher 2013). Some workers, and more likely women than men, may be drawn to or “pulled” into early retirement in order to care for grandchildren. A few studies have found that early retirement is negatively related to the number of children one has as well as having financial responsibility for children (Matthews and Fisher 2013). One explanation is that women may enter the workforce because of the need to financially support their children. Therefore, continued economic pressure may prevent women from early retirement to ensure that children are supported.

#### Job and Organizational Characteristics

Characteristics of work and the work environment are related to early retirement, though most of these issues do not lead to unplanned retirement and are therefore not discussed here in much detail. Early and unplanned retirement may result from organizational efforts to reduce the size of their labor force. This may happen by offering wage, bonus, or health insurance incentives to entice workers to retire early (Zhan 2013) or forced layoffs, producing both voluntary and involuntary mechanisms by which workers may retire early. In other words, an employee may retire earlier than he or she anticipated and without much advanced planning to accept an early retirement incentive from their employer. Many employers are reducing longer-term healthcare costs by reducing the amount of coverage or proportion of premiums paid to retirees. In an effort to retain high-quality health insurance, workers may opt to retire sooner than they originally planned in order to retain such benefits during retirement. This example would constitute a voluntary early unplanned departure. Early and unplanned retirement may also take place as a result of a layoff followed by not obtaining subsequent

employment elsewhere. Layoffs are an example of an involuntary cause of retirement.

Raymo et al. (2011) found that workers’ prior experiences with involuntary job loss (unemployment) as well as working in jobs characterized by not offering retirement plans, health insurance benefits, and good wages were associated with a lower likelihood of early retirement.

#### Economic Factors

##### Pension Plans

As noted above, one of the more significant changes to retirement incentives has been the transition of both private and, to a lesser extent, public pensions from defined benefit to defined contribution plans. Defined benefit plans provide a certain monthly dollar amount received during retirement based on age, years of service, etc. Defined contribution plans (e.g., 401ks, 403bs) in the United States consist of financial savings and/or investment accounts to which employees and sometimes employers contribute money, usually a percentage of wages. The value of accounts fluctuates based on how money is invested. Generally, longer work tenure means more retirement savings. Defined benefit plans produce economic incentives for workers to retire when they reach a particular age or tenure with the organization, offering little financial benefit for continued work. Not surprisingly then, research demonstrates a robust effect of the presence of a defined benefit pension plan on earlier retirement (Mermin et al. 2007; Aaron and Callan 2011; Cahill et al. 2012)

According to Butrica et al. (2009), employee participation in defined benefit pension plans was reduced from 38% to 20% in the United States between 1980 and 2008. Participation in defined contribution plans increased from 8% to 31% during the same time period. This shift in pension plan type provides some economic incentives for employees with a pension plan to remain in the workforce – to continue saving for retirement and postpone spending down retirement savings. Likewise, the decline of defined benefit pension plans means that this cause of early retirement is likely to diminish over time.

### Health Insurance

Prior to the Affordable Care Act of 2010 in the United States, the link between employment and health insurance meant that those wishing to retire early or who were forced to leave the workforce prior to the age of 65 (i.e., age of eligibility for government-sponsored health insurance through Medicare) could also risk going without health insurance. Most workers receive health benefits from their employers, but they often forfeit their insurance when they retire. Not surprisingly then, health insurance provision has been shown to affect retirement decisions. For example, potential costs of health insurance reduced retirement rates in workers age 51–61 (Johnson et al. 2003).

Some work places offer health insurance as a benefit to their retired employees, and this may have an impact on early retirement. In a review of the literature, Gruber and Madrian (2004) reported that the availability of retiree health insurance increases the odds of retirement by 30–80%. Others have shown that it substantially increases the probability of retirement by age 62 (French and Jones 2011). Nyce et al. (2013) investigated this effect in a large data set representing individual data from 54 US firms. Presence of employer-provided health insurance has its biggest effects between ages 62 and 64, increasing the rate of retirement at 62 by 6.3% and nearly 8% at age 63. Health status may affect the value individuals place on employer-provided retiree health insurance. For example, Blau and Gilleskie (2008) demonstrated that the cost of health insurance has a modest effect on retirement rates for men in good health but a large effect on retirement decisions of men in poor health. Specifically, having retiree health insurance available appears to provide a path to early retirement for men in poor health.

Lastly, aspects of public and private insurance programs vary across countries, and thus effects vary by country, as some nations have government-sponsored health insurance that is provided independent of labor force status. For example, Zissimopoulos et al. (2007) found that the retirement rate is higher in England compared to the United States, and the overall earlier age at retirement by age 55 and beyond is partly

accounted for by the availability of public health insurance. In other words, workers are more likely to retire early when public health insurance is provided.

### Wealth

Theoretical economic models of savings and labor force participation posit that higher levels of wealth are associated with a higher probability of labor force exit (Gustman et al. 2011). In general, empirical results support this hypothesis: early retirement is more likely when individuals have greater financial resources. For example, among American workers between the ages of 55 and 66, greater wealth was generally associated with leaving the workforce (Aaron and Callan 2011), although interestingly greater education was associated with remaining at work. However, research demonstrating an empirical effect of personal wealth on retirement reveals relatively modest effects, net of other factors (Bloemen 2011). For example, Gustman et al. (2011) found that the recent economic recession, on average, had a modest effect on retirement. This is explained in part by the fact that a majority of Americans have no significant stock market investments.

It is important to note that economic resources, including personal wealth, pension wealth, and health insurance, are dynamically interrelated and decisions about work can unfold for many years leading up to retirement. Poor health is often a reason for leaving the workforce, yet low economic resources often have the effect of delaying retirement. Bound et al. (2010) followed men age 51–61 who were working in 1992 to evaluate the impact of health and financial resources on work choices. Men in good health were not likely to retire without fairly substantial economic resources behind them, whereas men in poor health were likely to retire even without pension benefits.

### Outcomes

Retirement researchers have also extensively investigated outcomes of early and unplanned retirement. This section summarizes some of this research.

## Economic

Economic outcomes of early and unplanned retirement are both macro- and microeconomics. At the macrolevel, early and unplanned retirement results in additional use of government resources (e.g., disability pensions, less employee contributions to Social Security). At the microeconomic level, Munnell and Sass (2008) indicated that many individuals do not save enough money for retirement and are therefore not likely to have the necessary financial resources to maintain their standard of living in retirement based on low savings rates. Early and unplanned retirement is likely to result in individuals spending down their retirement savings compared to individuals who remain in the workforce longer, because they have a longer amount of time on which to rely on their own financial resources. To the extent that individuals retired at earlier ages and without anticipation of retiring, it is quite possible that they left the workforce prior to attaining all the financial resources needed for financial security during retirement. Munnell and Sass (2008) pointed out that working two more years has a significant impact on the preservation of retirement wealth.

## Health

Research examining health consequences of early retirement emphasizes the need to distinguish between voluntary and involuntary retirements. Van Solinge (2007) suggested that retirement itself has no categorically harmful or beneficial effect on health. Instead, it is the degree of perceived control over the retirement process (i.e., voluntary vs. involuntary retirement) that adversely affects health and emotional well-being. A great deal of research has found higher levels of physical and mental health associated with voluntary retirement compared to involuntary retirement (Isaksson and Johansson 2000; Shultz et al. 1998). For example, research has shown that involuntary retirement was associated with an increase in problem drinking behavior during retirement (Bacharach et al. 2008). This study found that after accounting for preretirement drinking behavior, having more control over the retirement decision was associated with less alcohol consumption and a lower risk of problem drinking behavior.

Methodological limitations, limited and cross-sectional data, differences in cultural norms, labor markets and economic incentives, and failure to differentiate between voluntary and involuntary retirement have likely contributed to inconsistencies in understanding the impact of retirement on health status. Dave et al. (2008) suggested there are two primary complications when attempting to identify the causal effect of retirement on health: unobserved selection effects (i.e., a sample selection bias) and endogeneity biases, which results in the inability to determine which comes first. A few studies have examined the effects of retirement on health. First, Dave et al. (2008) adjusted for selection bias (e.g., life history, retirement time preferences) and used a stratified sample, such that in waves prior to retirement individuals reported no major illness or health problems and no worsening of health between adjacent waves. Thus, any changes in health postretirement were likely due to factors exogenous to health. They found that these confounding biases accounted for the majority (80–90%) of the observed differences in health over time and that involuntary retirement was associated with greater adverse health effects. Second, Calvo et al. (2013) examined retirement timing in relation to physical and mental health. They found that retiring early (i.e., exiting the workforce at an earlier age than culturally and institutionally expected) can be problematic for both physical health and emotional health. Calvo et al. (2013) assessed the potential for reverse causality in the relationship between retirement timing and health by adjusting for endogeneity bias and controlling for confounding effects of unobserved factors (e.g., personality traits, genetic predispositions).

Contradictory results were found by Jokela et al. (2010) in a study of British social servants over 15 years. Jokela et al. (2010) found that both on-time retirement and voluntary early retirement were associated with better physical functioning and mental health compared to those remaining in the workforce. Moreover, results indicated that physical functioning and mental health prospectively predicted retirement timing. Compared to continued employment or having left the

workforce due to reasons other than retirement, poor mental health was associated with increased odds of subsequent voluntary early retirement, and those with poorer physical functioning were more likely to retire at the statutory age. Jokela et al. (2010) suggested that these results support a causal relationship between statutory and early voluntary retirement and positive health outcomes because analyses of reverse causality (using discrete-time survival analysis models) showed poor health increased the probability of retirement; thus it is unlikely reverse causality accounted for improved health postretirement. Further, longitudinal within-person analyses revealed that greater health benefits were obtained after retirement. Not surprisingly, both poor mental health and physical functioning increased the odds of ill health in retirement and were indicative of selection rather than causation.

### Psychological Well-Being

An individual's transition and psychological adjustment to retirement is a dynamic, multifaceted process contingent upon many personal and contextual factors such as individual attributes, preretirement job-related variables, family-related variables, retirement transition-related variables, and postretirement activities (Pinguart and Schindler 2007; Wang et al. 2011). Because work is an integral part of people's lives, and is highly valued in society, work roles can serve as a source of psychological well-being by contributing to feelings of self-worth, meaningfulness, and personal identity (Steger and Dik 2009). Further, work can provide important social and financial resources. Given the significance of work, the loss of one's job through retirement can have adverse consequences for psychological well-being, especially when the event is unplanned, unexpected, or involuntary.

Early and unplanned retirees are especially vulnerable to maladjustment to retirement. A major determinate of well-being among older adults is perceived control over one's immediate environment (Lachman 2006). Similar to the empirical results regarding early retirement and physical health outcomes, research has shown a lack of perceived control over the timing or circumstances of retirement (e.g., unplanned or

involuntary retirement) is related to lower levels of well-being, including life satisfaction (Isaksson and Johansson 2000) and happiness (Quine et al. 2007). From a life course perspective, the timing of retirement can have a significant influence on psychological well-being; specifically, transitioning into retirement either earlier or later than expected or preferred is thought to be disruptive and stressful, leading to greater difficulty in adjustment (Quick and Moen 1998; Isaksson and Johansson 2000). For example, Wang (2007) found that individuals who retired earlier than expected experienced declines in health. Those who were in unhappy marriages consistently experienced declines in well-being following retirement.

Research indicates that psychological and financial preparation is also important for individuals' well-being in retirement (Bender 2012; Noone et al. 2013). Although a substantial body of literature suggests that early retirement is detrimental to psychological well-being, Potočník et al. (2010) found that retirees who acted in accordance with group norms favoring early retirement and retirees who perceived low capacity to continue working were more satisfied with early retirement and reported higher levels of well-being. Moreover, compared to retirees who entered retirement early by their own volition, retirees who perceived their retirement as forced or involuntary experienced lower levels of both satisfaction with early retirement and psychological well-being. These results are consistent with other studies that found when individuals transition into early retirement voluntarily, they can experience greater satisfaction with retirement and life and higher levels of psychological well-being (Quick and Moen 1998; Isaksson and Johansson 2000; Hershey and Henkens 2014; Noone, et al. 2013).

Although there is some heterogeneity in the empirical findings concerning the impact of early retirement on the transition and psychological adjustment to retirement, there is general agreement that unplanned and involuntary retirement is detrimental to retirees' well-being and adjustment. Further, it has been established that planning for retirement (both psychologically and

financially) and having control over the timing and circumstances of retirement are beneficial.

### Family

Early and unplanned retirement may help address family caregiving needs, including the care of one's spouse or partner or other family members. Increasingly, workers (more often women than men) retire in order to have more time available to care for grandchildren (Matthews and Fisher 2013) (see "Antecedents").

### Bridge Employment

Bridge employment is an increasingly common phenomenon, in which individuals continue working after they retire from a career job (Beehr and Bennett 2014). Feldman (1994) first highlighted the importance of bridge employment in relation to early retirement, and since then many researchers have paid a great deal of attention to the topic of bridge employment (e.g., Shultz 2003; Zhan et al. 2009). Bridge employment is relevant to early retirement because workers who may be considered early retirees in terms of their career job may continue to work in bridge jobs prior to leaving the workforce altogether. (See other entries on "► [Bridge Employment](#).")

Bridge employment is increasing in prevalence. According to Cahill et al. (2005), half to two-thirds of workers transition to bridge jobs before retiring completely. Maestas (2010) reported that 44% of workers in 2004 were only partially retired, and a growing proportion of workers (initially 25% but recently more than 33%) return to work after retiring. Bridge employment can serve as a mechanism for workers to earn additional wages, easing the financial burden of early and unplanned retirement. Bridge employment may also fill a gap for individuals for whom work is an important role.

### Conclusion

Early and unplanned retirement is important for understanding the retirement process. Economic

and health factors play a large role in shaping the timing of retirement as well as the degree to which retirement may be planned or unplanned. Recent changes to government pension plans have increased the age of eligibility to receive retirement benefits, thereby increasing the age that defines early retirement in economic terms. In general the age at which retirement benefits first become available is a strong predictor of retirement timing. However, there are many additional antecedents of early and unplanned retirement, including health status, marital status, kinship and family caregiving roles, and organizational incentives that encourage employees to leave the workforce. Early and unplanned retirement is associated with more negative than positive economic, physical, and emotional health outcomes. Although retirement timing is important, the extent to which the retirement process is voluntary or involuntary is a strong determinant of health and well-being among retirees, with much more positive outcomes associated with voluntary retirement and negative outcomes associated with involuntary retirement. Bridge employment, which refers to continued work after retiring from one's career job, is an increasingly common work arrangement particularly for early retirees.

### Cross-References

- [Parents' Retirement Processes, Role of Children](#)
- [Retirement and Continuity Theory](#)
- [Retirement and Social Policy](#)
- [Women and Retirement](#)

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## Eating Disorders and Eating Disordered Behaviors

Viktoriya Samarina<sup>1</sup>, Susan Sharp<sup>2</sup> and Dawn La<sup>3,4</sup>

<sup>1</sup>Barrow Neurological Institute, Phoenix, AZ, USA

<sup>2</sup>Memphis Veterans Affairs Medical Center, Memphis, TN, USA

<sup>3</sup>Palo Alto University/Pacific Graduate School of Psychology, Palo Alto, CA, USA

<sup>4</sup>Sierra Pacific Mental Illness, Research Education and Clinical Centers at the Veterans Affairs Palo Alto Health Care System, Palo Alto, CA, USA

### Synonyms

Dementia; Eating disordered behaviors; Eating disorders; Older adults

### Definition

Eating disorders are characterized by severe and persistent disturbances in eating behavior that may significantly impair physical health and psychosocial functioning in both men and women. According to the DSM-5 there are different types of feeding and eating disorders: pica, rumination disorder, avoidant/restrictive food intake disorder, anorexia nervosa, bulimia nervosa, and binge-eating disorder (American Psychiatric Association 2013). Eating disorders are common among women and have gradually increased over several years worldwide.

Disordered eating includes a variety of problematic eating behaviors ranging from dieting and extreme weight control methods (i.e., fasting, binge eating, and purging) to clinically diagnosed eating disorders (e.g., anorexia and bulimia nervosa). Accompanying these behaviors is also a range of disordered eating attitudes, such as the need to be thin as well as weight and shape fears. The majority of research on eating disorders concentrates on adolescents or young adult women, however, in the recent years data has emerged focusing on middle-age and older adults who may be experiencing eating disorders, namely anorexia nervosa, bulimia nervosa, and binge-eating disorder.

### Eating Disorders as Defined by the DSM-5

The Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association 2013) made several recent changes to the criteria for feeding and eating disorders to better characterize symptoms and behaviors of patients across the lifespan. Some of the changes included recognizing binge eating as a disorder, revising the diagnostic criteria for anorexia nervosa and bulimia nervosa, and including pica, rumination and avoidant/restrictive food intake disorder (the latter three were originally included in the Disorders Usually First Diagnosed in Infancy, Childhood, or Adolescence section of the DSM-IV-TR).

Anorexia nervosa is defined by a distorted body image, a pathological fear of gaining weight, and excessive dieting that leads to severe weight loss. This disorder mostly affects adolescent girls and young women. Some of the changes that were made from the DSM-IV-TR include taking out the word “refusal” in terms of weight maintenance since that signifies intention on the part of the patient and is difficult to determine. In addition, in the DSM-IV-TR a diagnosis of anorexia nervosa required amenorrhea, or the absence of at least three menstrual cycles. This criterion was taken out, because it cannot be applied to males, premenarchal females, females taking oral contraceptives, and postmenopausal females. Moreover, some women may report some menstrual activity but still show signs and symptoms of anorexia nervosa (American Psychiatric Association 2013).

It is important to understand that older adults may experience anorexia of aging, which is different from anorexia nervosa. Anorexia is a medical condition that is characterized by reduced appetite or dislike of food therefore leading to the inability to eat. Symptoms such as fear of gaining weight or distorted body image, which are key in anorexia nervosa, are absent in anorexia of aging. Anorexia of aging, which is involuntary weight loss and protein-energy malnutrition, includes the normal physiological changes that cause an increase in the proportion of body fat and decrease in lean muscle mass and extracellular fluid mass. This change in body makeup is usually a result of decrease in energy needs and therefore a decrease in appetite and calorie intake (Champion 2011).

Bulimia nervosa is characterized by recurrent episodes of binge eating followed by inappropriate behaviors such as self-induced vomiting to avoid weight gain, and self-evaluation that is disproportionately influenced by body shape and weight. In contrast to the DSM-IV-TR criteria, which required the frequency of binge eating and compensatory behaviors to occur twice a week, the DSM-5 specifies that these behaviors must occur once a week (American Psychiatric Association 2013). Older adults may especially engage in the inappropriate behaviors as they move

further away from the “cultural ideal” of looking young and thin.

Binge eating disorder is characterized as recurring episodes of eating significantly more food in a short period of time than most people would eat in the same circumstances. These episodes are also defined by feelings of lack of control over eating (e.g., a feeling that one cannot stop eating or control how much one is eating). A person with a binge eating disorder may eat more rapidly than normal whether he or she is hungry or not. The individual may experience feelings of guilt, embarrassment, or disgust and may binge eat alone to cover the behavior. Marked distress is usually associated with binge eating. Additionally, this disorder occurs, on average, at least once a week over three months (American Psychiatric Association 2013). Older adults suffering from binge eating disorder may feel lack of control or willpower. In addition, loneliness, depression, and other psychiatric or medical comorbidities may impact older adults’ eating habits.

### Prevalence Rates of Eating Disorders and Older Adults

Anorexia nervosa and bulimia nervosa are 10 times more common in females than males, and binge-eating disorder is three times more common (Treasure 2007). Though in recent years studies have shown that one in six males also suffer from an eating disorder (Andersen 2002). Eating disorders have become a major public health issue as it is the third most common illness in adolescent females, and is affecting more women of all ages worldwide. Research suggests that more than 20% of women aged 70 and older were dieting and experiencing unhappiness with one’s body image and the desire to be thin; and these concerns do not disappear with age (Fisher et al. 1995). Anonymous questionnaires were administered to 1,500 Austrian women between the ages of 40 and 60 assessing for eating disorders (as defined by the DSM-IV), subthreshold eating disorders, body image, and quality of life. Subthreshold eating disorder was

defined by the presence of either binge eating with loss of control or purging behavior, without requiring any of the other usual DSM-IV criteria for frequency or severity of these symptoms. Of the 715 middle-aged to older adult women that responded, 33 (4.6%) reported symptoms meeting full DSM-IV criteria for an eating disorder. None indicated symptoms or behaviors consistent with anorexia nervosa, possibly due to the DSM-IV criteria of requiring amenorrhea. Another 34 women (4.8%) displayed sub-threshold eating disorder (Mangweth-Matzek et al. 2013).

There are different patterns or categories into which older adults may fit with regard to eating disorders. Some older adults have struggled with an eating disorder since adolescence and never received treatment. Others likely received treatment in their younger years but relapsed later on in life as a result of a stressful life event (e.g., death or illness of family member or friend). Another group may be older adults who were always pre-occupied with food and weight throughout their lives but experienced limited consequences of eating disorders when they were younger. Lastly, there is a small subset of older adults who developed an eating disorder later in life (American Psychiatric Association 2013).

Similar to adolescents and younger adults, middle aged and older adults also face devastating physical and psychological consequences of eating disorder. Issues such as social isolation, physical illness, bereavement, and minimal support are just a few factors that can impact the onset of late-life eating disorder (Cosford and Arnold 1992). Additionally, eating disorders in older adults are associated with anxiety, depression, and suicidal ideation and attempts (Hudson et al. 2007). Eating disordered behaviors may also increase the risk of medical morbidity, such as cancer and obesity (Ng et al. 2013).

## Biology of Eating Disorders

Research on the biology of eating disorders has primarily focused on anorexia nervosa and

bulimia nervosa. Studies show a genetic predisposition and a variety of environmental risk factors that contribute to eating disorders. Clinical studies with twins show an agreement for anorexia nervosa of 55% in monozygotic twins and 5% in dizygotic twins, and bulimia nervosa being 35% and 30%, respectively. In addition, much of the research focuses on the neurobiology of eating disorders, looking specifically at neuropeptide and monoamine (especially 5-HT) systems, which are thought to play a central role in the physiology of eating and weight regulation.

Studies incorporating functional imaging of the brain show altered activities in the frontal, cingulate, temporal, and parietal cortical regions in both anorexia nervosa and bulimia nervosa, and there is some suggestion that these changes persist after recovery. Whether these changes are a result of the eating disorder or have somehow contributed to the risk of developing an eating disorder is not well researched (Lapides 2010; Kaye and Strober 1999).

## Eating Disordered Behaviors: Signs and Symptoms in Older Adults

It can be difficult to determine or diagnose an eating disorder in older adults. However, some signs and symptoms can be recognized as clues to changes in eating behavior in older adults. For example, significant change in weight over a short period of time; behavior changes such as disappearing after a meal or using the restroom after eating; new use of laxatives, diet pills, or diuretics; wanting to eat alone rather than with family; skipping meals; loss of concentration; physical symptoms such as enamel loss, chronic sore throat, cracked lips, sensitivity to cold, excessive hair loss, dental damage, or heart and gastrointestinal problems (e.g., constipation); excessive consumption of high-calorie foods that are sweet (especially prominent in people with binge eating disorders). Furthermore, osteopenia and osteoporosis are common symptoms of longstanding anorexia nervosa and are associated with an increased fracture risk in older adults.

Additionally, it is suggested that physicians complete a physical for medical conditions and review medications as medical conditions (e.g., thyroid and gastrointestinal conditions), medications, and substance use can mimic symptoms of an eating disorder (e.g., nausea, weight gain or loss) (Lapides 2010; Lapid et al. 2010).

### **Contributing Factors to Eating Disorders in Older Adults**

Triggers of eating disorders may appear similar for younger and older adults; however specific differences occur, as life stressors change as people age. Body image issues and body dissatisfaction are some of the common risk factors for eating disorders and increase with age as the human body experiences natural changes (e.g., wrinkles, graying hair, and weight gain). Additionally, the development of eating disorders in midlife can be due to other changes or transitions that occur as one ages. For example, loss of loved ones, widowhood, divorce, traumatic illness or disability, children moving out of the house, growing old and facing mortality, and loss of independence can all have an impact on eating behaviors of midlife or older adults (Lapides 2010; Zerbe 2008).

Certain medical conditions can also contribute to developing an eating disorder. For example, older adults are at a higher risk for developing high cholesterol, diabetes, and other cardiovascular diseases and may be advised by their primary care physicians to be mindful of and careful with their diet. Some older adults may become anxious about their diets, but also lack knowledge about proper nutrition that lower the risk for cardiovascular diseases. They may begin restricting their diets and lose weight unintentionally. Their anxiety may maintain their eating disordered behaviors. Other contributing factors to eating disorders for older adults may be lack of enthusiasm for life, attempts to obtain attention from family members, financial difficulties, medical problems, and dissatisfaction or objection of living situations (i.e., nursing home, skilled facilities) (Lapides 2010).

Overall, stress is the most common trigger of eating disorders in both younger and older adults; stressors often change as one develops and become more prominent. Eating disorders are usually not about weight or food, but a way of coping with other stressors in life that the individual does not know how to handle. Disordered eating behaviors are often a way to avoid and numb emotions and feelings. If during adolescence or young adulthood the individual learned maladaptive coping mechanisms to tolerate stress, then the individual may utilize these unhealthy coping methods later in life as an older adult (Lapides 2010).

In one study, 50 women who were treated in a residential program and who eating disorder symptoms began after the age of 40 were examined. On an eating disorder inventory, midlife women scored higher than younger women on scales of ineffectiveness, perfectionism, interpersonal distrust, and asceticism, but scored lower on drive for thinness, bulimia, and body dissatisfaction. Both midlife women and younger women reported moderately severe depression and anxiety symptoms. On the Minnesota Multiphasic Personality Inventory (MMPI), midlife women indicated more denial than younger women. These midlife women also endorsed a higher frequency of sexual abuse (63%) than reported by younger women with eating disorders. There was no significant difference between midlife and younger women in alcohol or other substance use; however, midlife patients abused cannabis much less and opioids more than younger patients. Though not statistically significant, midlife patients more often abused sedatives, hypnotics, and anxiolytics suggesting a higher tendency to abuse calming/sedating medications. About 22% of older women reported a history of self-harm and 28% had attempted suicide. Though this study was limited to only patients who were seeking treatment in a facility, this suggests that older adults with eating disorders may under report some of their distress and need serious consideration and treatment in the community (Cumella and Kally 2008).

## Eating Disorders and Neurocognitive Disorders

Dementia is not one specific disease; rather, it is a clinical syndrome characterized by a loss of cognitive functioning that negatively impacts a person's abilities to complete day-to-day activities. Dementia can affect many body systems and produce a variety of problems, such as poor or inadequate nutrition. Individuals with dementia may decrease the amount of food they eat, forget to eat and drink, or believe they have already eaten. Changes in an older person's daily routine (e.g., such as meal time) or other distractions (e.g., how the food smells or tastes, environmental issues such as too much confusion) may affect their eating patterns. In some cases, people with advance dementia may lose control of the muscles used to chew or swallow and this could put the person at risk of choking. Additionally, people with dementia may lose the feeling of hunger and the desire to eat. Other comorbid factors such as depression, medication side effects, and constipation, can decrease the individual's interest in food (Ikeda et al. 2002).

Frontotemporal dementia (FTD) encompasses several clinical syndromes all sharing frontal pathology. The FTDs include behavioral variant FTD (bv-FTD), progressive nonfluent aphasia (PNFA), and semantic dementia (SD). A variety of behavioral changes noted in bv-FTD, include loss of insight, disinhibition, impulsivity, apathy, poor self-care, mood changes, mental rigidity, and stereotypic behavior. Some research with bv-FTD individuals has also found a high prevalence rate of changes in food preferences, appetite, and eating behaviors. Individuals with semantic dementia characterized by anomia and impaired comprehension, also show behavioral changes, such as changes in appetite and food preferences that are similar to those observed in bv-FTD (Ikeda et al. 2002).

One of the most prevalent dementia syndromes, Alzheimer's disease (AD), accounts for about 35% of all dementia cases. AD is characterized by early onset of memory impairment (poor consolidation and recognition of information), poor confrontation naming (dysnomia), deficits

in visuoconstructional skills, social withdrawal, and mood changes (symptoms of depression) can occur. Eating changes in AD have been shown to be less common. However, some research indicated anorexia is more common in AD (Ikeda et al. 2002). Research found more significant changes in eating behaviors in both bv-FTD and semantic dementia in contrast to Alzheimer's disease. Individuals with semantic dementia first typically see a change in food preference, whereas individuals with bv-FTD show changes in food preferences as well as alterations in appetite (Ikeda et al. 2002).

Though there is limited research on other types of dementias (e.g., vascular dementia) and eating disorders, overall, individuals with any type of dementia may suffer from a diminished interest to eat or forgetting to eat. Changes in food intake can lead to malnourishment and dehydration, increasing the risk of infections, abnormally low blood pressure, and other medical problems. Proper nutrition does not necessarily prevent weight loss in people who suffer from dementia, nor will it slow down the progression of the neurodegenerative process, however continuing to maintain a healthy weight and diet can support overall health and better quality of life. Primary care physicians, psychiatrists, psychologists, dietitians, family members and other caregivers play an important role in some of the treatment options for eating disorders in older adults.

## Treatment Options for Eating Disorders

As people age, their interest in eating and enjoying food changes. Individuals with dementia have pronounced changes in taste or food preferences as well as changes in mood, behavior, and physical functioning, which can impact eating. Some general treatment goals for eating disorders in individuals both with and without dementia are to restore adequate nutrition, and weight to a healthy level, reduce excessive exercise, and stop bingeing and purging behaviors. Additionally, individuals that suffer from dementia may benefit from specific memory strategies (e.g., following a specific routine everyday or incorporating various

reminders or cues to remember to eat) or feeding tubes in later stages of the neurodegenerative disease. Multidisciplinary treatment teams such as a primary care practitioner, psychiatrist, dentist, nutrition specialist or dietician, and a mental health care professional may be needed to manage eating disorders (Fairburn 2010; Shapiro et al. 2007). In addition, health care professionals treating patients with eating disorders have to be mindful of different cultural and religious values and practices patients may possess.

Several psychological theories have been proposed to account for the development and maintenance of eating disorders, with cognitive behavioral theory being one of the most prominent with regard to treatment. Cognitive behavioral theorists propose that there are two main origins for the restriction of food intake. The first is the need to feel in control of life, which transfers into the need to control eating. The second is over evaluating one's shape and weight. In both cases, a dietary restriction is reinforcing. Following this, other processes such as social withdrawal, binge eating due to extreme and rigid dietary restraint, and negative impact of binge eating or concerns about shape and the sense of being in control, begin to play a role and serve to maintain eating disorders (Fairburn 2010; Shapiro et al. 2007).

Cognitive and behavioral approaches have been shown to successfully treat eating disorders based on studies with younger and middle-aged women and men. In addition, antidepressant medications may also be effective for some eating disorders as well as treating comorbid anxiety or depression. Medical consequences of an eating disorder can be devastating and life threatening, however, the internal dialog within the person and specific behavioral rituals that are constantly repeated can cause suffering and pain. The constant fear of judgment, self-imposing rules and demands can take over and cause negative emotions and perpetuate negative behaviors. Individuals with eating disorders often maintain negative view of themselves and their bodies. These negative thoughts can cause feelings of shame or anxiety that can then trigger behaviors to control weight. Cognitive behavioral therapy can focus on the specific factors that are maintaining the

disorder and set specific goals throughout the therapy. Three phases can occur over the course of cognitive behavioral therapy: behavioral phase, cognitive phase, and maintenance and relapse prevention phase. During the behavioral phase the patient and therapist come up with a plan to stabilize eating and eliminate symptoms. In the cognitive phase, the therapist begins cognitive restructuring where the individual begins to recognize and change problem thinking patterns. Negative thoughts and beliefs (e.g., I will only be happy if I can lose weight) are identified and restructured. In addition, other concerns and issues such as relationship difficulties, self-esteem concerns, and emotion regulation are focused on. The last stage of CBT focuses on minimizing triggers, preventing relapse, and maintaining progress previously made (Fairburn 2010; Shapiro et al. 2007).

In addition to psychotherapy, psychotropic medications have also been shown to play a role in treating eating disorders. Research on medication use for anorexia nervosa have not found medication to promote weight gain, though some studies suggested fluoxetine as an option in preventing relapse in patients after normal weight is restored. In contrast, fluoxetine has shown to reduce bingeing frequency in bulimia nervosa, as well as anxiety and depressive symptoms (Zhu and Walsh 2002).

While research demonstrates the benefits of medication, the best results were seen with a combination of psychotropic medication and psychotherapy (Zhu and Walsh 2002; Maine et al. 2010). Research shows that patients who received cognitive behavioral therapy demonstrated more improvement in symptoms than those who only received medication. However, medication is efficacious for patients who have not responded to psychotherapy. When patients who did not benefit from cognitive behavioral therapy or interpersonal therapy were administered a placebo or fluoxetine, significant results in favor of fluoxetine were found (Walsh et al. 2000). While older adults have not been the focus of eating disorder randomized control trials, interpersonal and cognitive behavioral therapies were successfully used to treat other later-life psychiatric disorders, such

as depression (Hudson et al. 2007), which often co-occur with eating disorders.

In addition to psychotherapy and medication, nutrition intervention, such as counseling by a registered dietitian is an important aspect of multidisciplinary treatment of eating disorders, and would certainly contribute to determining the course of treatment in older adults. The dietitian can perform a nutrition assessment to identify nutrition problems related to the eating disorder and implement a care plan that might establish healthy eating patterns and restore the individual back to a healthy weight. In addition, the dietitian can monitor and re-assess the individual's progress with the plan and jointly work with other health professionals to address the individual's needs. The trained dietitian can recommend keeping a daily food, hydration, and exercise log and this information can help identify if any new physical or medical problems may arise that can impact food intake and changes in weight. A full workup by a dietitian is critical given the complexity of eating disordered behaviors and disorders in older adults. A dietitian can monitor and refer older adults to other physicians or specialists as eating disorders can arise due to various causes (Walsh et al. 2000).

## Conclusion

This chapter focuses on late-life eating disorders and eating disordered behaviors in older adults, and issues that have been largely overlooked or potentially under diagnosed. The dearth of information on eating disorders and related issues suggests that, although these issues are not common, it is possible for an older adult to have a disorder or issue with their eating. Those issues could be caused by various life stressors (e.g., abuse, loss of a loved one, loss of independence) and/or medical (e.g., neurodegenerative diseases, diabetes) or psychiatric (e.g., depression, anxiety) conditions, as is the case in many instances. Older adults are also not as physiologically resilient as younger adults. Physiological changes and vulnerability of an aging person could lead to more serious consequences of eating disorders much more rapidly than in a younger person. In rare instances,

but certainly possible, the eating issue could be a longstanding disorder or newly diagnosed condition. For these reasons, health care professionals need to be cognizant of the possibility of eating disorders in the elderly, given the serious consequences of misdiagnosing or leaving them untreated in any population.

## Cross-References

- ▶ [Behavioral and Psychological Symptoms of Dementia](#)
- ▶ [Cognitive Behavioural Therapy](#)
- ▶ [Comorbidity](#)
- ▶ [Stress and Coping Theory in Geropsychology](#)

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## Effects of Stress on Memory, Relevance for Human Aging

Oliver T. Wolf

Department of Cognitive Psychology, Institute of Cognitive Neuroscience, Ruhr University Bochum, Bochum, Germany

### Synonyms

Changes in stress vulnerability during aging:  
Focus on the brain; Effects of stress on memory:

Relevance for human aging; HPA axis alterations during aging: Impact on cognition

## Introduction

Is aging associated with a more pronounced susceptibility to stress? Do older people respond differently to stress, and if so, how does this influence their cognitive performance? Might chronic stress be one of the reasons for the large interindividual variance observed in cognitive aging? The present chapter aims to answer these and related questions. A neuroendocrine perspective is taken, focusing on stress hormones and their action in the human brain. The response patterns of young people are described before age-related changes are discussed. Acute and chronic stress effects are then compared with each other, and finally, some possible lines of intervention are characterized.

## Definition of Stress

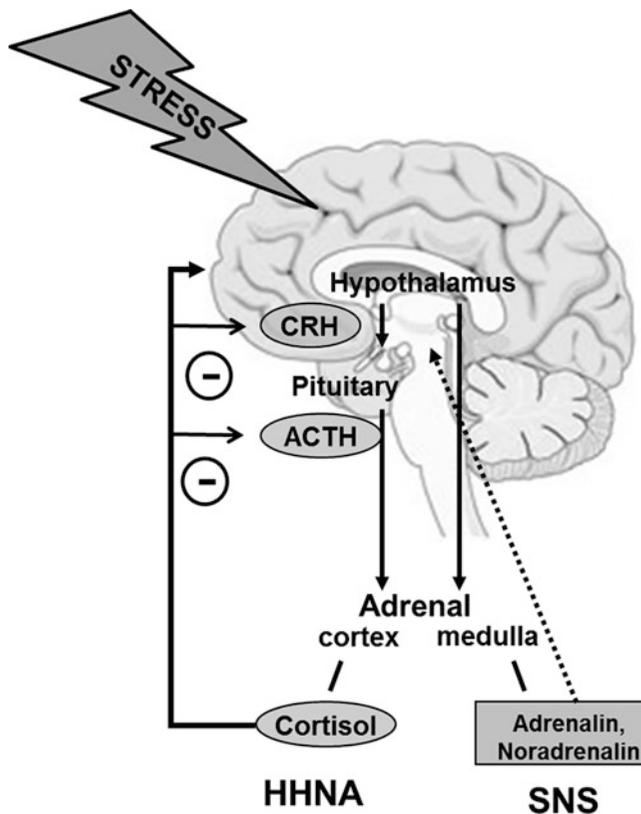
A common definition is that stress occurs when a person perceives a challenge to his or her internal or external balance (homeostasis; De Kloet et al. 2005). Thus, a discrepancy between what “should be” and “what is” induces stress. A stressor can be physical (e.g., cold, hunger) or psychological (e.g., work overload, mobbing, neighborhood violence, marital problems), as well as acute or chronic. The subjective evaluation of the stressor and of available coping resources determines its impact on the individual (Lazarus 1993). Something perceived as a threat by one person might be perceived as an exciting challenge by another. There is thus substantial interindividual variability in the vulnerability to stress. As humans are social animals, a threat to the social self (social evaluative threat), in combination with uncontrollability of the situation, is especially potent in prompting stress (Dickerson and Kemeny 2004). As further outlined below, genetic susceptibilities, when combined with early adversity, render an individual more vulnerable in adulthood.

## The Two Stress Systems: HPA and SNS

Stress leads to neuroendocrine responses aimed at facilitating adaptation. In this context, the hypothalamic-pituitary-adrenal (HPA) axis and the sympathetic nervous system (SNS) play the most important roles. SNS activity leads to the rapid release of (nor)epinephrine from the adrenal medulla, which constitutes the first response wave. Activity of the HPA axis on the other hand leads to the release of glucocorticoids (GCs; cortisol in humans, corticosterone in most laboratory rodents) from the adrenal cortex.

This response is slower and constitutes the second response wave (De Kloet et al. 2005). The two systems are illustrated in Fig. 1.

GCs are lipophilic hormones that can enter the brain, where they influence regions involved in cognitive functions (e.g., amygdala, hippocampus, and prefrontal cortex). These effects are mediated by the two receptors for the hormone: the mineralocorticoid receptor (MR) and the glucocorticoid receptor (GR), which differ in their affinity for GCs and in their localization. While MR activation leads to enhanced neuronal excitability, GR activation causes a delayed



**Effects of Stress on Memory, Relevance for Human Aging, Fig. 1** Stress activates two neurohormonal systems: the rapidly acting sympathetic nervous system (SNS) and the slightly slower hypothalamic-pituitary-adrenal (HPA) axis. Activation of the hypothalamus stimulates the SNS to secrete (nor)epinephrine from the adrenal medulla. These catecholamines cannot easily pass the blood-brain barrier but can exert excitatory actions in the brain by stimulating the vagus nerve (hence the *dotted line*). The hypothalamus releases corticotropin-releasing

hormone (*CRH*), which stimulates the secretion of adrenocorticotropic (*ACTH*) from the anterior pituitary gland into the blood stream. *ACTH* stimulates the adrenal cortex to release glucocorticoids (GCs, mostly cortisol in humans), which can easily pass the blood-brain barrier and modulate brain functions involved in learning and memory (see text). GCs exert negative feedback effects (indicated by the *minus* symbol) on the hypothalamus and the pituitary gland, leading to reduced activity of the HPA axis in the aftermath of stress

suppression or normalization of the neuronal network (Joels et al. 2008). Their activation furthermore leads to an altered expression of responsive genes. In addition, GCs can exert more rapid non-genomic effects which, in part, are mediated by membrane-bound MRs (Joels et al. 2008).

After acute stress, the HPA axis' negative feedback leads to GC levels returning to baseline values within hours (De Kloet et al. 2005; Dickerson and Kemeny 2004). In periods of chronic stress on the other hand, persistent alterations of the HPA axis can occur, leading to continuingly elevated cortisol levels. However, elevated cortisol concentrations, as typically observed in major depression, are not always the consequence of chronic stress (Wolf 2008). For example, reduced cortisol levels occur in several stress-associated somatoform disorders (Fries et al. 2005) as well as in post-traumatic stress disorder (Wolf 2008).

### **Age-Associated Changes in HPA Axis Activity/Reactivity**

Since HPA axis alterations are a close correlate of or even a determining factor in the onset of different diseases, the assessment of the integrity and functioning of HPA axis regulation is of major interest in older individuals in particular.

Aging is accompanied by several distinct alterations affecting basal HPA activity as well as the system's response to stress or pharmacological manipulations (Lupien et al. 2009). Regarding the circadian profile, several studies have revealed an increase in nocturnal nadir levels with age, meaning that older people are exposed to higher levels of cortisol during the night (Wolf and Kudielka 2008). A somewhat different picture has emerged for the cortisol awakening response (CAR), which occurs directly after awakening and is associated with a robust increase in cortisol concentrations during the first 30 min after waking up. During aging, this response appears to become more blunted, a phenomenon which has been linked to atrophy of the hippocampus (Pruessner et al. 2010), a structure critically involved in the supra-hypothalamic control of

the HPA axis and, at the same time, a structure of vital importance for episodic memory (see below).

Longitudinal studies indicate that not all older participants show an increase in basal cortisol levels over the years. A substantial interindividual variance exists, ranging from increasing or stable to even decreasing levels (Lupien et al. 2009). To summarize, the existing data point to altered basal cortisol concentrations during the nocturnal trough, while cortisol levels remain mainly unchanged or show only slight changes over the course of the day (Wolf and Kudielka 2008).

During the past decades, several studies have investigated the reactivity of the HPA axis using psychosocial laboratory stressors such as the Trier Social Stress Test. In this test, participants have to deliver a speech in front of an emotionally cold, nonresponsive committee. In addition, a difficult mental calculation task has to be performed. Based on observations made in rodents, older participants were expected to show a more pronounced and/or more prolonged stress response. Indeed, this is what several well-conducted studies observed, even though findings are not unequivocal (Wolf and Kudielka 2008), especially concerning some of the sex differences observed.

A different approach involves pharmacological stimulation of the HPA axis using, for example, CRH (with or without pretreatment with dexamethasone). The majority of these studies have found evidence for an enhanced HPA reactivity with aging, accompanied by an impaired negative feedback. Interestingly, these alterations appear to be more pronounced in older women (Otte et al. 2005).

The factors causing the HPA axis hyperactivity observed during aging in some individuals remain poorly understood. Possible candidates are early adversity or chronic stress (Lupien et al. 2009). However, metabolic alterations associated with glucose intolerance or type 2 diabetes (Convit 2005) should also be considered. Alternatively, degenerative processes in the central nervous system might be the starting point of the age-associated HPA axis alterations, since it is known that degeneration of supra-thalamic

control centers of the HPA axis (e.g., the hippocampus) leads to HPA axis hyperactivity. Of course, these explanations are not exclusive and might interact at multiple levels.

### **Stress and Cognition: Acute Effects**

Stress affects the central processing of incoming information at multiple levels. Early influences on perception and attention have been documented, as well as later effects on working memory and long-term memory. The present chapter will focus on the influence of stress on long-term memory because it is the area which has been best characterized in young adults and at least partially investigated with respect to aging.

Long-term memory can be subdivided into declarative or explicit and non-declarative or procedural (implicit) memory. Based on its content, declarative memory can be further subdivided into episodic memory (recall of a specific event which can be located in space and time) and semantic memory (our knowledge of the world). The medial temporal lobe is critical for declarative memory, with the hippocampus being especially important for episodic memory (Wolf 2009).

Long-term memory can further be subdivided into different memory phases, namely, acquisition (or initial learning), consolidation (or storage), and retrieval (or recall). The literature regarding the effects of stress on episodic memory was initially somewhat divergent and confusing, with groups reporting both enhancing and impairing effects of GCs on this form of memory. However, it has become apparent that this is largely due to the fact that the different memory phases outlined above are modulated by GCs in an opposing fashion (Wolf 2009).

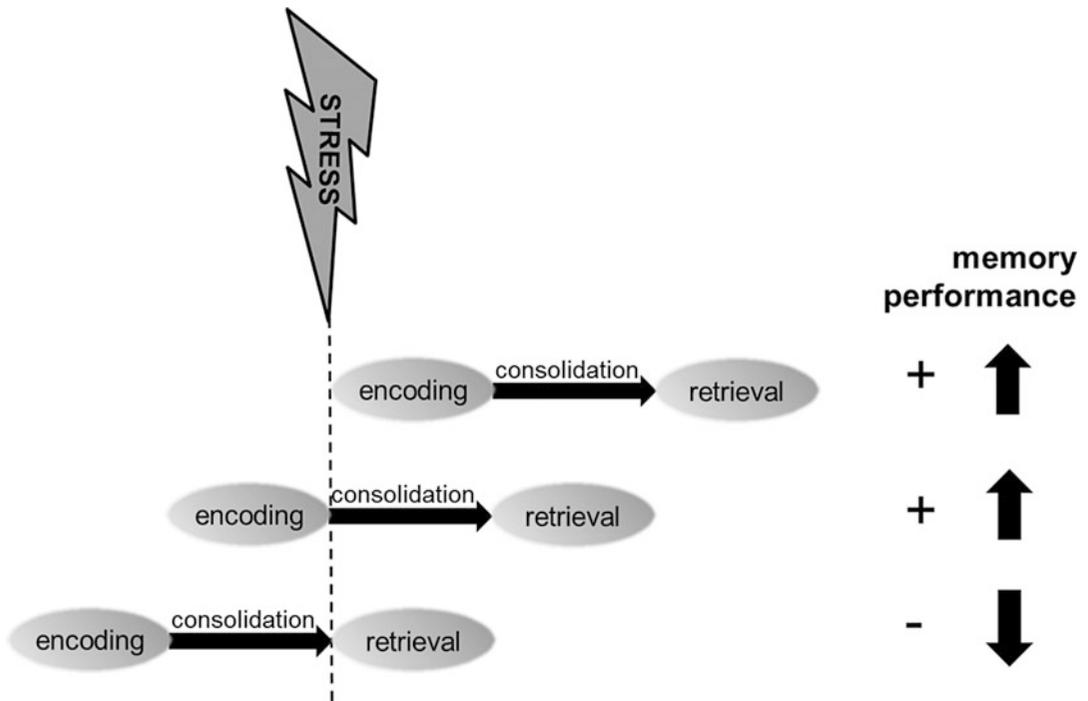
GCs enhance memory consolidation, this process representing the adaptive and beneficial side of the action of GCs in the central nervous system (see Fig. 2). It has been conceptualized as the beneficial effects of “stress within the learning context,” or “intrinsic stress.” The terminology used emphasizes the fact that a stressful episode is remembered better, an effect which is mediated by the action of stress-released GCs on the

hippocampal formation and which is very well documented in rodents. Studies have shown that an adrenergic activation in the basolateral amygdala (BLA) appears to be a prerequisite for the modulating effects of GCs on other brain regions (e.g., the hippocampus). Lesions in the BLA as well as beta-blockade abolish the enhancing effects of post-training GC administration (Roosendaal et al. 2009).

Comparable effects have been observed in humans: Immediate post-learning stress has repeatedly been linked to enhanced memory consolidation. Similar evidence comes from pharmacological studies, while neuroimaging studies have provided further evidence for a stress-induced modulation of amygdala and hippocampal activity (Wolf 2009). Pre-learning stress or cortisol studies have led to a somewhat less consistent picture. In this case, the exact timing of the stressor, the emotionality of the learning material, and the relation of the learning material to the stressor appear to be important modulatory factors (Wolf 2009).

While an enhanced memory consolidation is adaptive and beneficial, this process appears to occur at the cost of impaired retrieval (see Fig. 2). Using a 24 h delay interval, researchers were able to show that stress or GC treatment shortly before retrieval testing impairs memory retrieval in rats in a water maze. Further studies have revealed that, once again, an intact BLA and its adrenergic activation appear to be necessary for the occurrence of this negative GC effect (Roosendaal et al. 2009). Roosendaal has summarized these findings as indicative of stress putting the brain into a consolidation mode, accompanied by impaired retrieval. Such a reduction in retrieval might facilitate consolidation by reducing interference (Wolf 2009).

In humans, multiple studies have been able to demonstrate a stress-induced retrieval impairment using different stressors and different memory paradigms. Similar impairment has been induced using pharmacological cortisol elevations (Wolf 2009). Interestingly, the beneficial effects on consolidation and the impairing effects on retrieval in humans are more pronounced for emotionally arousing material. This observation fits the



E

**Effects of Stress on Memory, Relevance for Human Aging, Fig. 2** Memory phase-dependent effects of stress on long-term memory. Immediate pre- or post-learning stress enhances memory consolidation, thus leading to

enhanced memory retrieval hours, days, or weeks later. In contrast, stress shortly before memory retrieval impairs long-term memory by temporarily blocking the accessibility of the memory trace

mentioned observation in animals that GCs can only exert effects on memory in the presence of adrenergic activity in the amygdala. This arousal can result from specifics of the learning material and/or specifics of the testing conditions.

retrieval (see Fig. 2). Within this framework, emotional arousal and a nonlinear dose-response relationship are important modulatory variables (Wolf 2009).

In a meta-analysis, time of day appeared as an additional modulatory factor. Studies in which cortisol was administered before initial acquisition observed impairing effects on memory when conducted in the morning, a time of high endogenous cortisol levels in humans. In contrast, studies in the evening were more likely to observe beneficial effects (Het et al. 2005). This supports the idea of an inverted U-shaped function between cortisol levels and memory in humans, with levels too low as well as levels too high at the time of acquisition being associated with impairments, especially when retrieval is tested while cortisol levels are still elevated (Het et al. 2005).

**Age-Associated Changes in Acute Stress Effects**

In sum, studies in animals and humans converge on the idea that GCs acutely enhance memory consolidation while impairing memory

Few studies have investigated age-associated changes in the impact of stress or stress hormones on memory. Findings thus have to be considered as somewhat preliminary. A pharmacological study observed a cortisol-induced memory retrieval impairment in both young and old participants (Wolf 2009). Stress studies have revealed a somewhat different picture, with older adults less impaired by the stressor. At the same time, stressed older adults appeared to be more susceptible to distraction. Interesting correlational findings have been provided by a neuroimaging study. In young participants, increasing cortisol

concentrations were associated with more neural activity in several memory-relevant brain regions. In older participants, the opposite pattern was observed: Here, increasing cortisol concentrations were linked to less brain activity in the hippocampus.

In sum, the currently available literature indicates that the memory of older participants is in some cases differently affected by acute stress (Wolf and Kudielka 2008). Importantly, enhanced and reduced stress responsivities have been reported. It is therefore likely that the impact of acute stress on aging is specific for certain processes and brain regions.

### **Stress and Cognition: Chronic Effects**

The following paragraphs will focus on the impact of chronic stress on cognition in aging. First, the long-term consequences of early life stress will be summarized. These changes have an impact throughout the lifespan leading up to old age. Next, the impact of chronic stress on memory in adulthood is reviewed, before specific age-associated changes in the chronic stress effects associated with aging are highlighted.

#### **Long-Term Consequences of Early Life Stress**

Several studies support the notion that early stress exposure is associated with accelerated neurodegenerative processes and early onset of memory decline in the course of aging (Lupien et al. 2009). Neurodevelopmental impairments in association with early stress exposure may be one of the factors explaining such cognitive disadvantages at an older age. Changes in stress susceptibility programmed early on in life might account for such deficits (Schlotz and Phillips 2009). There is evidence for pre- and postnatal stress exposure being associated with a chronically increased reactivity of the HPA axis, potentially resulting from a reduced expression of central glucocorticoid receptors (Meaney 2001). Animal models

show increased corticosterone concentrations and lower GR density in the hippocampus in the offspring of stressed mothers. Also, postnatal maternal separation and poorer maternal care have been associated with reduced GR gene expression in the hippocampus, which, in turn, is associated with reduced feedback sensitivity of the HPA axis. Recently, a mechanism has been discovered in rodents that explains how environmental stimuli can impact gene expression. Permanent alterations of GR gene expression result from methylation/demethylation of specific GR promoters, a process associated, among others, with variations in maternal care (Meaney 2001). Initial evidence suggests that the human GR gene is also subject to early life programming (Schlotz and Phillips 2009). Moreover, elevated cortisol concentrations have, for example, been reported in association with reduced birth weight or pre-term birth.

In the following, the consequences of chronic stress exposure throughout life on cognitive functioning will be described. It will become apparent that individuals with an increased stress susceptibility (reflecting genetic susceptibilities and/or early adversity) are especially vulnerable to stress-induced cognitive impairments in adulthood and aging (Lupien et al. 2009).

#### **Chronic Stress During Adulthood: Effects on Cognition**

Animal research provides insights into the structural alterations caused by chronic stress. One main finding is that the integrity of the hippocampus and the medial prefrontal cortex is compromised, while, in parallel, the amygdala (the “fear center” of the brain) and parts of the striatum (the “habit center” of the brain) become hyperactive (Roosendaal et al. 2009). In the hippocampus, chronic stress leads to a retraction of dendrites (dendritic atrophy), and similar effects occur in the medial PFC (Lupien et al. 2009). This atrophy is reversible after stress termination, pointing to substantial neuroplasticity. In addition, stress leads to reduced neurogenesis in the

dentate gyrus and the mPFC. Even though the function of these newborn neurons is discussed controversially, impairment of memory and learning resulting from reduced neurogenesis is likely. At the behavioral level, impaired performance in hippocampal-dependent spatial memory tasks and impaired PFC-dependent set-shifting capabilities can be observed (Roozendaal et al. 2009).

In contrast to the hippocampus and the PFC, the amygdala becomes hypertrophic in conditions of chronic stress. Increases in dendritic arborization and spine density take place (Roozendaal et al. 2009). Moreover, activity of the CRF system in the amygdala, which is involved in anxiety, is enhanced. Chronically stressed animals show enhanced fear conditioning and are characterized by a more habitual and less goal-directed response style. Thus, the balance between brain regions involved in cognition is altered by chronic stress (Lupien et al. 2009). While “analytic” cognitive functions mediated by the hippocampus and PFC are impaired, “affective” fear-related amygdala functioning and habit-related striatal functioning are enhanced (Wolf 2008).

In humans, exposure to chronic stress (e.g., shift workers, airplane personnel, soldiers) is associated with cognitive deficits in several domains such as working memory and declarative memory (Lupien et al. 2009; Wolf 2008). These observed cognitive deficits can, in part, be explained by GC overexposure in the presence of chronic stress, a finding supported by studies administering GCs for days to weeks, resulting in cognitive impairments. Further evidence comes from studies with patients receiving GC therapy. Whether the negative effects on memory reflect acute or chronic effects is sometimes hard to disentangle, and at least one study showed a rapid reversal of the deficits after discontinuation of the GC treatment. Data from patients with Cushing’s disease point in the same direction, with cognitive impairments and hippocampal volume reductions reported. Hippocampal atrophy might be reversible once successful treatment has occurred. This would be in line with the remaining plasticity of this structure observed in animal studies (Wolf 2008).

## **Chronic Stress or Rising Cortisol Levels During Aging: Effects on Cognition**

In older laboratory rodents, an increase in basal corticosterone levels and a less efficient negative feedback of the HPA axis can be detected. Studies have reported that enhanced HPA activity is associated with poorer memory in those animals (Lupien et al. 2009).

As reviewed above, increases in basal cortisol levels occur during human aging. In addition, pharmacological or behavioral challenge studies observe an increased HPA response. Moreover, HPA-negative feedback in older subjects is less efficient. These alterations might reflect age-associated diseases, stress exposure over the lifespan, genetic vulnerabilities, the long-term consequences of exposure to early life adversity, or a combination of the above (Lupien et al. 2009). In older adults, correlations between elevated or rising cortisol levels and cognitive impairments have been reported (Lupien et al. 2009). The association between rising cortisol levels and atrophy of the hippocampus is not sufficiently understood, and the current empirical situation is heterogeneous. Similar associations with other GC-sensitive brain regions (e.g., PFC) have received less attention so far.

Evidence for HPA hyperactivity has been observed in patients with Alzheimer’s dementia (AD). This could reflect the damage to HPA feedback centers in the brain, but it might also be causally involved in disease progression (Wolf and Kudielka 2008). Work in animals has documented that HPA hyperactivity can influence amyloid metabolism as well as tau phosphorylation, the two hallmarks of AD pathology. In human patients, treatment with prednisone resulted in exaggerated memory loss. Moreover, a genetic susceptibility to AD could be linked to the gene encoding 11 $\beta$ -HSD, which influences local GC metabolism. In addition, at the self-report level, evidence exists that enhanced stress susceptibility is associated with a greater risk of dementia (Wolf and Kudielka 2008).

Another condition associated with HPA hyperactivity is the metabolic syndrome, as well as type

2 diabetes. There are close links between the stress system and the glucoregulatory system. Several authors have suggested that chronic stress facilitates the occurrence of the metabolic syndrome by influencing visceral fat deposition, impairing insulin sensitivity, or by changing eating habits toward unhealthier (comfort) food. Alternatively, the negative impact of glucose intolerance on the brain might lead to HPA hyperactivity and, in turn, elevated cortisol levels (Convit 2005).

### Intervention Strategies

In laboratory animals, stress-induced dendritic atrophy and reduced neurogenesis can be prevented with antidepressants and anticonvulsants. Also, treatment with a glucocorticoid receptor antagonist is effective in preventing such stress-induced changes in neurophysiology. Similarly, memory impairments can be prevented with these drugs (Wolf 2008).

In humans, chronic stress without an associated psychopathology could be alleviated by psychological stress intervention strategies. Possible examples are stress inoculation training and mindfulness-based stress reduction training. In addition, social support is an effective stress-buffering factor.

Pharmacological treatment with beta-blockers can prevent the effects of acute GC elevations on memory retrieval. It remains to be shown whether similar approaches are effective in conditions of chronic stress. In addition, GR antagonists and/or CRF antagonists might be candidate drugs. Moreover, drugs that influence the local GC metabolism in the brain could also be effective. Depression is often associated with HPA hyperactivity. Successful treatment with antidepressants leads to a normalized HPA axis. One study observed that treatment with a selective serotonin reuptake inhibitor (SSRI) improved memory performance and reduced cortisol levels. More direct interventions targeting the HPA axis have been tested in laboratory animals, and clinical trials are on the way. In this context, CRF antagonists

and GR antagonists appear promising. In sum, reinstating appropriate HPA signaling appears to be a promising treatment approach both in chronically stressed animals and in human patients suffering from stress-related psychiatric disorders (De Kloet et al. 2007).

Intervention strategies specifically designed for older people could be developed based on the following findings. In rodents, behavioral (e.g., neonatal handling) and pharmacological (adrenalectomy with low-dose corticosterone replacement) intervention strategies, leading to stable HPA activity throughout life, prevent age-associated cognitive decline. Similarly, a pharmacological reduction of active GC concentrations in the hippocampus (inhibition of 11beta-HSD synthesis) is efficient in preventing memory impairments in aging mice. In humans, a pilot study showed that the 11beta-HSD inhibitor carbenoxolone improved some aspects of memory in older men and in older patients with type 2 diabetes (Wyrwoll et al. 2010). Future studies are needed to better investigate possible side effects of long-term treatment with these kinds of drugs. Regarding treatment of the metabolic syndrome, lifestyle modifications are often successful if started early enough. In addition, pharmacological approaches are available. They should be able to prevent or reduce memory impairment and hippocampal atrophy associated with diabetes and the metabolic syndrome (Convit 2005).

### Summary and Outlook

This chapter illustrates that chronic stress has a negative impact on cognition throughout life. A lifespan approach in research on stress and cognition emphasizes the long-lasting effects of exposure to early life adversity. Genetic risk factors, in combination with early life adversity, render an individual more susceptible to stress and stress-associated diseases during aging.

By reducing early adversity, it would thus be possible to support the development of a more

resilient phenotype less susceptible to stress-associated cognitive disturbances in later life. Importantly, a previously unappreciated amount of neuroplasticity remains in adulthood, allowing an optimistic view of the potential to successfully treat stress-associated neurophysiological changes in the future. These interventions should aim at reinstating appropriate HPA signaling and will thus rely upon a thorough diagnostic neuroendocrine workup of the phenotype.

Taken together, considerable progress has been made in understanding the impact of acute and chronic stress on the human brain. This knowledge has substantial relevance for aging, since age-associated changes in HPA (re)activity have been found to occur, and the sensitivity of the brain to stress appears to be altered in aging. Preventing or diminishing the age-associated increase in HPA activity appears to be a promising future research avenue to foster successful (mental) aging (Lupien et al. 2009; Wolf and Kudielka 2008).

## Cross-References

- ▶ [Cognitive and Brain Plasticity in Old Age](#)
- ▶ [Emotion–Cognition Interactions](#)
- ▶ [Memory Training Methods and Benefits](#)
- ▶ [Memory, Autobiographical](#)
- ▶ [Memory, Episodic](#)
- ▶ [Mild Cognitive Impairment](#)
- ▶ [Process and Systems Views of Aging and Memory](#)
- ▶ [PTSD and Trauma](#)
- ▶ [Stress and Well-Being: Its Relationship to Work and Retirement for Older Workers](#)

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## Elder Abuse and Neglect

Shelly L. Jackson

Institute of Law, Psychiatry and Public Policy,  
University of Virginia, Charlottesville, VA, USA

### Synonyms

Elder maltreatment; Elder mistreatment; Mistreatment of older adults; Victimization of older adults

### Definition

Elder abuse was first publically recognized in the United Kingdom and the United States in the 1970s. It is now a recognized phenomenon found around the world, led by the advocacy work of the International Network for the Prevention of Elder Abuse. The definition of elder abuse has expanded over time. However, across countries elder abuse is frequently defined as a single or repeated act, or lack of appropriate action, occurring within any relationship where there is an expectation of trust which causes harm or distress to an older person and typically encompasses six types of abuse: physical abuse, caregiver neglect, financial exploitation, psychological abuse, sexual abuse, and (in some countries) abandonment (World Health Organization 2002a). Since abandonment has received virtually no empirical attention, it is omitted from this review.

The trust component of the definition serves to distinguish elder abuse from other harms perpetrated against older adults. Abuse in later life, for example, focuses on domestic violence and sexual assault of older adults (particularly women). Although overlapping to a degree with elder abuse, it is narrower than elder abuse and typically espouses a very different theoretical position. Crimes against older adults (e.g., burglary, financial scams, assault) that are committed by strangers are not typically considered elder abuse, although homicide committed by a family member would be a form of elder abuse. And abuse of vulnerable adults (ages 18 years and

older with some statutorily defined vulnerability) may overlap with elder abuse but only when the vulnerable adult is over the age of 60.

### Prevalence and Consequences of Elder Abuse

Nationally representative studies in the USA find that overall, one in 11 older adults experience some type of elder abuse in a given year, although prevalence varies by the type of abuse involved: financial exploitation (5.2%), caregiver neglect (5.1%), emotional/psychological abuse (4.6%), physical abuse (1.6%), and sexual abuse (<1%) (Phelan 2013). However, between 30% and 40% of reported abused older adults experience more than one type of abuse simultaneously. Prevalence studies conducted in the European Region find that about 2.7% of people age 60 and over have experienced physical abuse in the preceding year, 0.7% sexual abuse, 19.4% psychological abuse, and 3.8% financial abuse (World Health Organization 2011). Throughout Asian countries, prevalence estimates vary wildly from 0.2% to 62%, although again, prevalence rates vary by the type of abuse involved (Phelan 2013). In Portugal, it is estimated that 12% of older adults fall victim to elder abuse in a given year, although again prevalence rates vary across types of abuse (Gil et al. 2014). In Western Australia, the prevalence of elder abuse is estimated to be 4.6% (Phelan 2013). Due to methodological differences within and between countries, comparisons are imprecise. However, it is generally accepted that the prevalence of elder maltreatment increases among people with a disability, cognitive impairment, and/or dependence (World Health Organization 2011).

There is evidence that elder abuse is underreported, with only one in 24 cases reaching the authorities, with rates of reporting differing across types of abuse (Phelan 2013). Although elder abuse occurs in long-term care facilities (Payne 2011), the majority of elder abuse occurs in the community, where most (95%) older American adults reside. However, residence varies tremendously in other parts of the world. In the

European Region, for example, more affluent countries have higher rates of paid caregiving and institutional care compared to less affluent countries where care is provided primarily by family members (World Health Organization 2011).

The field is recognizing the unique ways in which historically marginalized groups are impacted by the experience of elder abuse (Teaster et al. 2014). Distinct ethnic/racial groups may perceive the experience of abuse differently, experience elder abuse in different ways, and even at different rates. Individuals who self-identify with certain groups (LGBT, veterans) may have unique vulnerabilities that place them at risk for abuse, including financial exploitation. For example, threatening an LGBT older adult with outing may be sufficient to produce silence.

The myriad consequences of elder abuse are not often recognized (Payne 2011). They include psychological problems such as depression, emotional problems, disruptions in social and family relationships, compromised health, physical injury, hospitalization, and mortality, restrictions on and elimination of autonomy such as institutionalization or imposition of a guardianship, changes in living arrangements, and loss of assets including one's home. In some cases, there are secondary victims as well. For example, family members or the state may become physically and/or financially responsible for the older adult, or those who stood to receive an inheritance will not do so. The economic costs to society (direct costs to health, social, legal, police and other services) imposes a substantial financial burden. The consequences of elder abuse routinely lead to a diminished quality of life for abused older adults regardless of nationality.

### Case Identification and Reporting

Some countries (e.g., Israel, Brazil, South Korea, United States) have implemented a system for responding to reports of elder abuse, typically referred to as adult protective services (APS) (World Health Organization 2002b, 2011). Since the 1970s, all states in the USA have APS, a

government agency guided by state statute, although statutes vary considerably from state to state (Jackson 2015). Albeit somewhat controversial, all but one state (New York) have some form of mandatory reporting. Australia, in contrast, has eschewed mandatory reporting. APS is guided by the principle of self-determination and does not compel compliance with the provision of services unless the older adult is incapacitated or in certain emergency situations and the court approves such intervention. However, some states do compel compliance with an investigation. In practice, studies in the USA generally find that approximately a quarter of APS clients decline services, some of which will have a subsequent APS report. Over the decades, elder abuse has shifted conceptually to that of a crime, implicating the involvement of law enforcement and prosecution, although prosecution remains uncommon (Payne 2011).

Concern over financial exploitation (i.e., the illegal or improper use of an elder's funds, property, or assets) has consumed much of the attention towards elder abuse (Factora 2014). Financial exploitation has captivated the federal and state responders in the USA and Australia, with the majority of new movement within this defined area of elder abuse. As lawmakers bear witness to older adults being financially ruined, they have responded in kind with increased legislation (albeit not funding). There are now 39 states in the USA that criminalize financial exploitation (Jackson 2015). The primary form of financial exploitation prevention has been education, but researchers are suggesting that this may be ineffective for many older adults (Payne 2011).

The field of elder abuse has suffered from a lack of theory (Payne 2011; Bonnie and Wallace 2003). However, the adoption of a lifecourse approach is recommended for understanding elder maltreatment (World Health Organization 2011). While still thin, there have been modest empirical gains since the landmark release of the Institute of Medicine's *Elder Mistreatment: Abuse, Neglect, and Exploitation in an Aging America* (Bonnie and Wallace 2003), depicting the deplorable condition of the elder abuse field.

There is increasing recognition of the importance of distinguishing among types of abuse (Payne 2011), while recognizing that sometimes types of abuse co-occur or that one type of abuse may be a risk factor for experiencing other forms of abuse. However, there is still relatively little research that either increases basic knowledge or guides applied practice (Payne 2011). Furthermore, the research has been uneven, with less empirical attention to caregiver neglect and psychological/verbal abuse compared to other forms of elder abuse.

Detection of elder abuse remains challenging in all countries. In an effort to identify cases, elder abuse screens have been developed, although it is unknown how widely they are administered in any country. The U.S. Preventive Services Task Force recently concluded, however, that there are no valid and reliable elder abuse screens and could not recommend their use (Moyer 2013). Considerably more work is needed to develop psychometrically sound screening instruments for elder abuse. In the meantime, efforts in many countries (e.g., Canada) include public awareness campaigns designed to encourage community members to report suspected elder abuse. However, detection and reporting are related but distinct actions, with the decision to report considerably complex. Regardless, communities implementing public awareness campaigns must be prepared for the possible increase in maltreatment cases coming to the attention of those responsible for responding.

With few exceptions, the field suffers from a lack of forensic markers, which is interesting given the criminalization of elder abuse over the past couple of decades. Lack of forensic markers hampers the ability of geriatricians and other health care providers to differentiate between aging and abusive behavior (Bonnie and Wallace 2003), especially when victims are reluctant to disclose. Furthermore, insufficient knowledge surrounds the differentiation between accidental death and elder homicide. Forensic science also is being applied in the context of financial exploitation, with the utilization of forensic accountants in financial exploitation investigations.

## Risk Factors of Elder Abuse

Consistent with a public health approach, much of the elder abuse research has focused on the identification of risk factors (i.e., factors that increase the odds of some phenomenon such as elder abuse). Researchers have identified over 50 risk factors for elder abuse, although only 13 are found consistently across studies (Johannesen and LoGiudice 2013). However, risk factors are differentially associated with types of abuse. Other than co-occurring forms of elder abuse, little is known about the ebb and flow of these risk factors or the interconnectedness among them. Also lacking from this literature is the identification of protective factors that buffer against elder abuse.

One risk factor that seems to cut across all types of elder abuse is dementia (Dong et al. 2014). In 2002, the prevalence of dementia among American individuals ages 71 and older was 13.9%, with another 22.2% having some form of cognitive impairment without dementia. However, it is important to remain cognizant that more people without dementia experience elder abuse. In response to the concern about identifying dementia among older adults, over 100 cognitive screens have been developed and many are in use in every day practice throughout the world. However, the US Preventive Task Force concluded that “. . . current evidence is insufficient to assess the balance of benefits and harms of screening for cognitive impairment” (Moyer and U.S. Preventive Services Task Force 2014).

The risk factor that consumes the most real estate in this field is social isolation. However, this concept is unrefined in the context of elder abuse, often being conflated with network size, loneliness, and living alone, and yet there are important distinctions among these concepts. The manner in which isolation manifests across types of abuse appears to differ as well. Some studies have found, for example, that while low social support was related to neglect, physical, sexual, and emotional abuse, it was not related to family-perpetrated financial exploitation. In contrast, other studies have found that living alone was related to financial exploitation, but not to

physical abuse (O’Keeffe et al. 2007). Social isolation likely plays an important role in victimization, but requires greater conceptual clarity. It has been proposed, however, that social connectedness may play a prophylactic role in elder maltreatment (World Health Organization 2011).

Gender has also been implicated in elder abuse, although scholars cogently argue that elder abuse is not a gendered phenomenon (Kosberg 2014). While the field awaits the development of victim profiles for each type of abuse, it is important to remember the heterogeneity that exists among older adults generally, and among elder abuse victims specifically. For example, the victimology literature asserts that there is a range of culpability expressed by victims (Doerner and Lab 2015). It may be more difficult for society to perceive an older adult victimized by a family member as a “pure victim” compared to an older adult victimized by a stranger.

Offenders have historically been excluded from elder abuse research as well as the response to elder abuse. Elder abuse offenders can be anyone, but are frequently family members, relatives, friends, neighbors, and professional caregivers, although the predominant type of victim-offender relationship appears to vary by abuse type (Jackson 2014). Furthermore, in Spain the main perpetrators for older people who are dependent or have disabilities were adult offspring, whereas for independent older people the perpetrators appear to be their partners (World Health Organization 2011). There are several offender risk factors that have substantial empirical support across studies from various countries (World Health Organization 2011; Payne 2011; Johannesen and LoGiudice 2013). These include psychopathology (substance abuse, mental illness, and/or criminal history), isolation, and financial dependence upon the victim. As with victims, appreciating the heterogeneity among elder abuse offenders is important. Prosecution has been the primary form of intervention for elder abuse offenders, and even that has been appallingly absent (Payne 2011). Development of offender interventions is urgently needed (Jackson 2014).

To truly understand and predict elder abuse, the ecological model instructs that there are risk factors at levels above and beyond the individual level (Payne 2011). For example, at the relationship level, the quality of the relationship prior to the occurrence of maltreatment may be an important predictive factor (World Health Organization 2011). Although the literature is scant, neighborhood-level factors (unsafe neighborhoods, high unemployment, and negligible social cohesion) have also been shown to be associated with elder abuse. At the societal level, elder abuse may be impacted by social policy and public attitudes such as ageism (i.e., stereotyping and discriminating against individuals or groups on the basis of their age).

## Intervention

The field of elder abuse has placed very little effort into intervention development and even less on the evaluation of interventions. Studies find little encouragement in this domain, with some scholars questioning the underlying assumptions of protective services legislation (Payne 2011). It is becoming increasingly recognized that elder abuse cases range in complexity, with implications for interventions. Some cases are easily resolved, but many are not. It is clear that cases involving older parents and their abusive adult children are often particularly challenging cases in which to intervene due in part to parent’s fierce protection of their offspring and entrenched patterns of behavior. Efforts are underway to identify and address high-risk victims.

Newer interventions have incorporated known risk factors such as social isolation (World Health Organization 2011), conceding, however, that this type of intervention is time consuming. Some offenders suffer from caregiver burden syndrome, with programs developed to address this condition. However, a systematic review of respite care concluded that, although some evidence supports a positive effect on burden and depression among caregivers, the evidence was limited and weak (World Health Organization 2011).

In the United States and throughout Europe there are examples of shelters offering support for women who have left an abusive relationship. In the USA, the Weinberg Center for Elder Abuse Prevention has gained considerable prominence. However, little is known about the effectiveness of emergency shelters in reducing elder maltreatment. In general, there are insufficient evaluation studies exploring the effectiveness of interventions on elder maltreatment, both locally and globally. One approach may be to identify strategies for preventing violence in general as there may be some underlying risk factors that cut across both of these fields.

In the American context and in some European countries, even less is known about the practice of APS caseworkers and the effectiveness of the services they employ (Payne 2011). There is evidence that a report of abuse to APS increases the likelihood of institutionalization as well as mortality. However, APS caseworkers tend to perceive their interventions (e.g., institutionalization) as effective. The field has yet to identify and define successful outcomes beyond the cessation of abuse. APS caseworkers and older adults sometimes hold different views of the underlying causes of abuse (Payne 2011), suggesting they might perceive outcomes differently. Victim satisfaction with an APS intervention is largely unknown. However, one study found that the services most frequently offered (social services) were not the type of service that had the greatest impact (legal) on the abusive situation (Alon and Berg-Warman 2014). In this evidence-based driven world, APS is going to have to go under the microscope.

One practice that is growing in prominence across countries is responding to elder abuse cases through multidisciplinary teams (MDTs) (Brandl et al. 2007). Rooted in the biopsychosocial model, an MDT simply refers to a group of people bound by a common purpose, typically comprised of five features: sharing, partnership, interdependency, power, and process. MDTs promote the inclusion of professionals historically absent from society's formal response to elder abuse, for example, psychologists to conduct neuropsychological evaluations. Although the concept

has existed since the 1950s, demonstration projects in the USA were funded in the early 2000s which served to raise awareness of the model. This model is expected to proliferate in the coming years, although very few states have adopted this practice legislatively. Unfortunately, the empirical validation of MDTs is woefully small.

## Conclusion

Elder abuse is a pervasive problem that affects all societies and countries. Considerable gains have been made in the field of elder abuse (research, practice, and policy) since it was first recognized in the 1970s. Although the knowledge base is growing, it remains underdeveloped. Very few interventions have been established, and far fewer have been evaluated. Practice continues to be based on experience rather than empirical evidence. And while there are now governmental policies of some kind in many countries (World Health Organization 2011), they are fragmentary and largely unfunded. It is sometimes easy for those in the field to become discouraged. And yet a look back over the past 35 years finds reason to be optimistic. For example, in 2002, the Toronto Declaration on the Global Prevention of Elder Abuse called on *all* countries to take action to prevent and ameliorate elder abuse. Many countries recognize the plight of abused older adults and are taking steps to respond. In the USA, for example, the Elder Justice Act (Pub. L. 111–148, 124 Stat. 119) was passed in 2009, the first federal legislation devoted exclusively to elder abuse.

As recommended by the World Health Organization, the adoption of a public health approach can facilitate a country's ability to prevent and ameliorate elder abuse. However, in the absence of a substantial investment in resources this fledgling field will continue to falter. Whether elder abuse has reached the level of a social problem in any country worthy of such investment remains dubious. However, in time society may look back and characterize this period as the turning point for many countries in the development of the field of elder abuse.

## Cross-References

- ▶ Behavioral and Psychological Symptoms of Dementia
- ▶ Caregiving and Carer Stress
- ▶ Social Support and Aging, Theories of

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## Eldercare and Work

Lisa Calvano<sup>1</sup> and Josie Dixon<sup>2</sup>

<sup>1</sup>West Chester University of Pennsylvania, West Chester, PA, USA

<sup>2</sup>London School of Economics and Political Science, London, UK

## Synonyms

Elder care; Informal care; Parent care

## Definition

Eldercare is informal and unpaid care provided by family and friends that includes meeting a variety of physical, emotional, household, and financial needs. Caregiving can be divided into two broad

categories: hands-on activities, such as feeding, transporting, and dispensing medication, and managerial activities, such as planning, coordinating, and supervising formal care provided by others (Rosenthal et al. 2007). Care recipients may live in their own homes with their families or in residential facilities such as assisted living communities, nursing homes, or sheltered housing schemes.

## Introduction

As populations age around the world, an increasing number of adults are working and caring for elders at the same time. In England and Wales, 11.9% of the female population and 9% of the male population provide some level of unpaid care with as many as 1.2% of the female population and 1% of the male population providing 50 h or more while working full time (Office for National Statistics 2013). In the United States, approximately 17% of the population takes care of older family members or friends while working full or part time (National Alliance for Caregiving 2015). Data from Australia, Canada, Israel, and the European Union show similar patterns of caregiving and employment (Cranswick and Dosman 2008; Fine 2012; Katz et al. 2011; Viitanen 2010). Overall, three times more people of working age are expected to care for two billion aging family members worldwide by 2050 (Carers UK 2013).

In most parts of the world, elders traditionally lived with their families in multigenerational households and were cared for by female relatives who did not work outside the home (Gross 2011). While women are still the primary caregivers in most families, eldercare arrangements are changing due to social, economic, and public policy trends. These trends include more women in the workforce, an increasing number of dual career households, delayed retirements, greater geographic mobility, shrinking family sizes, reduction of public spending on healthcare and social services, fragmented delivery of care to the aging, and a growing desire on the part of the elderly to remain in their own homes for as long as possible

(Bookman and Kimbrel 2011; Fine 2012; Kossek et al. 2010; Meng 2013; Yang and Gimm 2013).

With a growing number of women and men providing informal care worldwide and careers and caregiving responsibilities peaking at roughly the same time, eldercare has emerged as an important issue for employers. Although balancing caregiving and work can be stressful, employment may provide a psychological buffer. Thus, employers have a positive role to play by creating supportive work climates and offering workplace-based eldercare assistance. The following sections will highlight recent research on the relationship between eldercare and work with a special focus on two of the most challenging caregiving situations – end of life care and dementia. The general impact of caregiving on caregiver health and well-being, caregiver employment outcomes, and workplace-based eldercare assistance will be discussed.

## Impact on Caregiver Health and Well-Being

From a theoretical perspective, caregiver health and psychological outcomes can be understood through the lens of a “social determinants of health” model. This model suggests that a range of individual and organizational factors, as well as wider societal and cultural factors, influence health and psychological outcomes for caregivers (Mikkonen and Raphael 2010). Salient factors include gender, income, and social status; working conditions; health and social services; social support networks; culture; and personal health practices and coping strategies. One example of a culture factor is gendered expectations of who provides care (Williams et al. 2011).

On a practical level, caregivers tend to develop more health problems than non-caregivers, but the effect is generally minimal (Pinquart and Sörenson 2003; Vitaliano et al. 2003). However, they are much more likely to experience increased psychological strain (Duxbury et al. 2011) and higher rates of depression (Pinquart and Sörenson 2003). Some possible explanations for the negative impact of eldercare on well-being include the

role reversal of children caring for parents, caregivers confronting their own mortality, and the emergence of unresolved family issues (Smith 2004). In addition, strong negative emotions such as anger, helplessness, confusion, and guilt may surface when eldercare responsibilities occur because of an emergency or escalate over time as the health of the care recipient declines (Gross 2011).

Research demonstrates that certain types of eldercare produce more stress and strain than others, including caring for a spouse and/or co-residing with a care recipient (Duxbury et al. 2011; Pinguart and Sörenson 2003). Moreover, women and individuals with fewer financial resources experience poorer outcomes no matter where they live or for whom they care (Austen and Ong 2014; Carers UK 2013; Feinberg and Choula 2012; Lee et al. 2001; Schroeder et al. 2012). In addition, caregivers who live in countries with weak social safety nets experience more stress and strain (Hansen et al. 2013).

The most physically and emotionally demanding caregiving situations entail caring for someone with dementia or at the end of life. Dementia patients require high levels of care and supervision, particularly when the syndrome is in the moderate to severe stages (Wimo et al. 2013). People with dementia may also develop neuropsychiatric ailments, including personality changes and mood disorders, as well as associated problem behaviors. These are symptoms that are particularly associated with burden in dementia caregivers (van der Lee et al. 2014; Chiao et al. 2015; Ornstein and Gaugler 2012). Given the significant and cumulative losses associated with the dementia disease trajectory, dementia caregivers may also experience anticipatory and “pre-death grief” (Lindaur and Harvath 2014). Furthermore, dementia caregivers tend to provide more care each month and over a longer period (Kasper et al. 2014). As a result of these multiple pressures, dementia caregivers experience high rates of burden, depression and anxiety, social isolation, physical ill health, and feelings of guilt and frustration (van der Lee et al. 2014; Chiao et al. 2015; Springate and Tremont 2014), although some authors have also documented

gains such as spiritual and personal growth and skills acquisition (Zarit et al. 2012; Sanders et al. 2005).

End of life care is also physically and emotionally demanding because caregivers undertake physical tasks, manage complex symptoms, and provide emotional support to a dying person while simultaneously managing their own, sometimes complicated, feelings of loss and grief (Williams et al. 2011; James et al. 2009; Mangan et al. 2003). As a result, end of life care is associated with a wide range of negative health and psychological impacts (Funk et al. 2010; Stajduhar et al. 2010). For example, a cross-country European survey estimates that between 28% (Belgium) and 71% (Italy) of end of life caregivers were physically and/or emotionally overburdened during the last 3 months of the care recipient’s life (Pivodic et al. 2014).

### Caregiver Employment Outcomes

Employed caregivers report higher levels of stress and work-family conflict than non-caregivers, and employers perceive that caregivers are less productive (Keene and Prokos 2007; Zuba and Schneider 2013). While caregivers are more likely to experience disruption in their labor force participation than non-caregivers, it is debatable whether the stress of eldercare results in negative work outcomes for individuals who remain in the workforce (Zacher et al. 2012). Moreover, caregivers who continue to work may receive a psychological boost from combining the two roles.

**Labor force participation.** Research from around the world shows that caregiving impacts labor force participation, especially for women (e.g., Austen and Ong 2014; Feinberg and Choula 2012; Kotsadam 2011; Liu et al. 2010). Typical responses to the demands of caregiving include dropping out of the workforce permanently, reducing work hours, taking leave without pay, or retiring early (Dembe et al. 2008). Women are more likely than men to leave the workforce permanently. Other factors that increase the likelihood of exit include age, poor health, and lower socioeconomic status (Austen and Ong 2014;

Lilly et al. 2007; Meng 2013). There is also evidence that employment status is a risk factor for unpaid caring. Individuals not working or working part time are more likely to be the ones to provide care compared to those working full time (Hutton and Hirst 2000).

Intensity of caregiving is another factor that affects labor force participation for both women and men. Research in the United Kingdom shows that there is a “threshold effect” at 10 h a week, such that becoming an unpaid caregiver for 10 or more hours a week is associated with increased odds of leaving employment (King and Pickard 2013). Similarly, a Canadian study shows that higher intensity caregiving is associated with being fully retired for men and women aged 55–69. For women, high-intensity caregiving is also associated with working part time and being a labor force nonparticipant (Jacobs et al. 2014).

Type of caregiving also affects labor force participation. A large-scale nationally representative survey conducted by the Alzheimer’s Association (2014) found significant impacts on employment for dementia caregivers in the United States. Seventeen percent of workers gave up their jobs before or after assuming caring responsibilities, 8% took early retirement, and 13% moved from full- to part-time employment. Parallel research in the United Kingdom estimates that 21% of people caring for someone with dementia leave their jobs and 29% reduce their working hours (Centre for Economic and Business Research 2014). End of life caregivers are nearly 5% more likely to reduce their work hours than individuals caring for elders with a long-term, chronic condition (Williams et al. 2014).

Caregivers who reduce their hours or leave the workforce entirely incur long-term financial penalties in terms of lost wages and benefits and reduced retirement savings (Feinberg and Choula 2012). In addition, employers can incur costs because they will have invested resources to train and develop these employees. Many caregivers who leave the labor market will have valuable skills and experience because they are concentrated in the 45–64 age range (Carers UK 2013). Finally, there are public expenditure implications. For example, Pickard (2012) estimated

that the UK public expenditure cost of caregivers leaving employment is £1.3 billion per annum, covering £1 billion of lost tax revenues and £300 million in Carer’s Allowance.

**Work-family conflict.** While research consistently shows that eldercare affects labor force participation, there is less evidence to support assertions that the stress of eldercare causes negative work outcomes for those who remain in the workforce (Zacher et al. 2012). For example, employers perceive that eldercare causes employees to miss work (Katz et al. 2011). All caregivers are absent more frequently than non-caregivers, but employees with children miss more days than those taking care of elders (Boise and Neal 1996). Moreover, all caregivers experience higher levels of time- and strain-based conflict than non-caregivers, but there is no difference between those caring for children and those caring for elders (Lee et al. 2010). However, workers who take care of elders are likely to experience more frequent interruptions during the workday, most typically to make phone calls and accompany care recipients to appointments. This phenomenon is known as presenteeism and is a consequence of the fragmented delivery of services to the elderly, which require caregivers to coordinate care from multiple providers (Smith 2004). As with gendered outcomes for labor force participation, the impact of eldercare on absenteeism and presenteeism is greater for women, as well as workers in low-skill and low-status jobs (Austen and Ong 2014; Katz et al. 2011; Lee 1997; Zuba and Schneider 2013).

Employees with the most challenging caregiving responsibilities experience the most work-family conflict and work disruptions. For example, in the United States 54% of employees taking care of dementia patients reported unplanned absences from work, 15% took planned leave, and 8% saw their work performance suffer to point of being worried about dismissal (Alzheimer’s Association 2014). In the United Kingdom, as many as 6.6% end of life caregivers missed full days at work compared those caring for someone with a long-term, chronic condition (Williams et al. 2014).

**Work as a buffer.** Employed caregivers generally report better health than unemployed caregivers. This phenomenon may occur because employment is a protective factor or because the caregivers with the poorest health are those least able to work (Cannuscio et al. 2004). Nevertheless, research indicates that work may be a protective factor because it bolsters a caregiver's sense of efficacy, provides a sense of accomplishment, increases financial resources, and expands support networks and opportunities for respite (Utz et al. 2012; Zuba and Schneider 2013).

Two contrasting theories from the work-family literature explain how successfully (or not) individuals balance eldercare and work. Scarcity theory posits that an individual has a limited amount of time and energy for which caregiving and work compete (Marks 1977). On the other hand, role enhancement theory says that the benefits of one role spillover into the other, creating a net gain (Greenhaus and Powell 2006). Reid et al. (2010) studied which of these theories more accurately predicts employee behavior and found that the results vary greatly from individual to individual with some employed caregivers indicating that work enhances their well-being while others saying that it adds to their stress. Reid et al. (2010) conclude that an individual's subjective perception of the degree to which eldercare interferes with work is more predictive of role conflict and other negative outcomes than more objective measures.

### Workplace-Based Eldercare Assistance

Although employer support has been shown to reduce work-family conflict and caregiver burden (Zacher and Winter 2011), research on the availability and effectiveness of workplace-based eldercare assistance is sparse (Kelly et al. 2014). In general, a country's public policy context is a major determinant of how active private employers are in this area. In countries with weaker family leave laws and welfare policies, private employers are more likely to provide assistance, but it is usually limited to the largest companies and certain employees (Dembe et al. 2008; Yang and Gimm 2013). Employers cite the cost of

benefits and the difficulty measuring effectiveness as hindrances to providing assistance (Katz et al. 2011).

Workplace-based eldercare assistance can be divided into three broad categories: compliance with family leave laws, formal employer-sponsored services and benefits, and informal support from managers and supervisors. Legal compliance is the most basic level of assistance that employers provide. If employers offer formal benefits, they usually take the form of information, education, and referral programs. In the United States, these would typically be available through Employee Assistance Programs (EAPs). Some employers may go as far as offering flexible hours and paid leave, as well as subsidies for respite and emergency care (Dembe 2008). Flexibility is both the most desired benefit and most beneficial in terms of reducing caregiver burden, but access varies greatly across countries, industries, organizations, and job categories. For example, in the United States flexible work hours are available primarily to professional and managerial employees (Sweet et al. 2014).

Even when employers offer eldercare benefits, employees frequently do not utilize them either because they are not aware of their existence or they worry about being stigmatized if they disclose their care duties (Dembe et al. 2008). Fear of stigmatization is a particular concern for employees with the greatest caregiver burden. For example, the lack of understanding that still exists around dementia means that people may feel uncomfortable about mentioning their care responsibilities at work. This may prevent them from seeking the support they need. Therefore, employers need to take active steps to ensure that all employees are made aware of workplace-based assistance. Employers may also participate in "dementia-friendly" initiatives designed to reduce the stigma of dementia, including the UK's dementia-friendly workplace initiative (Alzheimer's Society 2015).

End of life caregivers may require compassionate or family-friendly leave, in addition to bereavement leave due to the intensity and trajectory of care (Vuksan et al. 2012). Psychoeducational interventions for end of life caregivers

may improve coping and help to reduce distress and burden (Hudson et al. 2013). In turn, reducing caregiver burden and distress can support death at home rather than in hospital (Visser et al. 2004).

## Conclusion

With populations aging around the world, more and more adults will find themselves juggling eldercare and work responsibilities. In order to minimize stress, maximize well-being, and ensure that caregivers can continue working as long as they want, forward-thinking employers – with the help of governments and the voluntary sector – should take the lead in developing creative and effective eldercare policies and programs to assist all employees. In order to create “aging-friendly societies” and workplaces, Bookman and Kimbrel (2011) argue that a “large-scale, cross-sector initiative is needed to coordinate efforts. . .to support all citizens from diverse cultures and incomes as they age” (p. 132).

## Cross-References

- ▶ [Dementia and Neurocognitive Disorders](#)
- ▶ [End of Life Care](#)
- ▶ [Flexible Work Arrangements](#)
- ▶ [Human Resource Management and Aging](#)
- ▶ [Organizational Climates and Age](#)
- ▶ [Palliative Care](#)
- ▶ [Stress and Well-being: Its Relationship to Work and Retirement for Older Workers](#)

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## Electroconvulsive Therapy

Shawn M. McClintock<sup>1,2</sup> and Donel M. Martin<sup>3</sup>

<sup>1</sup>Division of Psychology, Department of Psychiatry, UT Southwestern Medical Center, Dallas, TX, USA

<sup>2</sup>Division of Brain Stimulation and Neurophysiology, Department of Psychiatry and Behavioral Sciences, Duke University School of Medicine, Durham, NC, USA

<sup>3</sup>Black Dog Institute, School of Psychiatry, University of New South Wales, Sydney, NSW, Australia

## Synonyms

Convulsive therapy; Electroconvulsive therapy (ECT); Neurostimulation therapy; Somatic therapy

## Definition

Electroconvulsive therapy (ECT) is a neurostimulation intervention used to treat severe neuropsychiatric diseases, such as major depressive disorder, bipolar disorder, and schizophrenia. To perform ECT, while the patient is under anesthesia, controlled electrical stimuli are applied to the brain via two electrodes that are placed on select areas of the scalp to generate a therapeutic tonic-clonic seizure. The generated seizure tends to be time limited and results in both motoric (typically the foot) and electroencephalographic manifestations. To result in therapeutic efficacy, a typical ECT course includes on average between eight

and fourteen sessions that are administered either two to three times per week. There are no absolute contraindications to ECT, but patients undergo comprehensive medical and neuropsychiatric examinations before undergoing treatment and are monitored by an interdisciplinary care team during and immediately after the treatment. Though ECT tends to be medically safe, it can result in transient adverse effects including headaches, body aches, and importantly cognitive difficulties. Regarding the latter, the cognitive difficulties include disorientation, decreased processing speed, anterograde amnesia, retrograde amnesia, verbal dysfluency, and executive dysfunction. Despite these transient adverse effects, ECT has been found to be one of the most effective neuropsychiatric treatments, particularly for major depressive disorder. Due to its usefulness when other neuropsychiatric treatments fail, modern neuropsychiatric practice continues to employ ECT.

## Introduction

Introduced in the late 1930s, electroconvulsive therapy (ECT) is one of the oldest, most durable, and effective neurostimulation therapies in the neuropsychiatric armamentarium (American Psychiatric Association 2008). Initially developed for schizophrenia or other psychotic disorders based on the false assumption that seizures and psychosis were unable to coexist, ECT has since been found to be highly effective for major depressive disorder (MDD). Over the past two decades, numerous clinical investigations sponsored by the National Institute of Mental Health have informed the development and refinement of ECT (Fink 2014; Lisanby 2007). Such refinements have helped to minimize the side effects of ECT while maximizing the clinical benefits (McClintock et al. 2014). Indeed, despite the introduction of other neuropsychiatric treatments including pharmacotherapeutics, psychotherapy, and transcranial magnetic stimulation, ECT continues to be used in psychiatric practice as it tends to be relatively safe and effective in cases where other treatments fail.

## Practice of Electroconvulsive Therapy

Neuropsychiatric practices across the globe, including the United States, employ ECT (American Psychiatric Association 2008). Though there have been no formal epidemiologic studies on the use of ECT, it is estimated that approximately one million people worldwide are treated with ECT. In the United States, the number of people treated with ECT is estimated to be approximately 100,000 annually. Across the United States, the practice of ECT varies due to various mental health laws, as in certain states its use is restricted to certain patients (e.g., patients aged 17 and older). A main factor that limits the use of ECT is the negative stigma associated with it secondary to its associated side effects (e.g., retrograde amnesia, anterograde amnesia). Also, after the publication of the National Institute for Health and Care Excellence (NICE) guidelines (National Institute for Health and Care Excellence 2003), which resulted in more stringent practice parameters, the use of ECT has decreased in the United Kingdom. Nonetheless, ECT has a global presence and its use may increase as more people are diagnosed with neuropsychiatric diseases, particularly when they are nonresponsive to other treatments.

Clinical indications (see Table 1) for ECT include MDD, bipolar disorder, schizophrenia, and catatonia (Mankad et al. 2010). For MDD, ECT tends to be reserved when other treatments fail, and the illness is chronic, severe, and life-threatening. For bipolar disorder, ECT is useful for both the manic and depressive episodes and is indicated when other treatments fail to abate the

**Electroconvulsive Therapy, Table 1** Neuropsychiatric indications for electroconvulsive therapy

Behavioral disturbances of dementia (intractable to other treatments)
Bipolar disorder
Catatonia
Epilepsy (intractable to other treatments)
Major depressive disorder
Parkinson's disease (intractable to other treatments)
Schizoaffective disorder
Schizophrenia

bipolar symptoms. For schizophrenia, ECT is indicated when other treatments are ineffective and may be useful for both the positive and negative symptoms. For catatonia, ECT is indicated as a first-line treatment, though it tends to be reserved until other treatments are determined to be ineffective. Among these four clinical indications, ECT has been found most useful for MDD and catatonia.

### Administration of Electroconvulsive Therapy

An interdisciplinary healthcare team is needed to administer ECT (American Psychiatric Association 2008; Mankad et al. 2010). Such disciplines include (in alphabetical order) anesthesiology, clinical neuropsychology, clinical psychology, nursing, psychiatry, and social work. Before patients commence with ECT, they must undergo a comprehensive medical and neuropsychiatric examination to ensure that ECT is appropriate and safe. Components of the examination include a general medical and physical work-up, anesthesiology work-up, neuropsychiatric history including prior and current treatments, and global cognitive status examination. As needed, other medical work-ups may be recommended including electrocardiogram (EKG), x-ray (such as chest, spine, and head magnetic resonance imaging (MRI) or computerized tomography (CT)), and neurological examination.

Once a patient is cleared for ECT, the treatment team will provide education to the patient (and his/her care partner) about the ECT treatment process, perform informed consent procedures that will occur before the first ECT session and continue throughout the ECT course, and establish the ECT protocol to be used for the patient. During the provision of ECT, safety is a top priority. Before initiation of each ECT session, the patient is administered anesthetic agents to cause muscle relaxation (minimizes motoric seizure expression) and sedation (minimizes the treatment experience), a bite block is placed in the mouth to protect the teeth and tongue, and the patient is closely and continuously monitored (including

**Electroconvulsive Therapy, Table 2** Electroconvulsive therapy parameters

Domain	Specific parameter
Stimulus waveform	Sine wave <sup>a</sup> Brief pulse Ultra brief pulse
Electrode configuration	Bitemporal Bifrontal Right unilateral Left unilateral <sup>a</sup>
Electrical dosage strategy	Empirical dose titration Age method Half-age method
Pulse amplitude	500 mA 600 mA 700 mA 800 mA 900 mA

*mA* milliamperes

<sup>a</sup>Sine wave pulse width is no longer used in modern ECT practice due to its associated adverse cognitive effects, and left unilateral electrode configuration is rarely used in modern ECT practice

pulse, blood pressure, respiration, EKG, and electroencephalography (EEG)) by the treatment team (American Psychiatric Association 2008; Mankad et al. 2010).

To administer ECT, four treatment parameters (Table 2) can be adjusted to provide maximum clinical outcome and minimize adverse effects. These parameters include stimulus waveform, electrode configuration, electrical dosage (American Psychiatric Association 2008), and pulse amplitude (Peterchev et al. 2015). Although the initial stimulus waveform was sinusoidal (sine wave), that waveform is no longer used and modern-day ECT devices no longer carry this option due to its adverse cognitive effects. Both brief and ultra-brief pulse waveforms have been found to be efficacious, and research suggests that the latter may have a more benign cognitive adverse effect profile (Tor et al. 2015). The initial application of ECT employed bitemporal electrode configuration, and thus, it is sometimes called the “gold standard.” However, research has suggested that electrode placement along with bifrontal and right unilateral electrode configuration when properly dosed is equivalent with regard to clinical outcome but that the latter two

placements may have less cognitive adverse effects (Kellner et al. 2010). In another electrode configuration, left unilateral has rarely been employed in clinical ECT practice due its adverse cognitive effects particularly with verbal cognitive functions.

When providing the stimulus for the ECT session, two stimulus dosing methods are used including the age and empirical dose titration methods. For the age method, dose is adjusted based on the age of the patient, with younger and older patients treated with lower and higher doses, respectively. For the empirical dose titration method, a stimulus is applied at the lowest dose necessary to produce a tonic-clonic seizure. While the age method tends to generalize the stimulus dose across age groups and the empirical dose titration method individualizes the dosage, both have been found to be safe and efficacious (Mankad et al. 2010). An ECT parameter that has received more recent attention is the pulse amplitude. Current ECT devices usually have the pulse amplitude automatically set at 800 or 900 mA, and many clinics rarely adjust the amplitude. Some computational and pilot evidence suggested that decreasing the pulse amplitude down to 500 mA could result in an efficacious treatment with benign cognitive adverse effects (Peterchev et al. 2015). However, the current evidence base is lacking to justify altering pulse amplitude in clinical practice.

## Efficacy

While published rates of ECT antidepressant efficacy have been found to vary with as low as 20% and as high as 80% remission rates due to variability in ECT practice and patient populations, when judiciously employed following evidenced-based practices, ECT is a highly safe and efficacious treatment (Fink 2014; Trevino et al. 2010). Indeed, among all neuropsychiatric antidepressant strategies and in cases where antidepressant treatments have been ineffective, ECT has the highest efficacy rate with concordant large remission rates. Relative to psychotherapeutic and pharmacotherapeutic strategies that can at times

take up to 8 or 12 weeks to achieve remission, ECT results in a rapid onset of action with remission on average being achieved in approximately 3–4 weeks (Spaans et al. 2015). Such rapid rate of response and remission is critical for patients, particularly when the MDD is life-threatening such as in cases of MDD with catatonia.

The antidepressant effects of ECT apply to a broad range of depressive symptoms including melancholic and atypical features, psychosis, suicidal ideation, and catatonia. Importantly, ECT is safe and efficacious for populations in which medications may prove to be harmful. For instance, ECT is useful in elderly adults with MDD as there are no medication-medication adverse interactions. Also, ECT can be useful for women with perinatal depression as research has found it to be safe for both the woman and the developing fetus.

Unfortunately, relapse after acute treatment can be high, especially in cases where there is no continuation or maintenance treatment protocol (Fink 2014; Lisanby 2007). Research continues to be ongoing to find optimal strategies to prolong remission post the acute course including continuation ECT, continuation pharmacotherapy, continuation combined ECT and pharmacotherapy, continuation cognitive behavior therapy, and continuation depressive symptom-titrated ECT.

## Efficacy in Elderly Adults

Electroconvulsive therapy is considered an important treatment in elderly patients with depression. This is the case as elderly adults frequently require treatment with a rapid onset as they may present with greater depressive symptom severity (e.g., agitation, psychosis) and higher suicide risk and potentially may respond more slowly to antidepressant medication. Research has found that elderly adults with depression show rapid response and remission with ECT. For example, a study that compared outcomes from elderly patients who participated in a randomized controlled trial (RCT) for different antidepressant medications with outcomes from another RCT conducted in patients who received different forms of ECT found that both speed of remission

(mean time to remission for ECT group 3 weeks vs. 4 weeks for medication) and remission rates (63% ECT group vs. 33% in the medication group) were superior with ECT. After adjustment for clinical and demographic differences, the ECT group was also eight times more likely to achieve remission compared to the medication group after 5 weeks of treatment (Spaans et al. 2015).

## Adverse Effects

Electroconvulsive therapy is considered a safe procedure in the elderly, although not unlike any other medical procedure, there is the potential risk for adverse effects (Table 3). These risks, however, can be minimized through careful medical work-up, optimally by a multidisciplinary team composed of different specialists (e.g., anesthesiologist, cardiologists, psychiatrist, etc.). This is particularly important for the elderly, who frequently have medical comorbidities. Of these, preexisting cardiac conditions pose the most significant risk for adverse effects, including death. During ECT, the cardiovascular system is placed under increased stress due to activation of the sympathetic autonomic system that results in tachycardia, hypertension, and increased oxygen consumption. In modern ECT practice, with

appropriate anesthetic and cardiovascular management, evidence suggests that ECT can be administered safely even in elderly adults with premonitory cardiovascular conditions when appropriate precautions are put in place. For example, a retrospective review of the medical records of 35 elderly patients with a history of heart failure and reduced ventricular heart function found that ECT was safe, with no reported adverse effects (Rivera et al. 2011). Similarly, a case report of the oldest person (100 years old) to receive ECT who had severe aortic stenosis reported no cardiac complications over an extended period of ECT treatment that spanned 5 years (O'Reardon et al. 2011).

An additional adverse effect relevant to the elderly is increased risk of falls from ECT. However, it is important to note that falls are common in psychiatric settings, particularly among patients considered the older-old and those with medical comorbidities (e.g., motor dysfunction and cognitive impairment). A retrospective analysis of records from 1834 admissions to a psychogeriatric inpatient unit identified ECT as a significant risk factor after controlling for other confounders, including age, medication use, Parkinson's disease, and dementia (de Carle et al. 2001). Falls were additionally found to be more common during the day, which was considered to be potentially associated with short-term cognitive side effects. As such, it is recommended to use select ECT parameters to minimize cognitive side effects in elderly patients, as well as implementation of other precautions, such as increased surveillance.

A less common adverse effect is dental and oral injury due to clenching of the jaw from direct stimulation of the masseter muscles. These types of adverse events are rare and typically mild. Risk is increased with dental pathology prior to treatment, which can be identified and potentially mitigated via pretreatment medical work-up.

**Electroconvulsive Therapy, Table 3** Adverse effects associated with electroconvulsive therapy<sup>a</sup>

Medical adverse effects	Neurocognitive adverse effects
Headache	Decreased processing speed
Migraine	Disorientation
Myalgia (e.g., body aches)	Executive dysfunction
	Inattention
	Memory disruption Anterograde amnesia Retrograde amnesia
	Verbal dysfluency

<sup>a</sup>Most adverse effects associated with electroconvulsive therapy (ECT) tend to be transient. The medical adverse effects tend to dissipate 24–48 h after treatment and can be managed with over-the-counter medication. The neurocognitive adverse effects tend to dissipate within 1 week after the last ECT session, though some effects have been found to persist up to 6 months

## Medical Effects

Other common medical effects associated with ECT include somatic discomfort (e.g., headache,

muscle soreness, nausea) and postictal delirium. The most common medical side effect of ECT is headache, which commonly occurs during and following postictal recovery. An audit of subjective side effects reported by 70 patients who received ECT found that 11% of patients reported experiencing a severe headache, while 44% reported a mild or moderate headache (Benbow et al. 2004). Somatic complaints, including headache, are however common in depressed patients prior to ECT, which therefore makes it difficult to determine their etiology. For example, a study conducted in elderly patients found that approximately 20% of patients reported headache prior to treatment and that this proportion showed a nonsignificant increase following ECT treatment (Brodaty et al. 2001). Headaches during ECT are typically managed through prophylaxis with analgesic medications, or treated symptomatically. Muscle soreness/pain and nausea are also common. Muscle pain due to ECT is considered to be caused by the actions of the muscle relaxant (succinylcholine) or alternatively through excessive convulsive movements during treatment. In the case of the former, this is managed with prophylaxis using analgesic medications, while the latter can be addressed through an increased dose of muscle relaxant. Nausea in contrast may occur as a side effect of general anesthesia and is typically managed with antiemetics.

Postictal delirium is also known to occur in a minority of patients and is characterized by motor agitation, disorientation, and sometimes erratic behavior. Correspondingly, it poses a risk for injury for both patient and staff. A retrospective case-controlled study of 24 patients who experienced postictal delirium and 24 controls failed to identify any relevant clinical or treatment differences between groups, including age (Devanand et al. 1989). A more recent study similarly was unable to identify any predictors, other than a potential association with seizure length (Reti et al. 2014). Thus, while older age is considered a risk factor for delirium in other settings, it remains unclear whether elderly patients are similarly at increased risk for delirium after treatment with ECT.

## Neurocognitive Effects

Cognitive side effects from ECT are frequently the most significant concern for patients and typically manifest in short-term deficits in orientation during postictal recovery immediately following ECT, memory (anterograde and retrograde), executive function, and processing speed. Elderly patients treated with ECT may have poorer baseline cognitive functioning due to age and illness, which potentially may confound the interpretation of cognitive side effects in this population (McClintock et al. 2011). In contrast to research on the cognitive side effects of ECT in relatively younger adult populations, research findings to date have been mixed in regard to the extent in which elderly patients experience cognitive side effects.

Recovery of orientation immediately following ECT, typically assessed at regular intervals during recovery, has been identified as a predictor of retrograde memory side effects from ECT (Sobin et al. 1995). Monitoring of recovery of orientation during the ECT course has therefore been recommended to assist ECT practitioners with identifying patients at increased risk for these side effects. Importantly, increased age has been associated with longer time to reorientate midway during the ECT course (Martin et al. 2015). Older age, therefore, may be a vulnerability factor for increased memory side effects with increased number of ECT treatments.

Research into other ECT-related cognitive side effects in elderly patients, however, has been mixed and shown stability, impairment, or improvement in cognitive performance on measures including tests of global cognitive functioning, memory, and executive function (Tielkes et al. 2008). For example, a recent study conducted in 62 elderly patients (aged 60–85 years) found no significant changes in performance on measures of anterograde and retrograde memory, processing speed, and executive function following ECT compared to healthy elderly controls, although the ECT patients were found to perform poorer on a test of verbal fluency at post treatment compared to controls (Dybedal et al. 2014). In contrast, another recent study in 42 patients aged 58–91 years found significant

improvements in global cognitive function and anterograde memory but no changes on measures of attention and executive function following ECT (Verwijk et al. 2014).

Potential reasons for these mixed results may include heterogeneity in ECT treatment methodologies (e.g., electrode montage, dosing method, pulse width, frequency of treatment, and choice of anesthesia), cognitive assessment methods (i.e., brief screening compared to more detailed neuropsychological assessment), and time of cognitive testing in relation to the last ECT treatment. The latter is potentially important as cognitive side effects tend to resolve within a few weeks following treatment (Semkowska et al. 2010). It is also possible that reported cognitive findings in the elderly may be unduly biased due to the study cohorts. For example, elderly cohorts tend to have relatively higher proportion of involuntary patients who may be unable to participate in cognitive testing. Moreover, research studies often exclude patients who are at greater risk for delirium (i.e., who are cognitively impaired at baseline), which in turn may underestimate overall cognitive side effects. This is potentially important, as patients with higher educational and occupational attainment (i.e., increased cognitive reserve) are less likely to show cognitive side effects following ECT (Legendre et al. 2003).

Thus, while the extent to which elderly patients experience cognitive side effects from ECT remains unclear, given the vulnerabilities in this patient population (e.g., increased prevalence of cardiac comorbidities, cognitive impairment, severe illness), it is recommended to implement careful patient monitoring of cognitive side effects during ECT treatment. Also, use of ECT treatment methods associated with lesser cognitive side effects (e.g., ultra-brief pulse width, lesser frequency treatment) should also be considered for elderly patients who at potential increased risk.

## US Food and Drug Administration Recommendations

As ECT was grandfathered in and never formally approved or cleared by the US Food and Drug

Administration (FDA), it convened an advisory panel hearing in January 2011 to discuss the reclassification of ECT. Following that advisory panel meeting, the FDA released a draft of a guidance document (Center for Devices and Radiological Health document number 1823) in December 2015 that outlined their recommendations for ECT reclassification (US Food and Drug Administration, 2015). Per the document, the FDA suggested that ECT should be reclassified into Class II for patients age 18 and older with a diagnosis of MDD or bipolar disorder. A device classified into Class II represents a *high-risk* device that requires special controls to ensure device safety and utility. While such reclassification will allow greater access to ECT for patients age 18 and older with MDD or bipolar disorder, it by default suggests that ECT will be reclassified into Class III for all patients with other diagnoses. A Class III device is considered to be of the *highest risk* and has the greatest level of regulatory control. As such, patients younger than age 18 or those with neuropsychiatric diagnoses other than MDD or bipolar disorder in whom ECT has been found to be safe and useful may find it more difficult to be prescribed ECT.

The FDA also provided other recommendations in the guidance document. Regarding the practice of ECT, the document suggested the use of brief pulse waveform, unilateral electrode configuration on the non-dominant hemisphere (e.g., right unilateral), decreased stimulus intensity particularly with bitemporal electrode configuration, and two ECT sessions or less per week. As current ECT clinical practice has no mandated clinical neuropsychological assessment, the FDA recommended that clinicians monitor cognitive function before the initiation of and during the ECT course. The clinical neuropsychological assessment should include both patient self-report and observer-report of cognitive function. As ECT has been found to produce transient adverse cognitive effects, the FDA proposed that the label for ECT devices include the following warning: “Warning: ECT device use may be associated with: disorientation, confusion, and memory problems.”

As the guidance document is in review at this time and the FDA has invited comments from the

US community, it is unclear at this time which recommendations, if any, in the guidance document will be put into clinical practice. Given the safety and utility of ECT in patient populations where other treatments are intolerable or ineffective, the restriction of its use could prove problematic for the medical and neuropsychiatric communities.

## Future Directions

Being one of the oldest, though with modern technical and practice updates, most efficacious, and relatively safe neurostimulation interventions, ECT has earned its place in the neuropsychiatric armamentarium. With the recent recommendations from the US FDA, the practice of ECT may change with new practice guidelines. Regardless of the final US FDA recommendations, future research is warranted to understand the mechanisms of action underlying the efficacy and side effects of ECT. Further, research is warranted to integrate ECT with other neuropsychiatric interventions (e.g., psychotherapy, transcranial direct current stimulation) to minimize adverse effects and maximize clinical, functional, and quality-of-life outcomes.

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## Emotional Development in Old Age

Ute Kunzmann<sup>1</sup> and Carsten Wrosch<sup>2</sup>

<sup>1</sup>Life-Span Developmental Psychology Laboratory, University of Leipzig, Leipzig, Germany

<sup>2</sup>Concordia University, Montreal, QC, Canada

### Synonyms

Emotion and emotional reactivity; Emotion regulation and emotion control; Emotional competence and emotional intelligence; Emotional understanding and cognitive-affective complexity

### Definition

Affective well-being requires the frequent experience of positive emotions and the infrequent experience of negative emotions in daily life. Emotions denote fast and short-lived reactions to events that are important to an individual's well-being; these reactions can be described on different levels (physiological, subjective-experiential, and behavioral). Emotional competence includes several distinct facets, including the ability to regulate emotions, the ability to understand and make sense of own emotions, and the ability to infer and share others' emotions.

### The Stability-Despite-Loss Paradox of Affective Well-Being

Affective well-being, the frequent experience of positive affect and the infrequent experience of negative affect in daily life, is a key aspect of individuals' general subjective well-being and prominent indicator of successful aging, increasingly thought to play a central role throughout the life span in a wide range of areas involved in human functioning (Kahneman et al. 1999). Perhaps one of the most important findings in psychological aging research has been that affective well-being remains relatively stable during most of the adult life span and early old age, although many individuals experience an increasing number of losses in cognitive, physical, and social domains. Prominent theories of emotional aging have suggested that this discrepancy results from older adults' high emotional competence, particularly the effectiveness of their emotion regulatory strategies (Scheibe and Carstensen 2010). In recent years, however, at least three qualifications to what has been called the stability-despite-loss paradox of subjective well-being have been reported. First, many aspects of subjective well-being, including affective components, become increasingly likely to decline during very old age beginning around age 80 (Baird et al. 2010; Kunzmann et al. 2000) and show normative decline several months or even years before individuals die (Gerstorf et al. 2010). Second, the

stability found in overall subjective well-being is not necessarily evident for all its dimensions (e.g., the frequency of sadness remains stable and even increases in very old age; Kunzmann et al. 2013). Third, certain subgroups of older individuals are at risk for low subjective well-being (e.g., individuals who have been burdened by losses that affect many life domains; Lucas 2007). These qualifications point to potential limits of emotion regulatory processes in old age and the need for theories of emotional aging that paint a balanced picture about older adults' strengths and vulnerabilities in maintaining long-term affective well-being. Before discussing relevant theoretical and empirical work on emotional aging, it might be useful to present definitions of the terms emotion and emotional competence.

### Defining Emotion and Emotional Competence

Emotions have been defined as fast and short-lived reactions to events that are important to our personal goals and well-being. Emotions are manifested on different levels and typically characterized by certain cognitive appraisals, specific action tendencies, patterns of physiological activity, configurations of facial expressions, and inner feelings (Levenson 2000). Many researchers have acknowledged the importance of both positive and negative emotions for optimal functioning (Levenson 2000; Wrosch and Miller 2009). Although negative emotions may be unpleasant, they signal the individual that there is something wrong and motivate cognitive and behavioral processes that help regain a balance between the person and the environment. Seen in this light, the capacity to spontaneously react to significant and negative events with the appropriate emotion (e.g., fear to threat, anger to injustice) is an important contributor to longer-term emotional well-being. However, negative emotions may also be signs of or contributors to low affective well-being if they become chronic and decoupled from concrete and immediate causes.

Although emotions are often our best allies, helping us to respond effectively to the opportunities and difficulties we encounter, occasionally, it is necessary to regulate our spontaneous impulses and reactions. The ability to regulate

positive and negative emotions has been thought to be one central aspect of emotional competence (e.g., Scheibe and Carstensen 2010). In the broadest sense, emotional competence can be understood as "work" with emotions in ways that help us to keep on track and make progress with our immediate and longer-term goals. Moreover, three different dimensions of emotional competence can be differentiated: (a) regulating emotions so that they fit situational affordances and facilitate our goals; (b) understanding and sense making of emotions, including their causes, temporal dynamics, and consequences; and (c) responding empathically to fellow humans (i.e., being able to accurately infer others' emotions, share their feelings, and experience sympathy with them). These three dimensions of emotional competence have been thought to facilitate long-term affective subjective well-being, particularly in old and very old age (Kunzmann and von Salisch 2009).

### Theories of Emotional Aging

**Socioemotional selectivity theory.** Socioemotional selectivity theory (SST; Scheibe and Carstensen 2010; Carstensen et al. 1999) is a motivational theory of social and emotional aging that has portrayed old age as a period during which individuals are particularly motivated to shape their lives so as to maximize the occurrence of emotionally satisfying moments. More specifically, according to SST, advancing age is naturally associated with endings and a limited lifetime. As a consequence, older adults have a strong present orientation involving goals related to current feeling states, emotional meaningfulness, and satisfaction. By contrast, younger adults, who typically have an extended future time perspective, prioritize longer-term goals aimed at expanding breadth of knowledge and optimizing future resources. Thus, SST predicts that people of different ages prioritize different types of goals. As people age and increasingly perceive time as finite, they attach less importance to goals that expand their horizons and greater importance to goals from which they derive immediate emotional meaning. Obviously, younger people also sometimes pursue goals related to

meaning, just as older people pursue goals related to knowledge acquisition. However, the relative importance placed on these two types of goals is thought to change with increasing age.

In support of SST's main predictions, a large body of evidence suggests that, in comparison with their younger counterparts, older adults are more selective in their choice of social partners and prioritize familiar and close social partners over unfamiliar and emotionally less important persons (Carstensen et al. 1999). In addition, older adults report greater satisfaction and more positive experiences with members of their social networks than do younger adults. When conflicts occur, older adults typically respond with fewer negative emotions than young adults (Luong et al. 2011). Such age-related decreases in negative feelings and facial expressions during unpleasant social interactions concern particularly relationship-damaging emotions such as anger, aggression, or disgust, but not necessarily sadness (Blanchard-Fields and Coats 2008; Charles and Carstensen 2008). Also consistent with SST, in comparison to young adults, older adults seem to be more likely to appraise their partner positively during a conflict and to engage in deescalating conflict management strategies (Luong et al. 2011).

There is also substantial evidence for systematic age differences in basic affective information processing. Older adults appear to be generally more sensitive to positive information and less sensitive to negative information than young adults, a phenomenon termed the "positivity effect" (Reed and Carstensen 2012). SST states that this positivity effect results from an age-related shift in motivational states (i.e., a shift from goals related to knowledge acquisition to goals related to emotional meaning) that causes an age-related increase in the allocation of cognitive resources toward emotion regulation (Mather 2012). Given that the majority of studies interested in affective information processing have not elicited emotions or systematically manipulated emotion regulation strategies, however, the idea that "positivity effects" serve emotion regulation goals and lead to better emotional outcomes

is still in need of further investigation (Isaacowitz and Blanchard-Fields 2012).

**Dynamic integration theory.** According to dynamic integration theory (DIT; Labouvie-Vief 2003), high longer-term subjective well-being encompasses processes of affect optimization but also processes of affect differentiation. Affect differentiation involves tolerance for and sense making of negative and ambivalent experiences and, thus, ideally results in a deeper and more complex understanding of the self, others, and situations. DIT poses that diminishing cognitive resources, particularly those referring to basic information processing functions (e.g., logical reasoning, processing speed, or inhibition), will cause a decline in cognitive-affective complexity with age. As a consequence of their increasing difficulty to make sense of negative feelings, older adults are thought to increasingly favor affect optimization over affect complexity. Indeed, cognitive-affective complexity and affect optimization may mutually inhibit one another. On the one hand, in circumstances that involve reduced cognitive resources and, thus, cognitive-affective complexity, relatively effortless processes of affect optimization may prevail. On the other hand, the more individuals "use" affect optimization and, thus, avoid or quickly downregulate negative experiences, the less likely will they be able to acquire and maintain a complex and differentiated understanding of emotionally significant phenomena that inherently encompass both positive and negative aspects. Consistent with this idea is evidence from an age-comparative study that simultaneously assessed how individuals typically deal with marital conflict and what they know about marital conflict. In comparison with their younger counterparts, older adults were more likely to avoid conflicts with their partner and, at the same time, possessed less complex and elaborated knowledge about marital conflict; age differences in conflict avoidance were negatively associated with age differences in the complexity of knowledge about marital conflict (Thomas and Kunzmann 2013). The age-related diminution in the complexity of knowledge about marital conflict is further consistent with a large number of

studies interested in cognitive-affective complexity more generally (Labouvie-Vief 2003).

According to DIT, optimal functioning involves an integration and flexible coordination of affect optimization and affect complexity (Labouvie-Vief and Medler 2002). Seen in this light, the age-related increase in affect optimization, as, for example, manifested in older adults' positivity effects or avoidance of social conflicts, is a double-edged sword: it promotes a positive affect balance in the moment, but this effect is caused by age-related decline in basic cognitive functions and, ultimately, comes at the cost of an increasingly less differentiated understanding of emotionally significant phenomena. In the long run, a one-sided strategy to optimize affect may result in lower rather than higher levels of affective well-being.

**The strength and vulnerability integration model.** The strength and vulnerability integration model (SAVI; Charles and Luong 2013) states that understanding age-related stability and change in affective well-being requires considering interactions between older adults' improved emotional competence on the one hand and their decreased physical reserves on the other hand. Consistent with SST, the model poses that older adults' strengths lie in their high motivation and expertise to engage in effective emotion regulation. As an extension of SST, SAVI draws attention to older adults' physiological vulnerabilities and states that these vulnerabilities may render regulating distress and other negative emotions difficult and costly. For example, age-related changes in cardiovascular and neuroendocrine systems can lead to greater blood pressure and cortisol reactions to stressors among older adults relative to younger adults. Heightened and prolonged physiological reactivity most likely impairs older adults' ability to use those emotion regulation strategies that typically would help them lower distress and regain their typical level of affective well-being. Put differently, according to SAVI, because of their physiological vulnerabilities, some older adults may not be able to successfully use their motivation- and experience-based strengths. Particularly if exposed to chronic and complex

stressors with implications for multiple life domains, older adults may be at a greater risk for dysregulation and, thus, lower subjective well-being than young adults. Findings from Wrzus and colleagues (2013) are consistent with this idea. The authors found that older adults reacted with greater unpleasantness to complex and demanding stressors than their younger counterparts, but this age difference was not evident when the stressors were more circumscribed. In addition, in comparison with their younger counterparts, older adults showed reduced heart rate variability, a sign of poor physiological regulation, when they encountered complex stressors, but there were no age differences in heart rate variability when stressors were circumscribed. According to SAVI, in complex and taxing situations, age-related biological vulnerabilities come to the foreground and make it difficult for older adults to mitigate negative reactivity. Also consistent with this idea is work suggesting that older adults react to highly arousing negative stimuli with greater unpleasantness than their younger counterparts, whereas this age difference is reversed or nonsignificant if the stimuli are not particularly arousing (Streubel and Kunzmann 2011). Finally, recent research demonstrated that older adults who exhibited high levels of chronic illness were at a greater risk of experiencing sharp increases in feeling of loneliness over 8 years of study, particularly if they were unable to cope effectively with their health problems (Barlow et al. 2015). Together, the ideas put forward in the SAVI model could imply that older adults have the least benefit from their strengths when they need them most, namely, when age-related stressors and critical life events are serious and long lasting rather than mild and circumscribed.

**The discrete emotion approach to affective aging.** The discrete emotion approach to affective aging (DEA; Kunzmann et al. 2014) is based on a program of research conducted over the past decade (Kunzmann et al. 2013; Kunzmann and Grünh 2005; Kunzmann and Richter 2009; Kunzmann and Thomas 2014). DEA builds on the assumption that each stage in the life cycle (e.g., young adulthood, midlife, or old age) is

characterized by a specific configuration of constraints and opportunities, each residing in the environment, the person, or both (Baltes 1987; Freund 2007; Heckhausen and Schulz 1995). DEA states that these age-specific configurations can change the salience and adaptive value of particular positive and negative emotions. So far, DEA has focused on two stages in the adult life span, that is, young adulthood and old age, and posed that these two life stages are differentially associated with the salience and adaptive value of anger and sadness.

Young adulthood has been described as a phase of growth during which individuals have great opportunities to develop their potentials. Thus, processes of optimization rather than maintenance or compensation have priority in this life phase (Baltes and Baltes 1990). Young adults typically pursue many long-term goals focused on acquiring new resources, such as knowledge, information, or competencies (Carstensen et al. 1999). In young adulthood, individuals have a strong need to accomplish their goals, and perceptions of high personal control as well as a tenacious pursuit of goals are highly prevalent and closely tied to well-being (Wrosch and Heckhausen 1999). As compared to older adults, young adults also tend to be more assertive and willing to engage in social conflicts to accomplish their social goals (Luong et al. 2011).

In marked contrast, old age has been characterized as a phase during which social, cognitive, and physical resources become increasingly limited and processes of maintenance and compensation gain importance (Heckhausen and Schulz 1995; Baltes and Baltes 1990). Given the limited resources in old age, perceptions of low personal control and goal adjustment processes become increasingly frequent and adaptive in this phase of life (Wrosch and Heckhausen 1999). In addition, the awareness of a limited lifetime and the fragility of life seem to promote a tendency among older adults to relate to others in intimate and caring ways (Luong et al. 2011).

According to DEA, discrete emotions that indicate and promote individuals' progress in dealing with age-typical challenges are particularly salient, that is, easily elicited and frequently

experienced. Thus, discrete emotions that indicate young individuals' progress in developing their potential and that promote tenacious and assertive behaviors in the face of obstacles should be particularly salient. Anger serves as a prototypical example: it is elicited by the appraisal that one's goals are blocked by others, triggers a reactant "moving against" state of action readiness, promotes goal persistence, and facilitates assertive behaviors (Kunzmann et al. 2014).

In old age, by contrast, discrete emotions that indicate the individual's progress in dealing with losses (including the awareness of life's finitude) and that promote disengagement from unattainable goals in socially responsible ways should be particularly salient. Sadness is a prototypical example: it is elicited by the appraisal of a situation as an irreversible loss, triggers processes of adaptive goal disengagement, and is compatible with social closeness (Kunzmann et al. 2014).

Corroborating evidence for DEA's assumptions stems from a growing body of research on multidirectional age differences in sadness and anger reactivity. Research has documented that older adults tend to react with less anger-related emotions to social conflicts than their younger counterparts (Blanchard-Fields and Coats 2008; Charles and Carstensen 2008). Age differences in sadness reactions to social conflicts, by contrast, have been shown to be reversed (i.e., higher among older adults) or nonsignificant (Blanchard-Fields and Coats 2008; Charles and Carstensen 2008). Other studies have investigated age differences in emotional reactions to nonsocial stimuli. In this line of work, older, as compared with younger, adults reported less anger in response to anger-eliciting stimuli, but equal or higher sadness in response to sadness-eliciting stimuli (Kunzmann and Grünh 2005; Kunzmann and Richter 2009; Labouvie-Vief et al. 2003; Seider et al. 2011; Haase et al. 2012). Although most of the evidence refers to age differences in subjective reactivity, at least two studies, using sad films as stimuli, reported that the often observed age-related diminution in physiological activity (Levenson 2000) was not evident in their research; that is, older adults showed similar (Kunzmann and Grünh 2005) or greater

physiological reactivity (Seider et al. 2011) than young adults. It also deserves to note that similar age differences in the experience of anger and sadness were reported in two studies measuring the frequency of emotions during the past month (Kunzmann et al. 2013) and on a typical day using the day reconstruction method (Kunzmann and Thomas 2014). Finally, there is preliminary support for possible adaptive consequences of an age-related experience of anger and sadness. A laboratory study assessing affective responses to neutral films showed that anger predicted higher long-term subjective well-being in young adulthood, but not in old age. Conversely, sadness was related to high subjective well-being in old age, but not in young adulthood (Haase et al. 2012).

Taken together, DEA addresses the role of discrete emotions in young adulthood and old age, which are two stages in the life cycle that differ markedly in terms of their profiles on at least two psychologically influential dimensions: power control (high in young adulthood and low on old age) and affiliation communion (high in old age and low in young adulthood). To the extent that discrete emotions are differentially compatible with these age-typical profiles and promote adaptive ways in dealing with the challenges and opportunities that emerge, they should also differ in their age-related salience and potential adaptive value. Anger and sadness appear to be two negative emotions that clearly differ in both power control and affiliation communion; additional discrete negative and positive emotions that could serve age-related functions most likely include fear, disgust, pride, regret, and compassion.

### Age Differences in Three Facets of Emotional Competence

The remaining part of this review will focus on studies that have assessed emotional competence in vivo by using performance-based tasks. Much of what is known about age and emotional competence has been based on self-report measures. Although these measures have their strengths (e.g., they reveal people's beliefs and judgments about how they deal with emotions), they are likely influenced by impression management

strategies (people may be hesitant to describe themselves as emotionally incompetent), introspective limits (do we know how emotionally competent we are?), and implicit aging theories (if older people believe that individuals should become better at regulating their emotions as they age, they are likely to say that they do so). This is why we consider approaches that study emotional competence under standardized conditions and use performance-based tasks.

**Emotion regulation.** Relatively few laboratory studies have investigated age differences in emotion regulation in vivo. In these studies, younger and older adults have been instructed to regulate their emotional reactions (e.g., subjective feelings or facial expressions) before or while they were presented with emotion-evoking stimuli. The effectiveness of emotion regulatory attempts was operationalized as the difference in emotion reactivity during no-regulation versus regulation conditions. The theoretical framework for most of these studies has been provided by Gross and colleagues' process model of emotion regulation (Gross 1998). This model describes how different types of strategies aimed at regulating one's emotions are used before, during, and after exposure to a negative event. Anticipatory strategies such as attentional deployment or cognitive reappraisal have been shown to be more effective than response-focused strategies (e.g., behavioral suppression). In fact, the latter strategies have more circumscribed effects and may even be associated with physiological costs.

With respect to age differences in emotion regulation, several studies have shown that older and younger adults are similarly successful at reducing outward expressions of emotion (Kunzmann et al. 2005; Phillips et al. 2008). As to cognitive forms of emotion regulation, a growing number of studies indicate that older adults' regulatory strengths are associated with their use of strategies that are relatively effortless. For example, older adults are more successful at using positive reappraisal compared to younger adults, but are less successful at using detached reappraisal (Shiota and Levenson 2009). In positive reappraisal the individual attends to the emotional aspects of a situation and attaches a positive

meaning to these aspects; in detached reappraisal the individual thinks of the situation in a neutral or rational manner. Given that positive reappraisals keep one's focus on the emotional aspects of the situation, it arguably is less cognitively demanding than detached reappraisal that requires a person to ignore all emotional aspects. Consistent with this assumption, research has demonstrated that detached reappraisals have higher cognitive costs than other major emotion regulation strategies, such as distraction (diverting attention from an emotional situation; Sheppes and Meiran 2008). Corroborating the idea of age-related gains in cognitively undemanding emotion regulation strategies, older adults were better at using distraction (think about a positive memory) while watching negative film clips than young adults (Phillips et al. 2008). Studies interested in age-related positivity effects in attention to positive and negative stimuli also deserve note. Evidence from these studies suggests that temporarily decreasing cognitive resources through dual-task paradigms eliminates older adults' tendency to focus on positive stimuli and/or avoid negative stimuli. Although these studies have not elicited emotional reactions or instructed certain emotion regulation strategies, they provide evidence for the idea that even age-related gains in arguably less effortful processes of emotion regulation require a certain amount of cognitive resources (Mather 2012).

In sum, the reviewed evidence suggests multidirectional age differences in emotion regulation. While the effectiveness of some strategies may increase with age (positive reappraisal, attentional deployment), the effectiveness of other strategies remains stable (behavioral suppression) or declines (detached reappraisal). At first sight, this performance-based evidence is at odds with results from self-report studies, indicating that older adults believe that they are generally more effective in regulating their emotions than younger adults (Kunzmann et al. 2005). However, to the extent that older adults use strategies that work for them and avoid strategies that are more effective for young adults, overall gains in emotion regulation competence could be observed among older adults. Future research is needed to

investigate the idea that age is associated with an increasingly selective choice of those emotion regulation strategies that rely on intact resources (Urry and Gross 2010).

**Empathy.** Empathy is fundamental to building and maintaining satisfying social relationships and an important source of prosocial behavior (Davis 1994). Given the importance of social and emotional goals among older adults (Carstensen et al. 1999), empathy may also be among the most influential predictors of successful aging and particularly affective well-being.

There is broad agreement that empathy is a multidimensional concept that involves both cognitive (e.g., the ability to accurately infer another's emotions) and affective (e.g., the ability share another's feeling and to feel sympathy for him or her) dimensions (Davis 1994). Age-comparative work on empathy underscores the usefulness of this distinction, by showing that cognitive and affective facets of empathy exert multidirectional age differences: while the ability to accurately infer others' emotions seem to decline with age (Ruffman et al. 2008), affective facets have been shown to remain stable or to increase with age (Richter and Kunzmann 2011; Sze et al. 2012b). Although the underlying mechanisms for these multidirectional age differences have to be further investigated, it is likely that the age-related decline in empathic accuracy is due to parallel age-related declines in basic cognitive resources, such as logical reasoning, processing speed, or inhibition (e.g., Richter et al. 2010; Wieck and Kunzmann 2015). Emotional congruence and sympathy arguably rely less on such cognitive resources and are more dependent on age-friendly automatic and effortless processes related to certain forms of emotion regulation.

Much of the work interested in age differences in the cognitive facets of empathy relied on tasks that require individuals to recognize emotions depicted in decontextualized facial, vocal, or written material. Isaacowitz and Stanley (2011) considered it possible that such tasks systematically underestimate older adults' empathic accuracy, which may be particularly dependent on the contextual richness of a task. For example, Sze and colleagues (2012a) reported that age-related

decline in emotion recognition was less visible if the tasks were based on dynamic, genuine, and contextualized stimuli. A problem with this interpretation is, however, that the authors' contextualized tasks required participants to make overall judgments of valence rather than specific judgments pertaining to the intensity of discrete emotions. Thus, the absence of age deficits may be due to the lower difficulty level rather than the contextual richness and ecological validity of the task. In fact, an earlier study, manipulating contextual richness and keeping the rating part of the task constant across conditions, suggested that contextual richness does not moderate age differences in empathic accuracy (Richter et al. 2010). In addition, there is evidence suggesting that the negative effect of emotionally incongruent contextual information on empathic accuracy becomes greater with age (Noh and Isaacowitz 2013). Thus, the current evidence speaks against the idea that age deficits in empathic accuracy vanish in ecologically valid tasks. In order to demonstrate what older adults can do under ideal conditions, additional factors need to be taken into consideration. Recent work suggests that task motivation is a promising candidate. With the presence of a strong task motivation, older adults have been shown to perform equally well in empathic accuracy tasks as young adults (Richter et al. 2010; Wieck and Kunzmann 2015). This evidence is consistent with the selective cognitive engagement model, stating that older adults become increasingly selective as their cognitive resources decline and that selective resource allocation is a key to maintaining performance in situations that are particularly meaningful and relevant (Hess 2014).

In sum, the current evidence for age and empathy suggests multidirectional age differences. Overall, older adults appear to have greater difficulty in inferring other people's emotions, but emotional congruence and sympathy remain stable or even increase. Several researchers have discussed the question of whether older adults' deficits in empathic accuracy have implications for the quality of their social relationships and ultimately their long-term affective well-being

(Isaacowitz and Stanley 2011). Although this may be the case, two findings may contradict this possibility and deserve note: (a) age deficits in empathic accuracy seem to not occur in contexts that are personally relevant to older adults and (b) relatively stable and high levels of emotional congruence and sympathy may compensate for potential weaknesses in empathic accuracy.

**Emotional understanding.** Evidence for age differences in emotional understanding primarily stems from research by Labouvie-Vief and her colleagues. More specifically, the authors repeatedly investigated cognitive-affective complexity in several studies with individuals aged 10–80 (and older) using cross-sectional and longitudinal designs (Labouvie-Vief 2003). In some of these studies, the authors asked their participants to think aloud about situations in which they felt particular emotions (e.g., anger, fear, happiness) or about their self and relations to significant others. The answers were transcribed and later evaluated by independent raters with a coding scheme based on four levels of cognitive-affective complexity (Labouvie-Vief et al. 1989). In this scheme, a high level of cognitive-affective complexity is represented by a tolerance for negative and conflicting feelings, a clear differentiation between own and others' feelings, a deep understanding of the dynamics and causes of emotions, and an appreciation of the uniqueness of individual experiences. Findings consistently suggest that cognitive-affective complexity increases during adolescence and young adulthood, peaks in early midlife, and begins to decline during late middle adulthood (Labouvie-Vief 2003; Labouvie-Vief and Medler 2002; Labouvie-Vief et al. 1989). To the extent that cognitive-affective complexity contributes to individuals' optimal functioning, its age-related decline needs to be considered a risk factor for low long-term affective well-being.

## Conclusions

Empirical and theoretical work interested in emotional aging documents a complex picture of the

nature of emotion in old age. Older adults' strengths seem to lie in their ability to proactively shape their lives so as to avoid a great number of stressors and negative events. If such events cannot be avoided, older adults appear to be particularly motivated to downregulate the negative implications of problematic circumstances. As long as these events are relatively circumscribed and mild, older adults can take full advantage of their motivation and expertise-based strengths. However, regulatory problems may occur if the stakes are high or when older adults experience the onset of severe age-associated cognitive and physiological vulnerabilities. It is also evident that age differences in emotional reactivity are multidirectional – even if older adults typically experience a variety of negative emotion less often and with less intensity, certain negative emotions, such as sadness, directly relate to the age-relevant theme of loss and increase with age in salience. The functional implications of this enhanced emotional reactivity in particularly taxing and/or loss-related situations are largely unknown and need further investigation.

Across three domains of emotional competence, it became evident that those abilities that require cognitive resources (certain strategies of cognitive emotion regulation, empathic accuracy, or cognitive-affective complexity) cannot be considered a particular strength among older adults. By contrast, age-related gains have been documented in emotional competencies that rely on relatively effortless and automatic processes, such as positivity effects in attention and memory, the sharing of others' feelings, positive reappraisals of stressful events, or behavioral strategies to avoid certain negative experiences preemptively. To the extent that older adults can selectively optimize those competencies that rely on available and relatively intact resources, we can expect to observe age-related gains in emotional competence and ultimately long-term affective well-being. However, as of yet, whether the predominant theme of emotional aging is one of gain or loss cannot easily be determined, and multi-sided views of emotional aging are needed as they are most useful in reaching an accurate and comprehensive answer.

## Cross-References

- ▶ [Emotion–Cognition Interactions](#)
- ▶ [Life Span Developmental Psychology](#)
- ▶ [Motivational Theory of Lifespan Development](#)
- ▶ [Positive Emotion Processing, Theoretical Perspectives](#)
- ▶ [Selection, Optimization, and Compensation at Work in Relation to Age](#)
- ▶ [Social Cognition and Aging](#)
- ▶ [Socioemotional Selectivity Theory](#)
- ▶ [Strength and Vulnerability Integration](#)

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## Emotion–Cognition Interactions

Katharina M. Schnitzspahn<sup>1</sup> and  
Louise H. Phillips<sup>2</sup>

<sup>1</sup>School of Psychology, University of Aberdeen,  
Aberdeen, UK

<sup>2</sup>University of Aberdeen, Aberdeen, UK

### Synonyms

Cognition = thinking, reasoning, memory; Emotion = affect, mood, feelings; Emotion–cognition interplays; Emotion–cognition links

### Definition

Emotions influence cognitive processes such as memory and reasoning, but also cognitive appraisals and control processes are important in our experience of emotions. Emotion–cognition interactions are the interface between these different aspects of mental experience.

While cognitive and affective psychology have long been considered as two relatively independent subareas in aging research, there has been a recent surge of interest in investigating the interaction between cognition and emotion. While many cognitive functions decline with age, emotional abilities remain intact and may even improve across adulthood. These different developmental trajectories raise a number of important questions. Does intact emotional processing enhance aspects of cognitive processing in older adults? Is age a potential moderator of cognition–emotion interactions? Do emotional processes place different loads on cognitive function in younger and older adults? The present essay will present research on emotion–cognition interactions in aging from different perspectives. First, the socioemotional selectivity theory (Carstensen 2006) will be introduced, and it will be described how valenced task material and current mood states influence cognitive performance in younger and older adults. Second, age differences in the involvement of cognitive control in dealing with emotional challenges are discussed. Finally, age differences in specific functions combining cognitive and affective processes will be considered. The essay ends with a conclusion and brief outlook.

### Socioemotional Selectivity Theory and Effects of Emotional Task Material on Cognition in Younger and Older Adults

The idea that cognition–emotion interactions may be influenced by adult aging has been suggested by theories from lifespan developmental psychologists, providing the conceptual framework for the majority of empirical work. The most

prominent framework is the *socioemotional selectivity theory*, a lifespan theory of motivation, which assumes that the subjective sense of remaining time has profound effects on basic human processes, including cognition and emotion (Carstensen 2006). More precisely, when time is perceived as open ended as in youth, gathering information, experiencing novelty, and expanding breadth of knowledge are prioritized goals. When time is perceived as constrained, as in old age, goals tend to emphasize current feelings and emotion states, particularly regulating emotional states to optimize psychological well-being in the moment. As people age and increasingly perceive time as finite, the theory predicts that they ascribe greater importance to goals from which they derive emotional meaning. The age-related shift in goal priorities should effect cognitive functioning, as it changes the focus of attention and memory.

Socioemotional selectivity theory predicts that older adults should favor processing of information likely to maintain or enhance well-being, which will often mean a bias toward positive information. This hypothesis motivated many studies manipulating the emotional valence of cognitive task material. Results often showed an age-related increase in the preference for positive over negative information in attention and memory, the so-called positivity effect. A clear age-related shift in emotion–cognition interactions was confirmed by a recent meta-analysis (Reed et al. 2014), which showed that younger adults tend to show a negativity bias: that is preferential processing of negative over positive material, while older adults show instead a positivity bias. The majority of the studies reported look at age differences in memory for positive and negative information, finding that older adults remembered more positive information than negative, while younger adults showed the opposite pattern of bias. However, this review combined studies which varied substantially in the tasks used to look at emotional biases, and the authors point out the importance of testing for possible moderators. They found that age-related positivity biases are strongest when the memory task does not impose specific instructions on encoding, for

example, in incidental learning tasks where participants do not know that their memory will subsequently be tested.

Another moderator of age changes in emotional biases suggested by a second meta-analysis (Murphy and Isaacowitz 2008) is type of cognitive task assessed. Specifically, memory paradigms yielded overall stronger effects than attention paradigms, and within memory measurements, emotional effects in older adults were stronger in recall paradigms compared to recognition paradigms. While most studies examined emotion effects on retrospective memory for past events, some recent studies have looked at whether emotion influences age-related differences in prospective memory, which is the creation and enactment of an intention, such as remembering to attend an appointment at a specific time. For example, age differences in the influence of positive and negative compared to neutral target cues indicating the right moment to initiate an intended action on its correct fulfillment have been examined (Schnitzspahn et al. 2012). Results did not support a specific positivity bias in old age but instead indicated an age-related emotional salience effect: older adults were better at carrying out the intention in response to both negative and positive words compared to neutral. Similar findings from other studies of age–emotion interactions in prospective memory, using different tasks and materials, support the idea of enhanced emotional salience for both positive and negative material in remembering intentions in old age.

These findings underline the importance of examining valence effects across different cognitive abilities to test the generalizability of the positivity effect. Information processing and encoding may be influenced differently by emotion valence depending on the specific requirements of the examined cognitive function. Besides task type, general cognitive resources seem to play a critical role in the positivity effect (Reed and Carstensen 2012). The positivity effect emerges when resources are relatively available and undivided but is absent when resources are rather poor or divided. Further, positivity emerges during controlled stages of information

processing, but not for relatively automatic processing. These findings led to the conclusion that positivity reflects top-down motivational controlled cognition in older adults that can be influenced by situational and contextual factors (Reed and Carstensen 2012).

### **The Influence of Mood States on Cognition in Younger and Older Adults**

Research motivated by the socioemotional selectivity theory examined emotion–cognition interactions by experimentally manipulating the valence of the task material and its influence on cognitive performance in the respective task, while the participants' mood is assumed to be neutral. A second line of research addresses emotion–cognition links by using neutral cognitive task material after inducing a positive or negative mood and compares subsequent performance to a neutral mood condition. Thus, the emotional state of the participant instead of the valence of the task material is varied. These manipulations are of interest because it is known that mood states can influence cognitive performance in younger adults: for example, being induced into a positive or negative mood may cause more heuristic processing, which can improve performance on some creative tasks but impair performance on constrained tasks which demand concentration and detailed processing. Only very few studies examined age-by-mood interactions in influencing cognitive performance. In general, two possible but contradictory outcomes can be predicted. On the one hand, age effects in cognition may be exacerbated when participants have to deal with a cognitive task and an acute mood state in parallel. As suggested by the socioemotional selectivity theory, older adults are assumed to focus on the regulation of their emotional state which may compete with the ongoing cognitive activity and requires processing resources which are already limited in older adults. On the other hand, dealing with emotions may be a better practiced, more streamlined process in old age. Accordingly, older adults

may automatically and more effectively regulate their emotions during mood induction than the young, resulting in less impairment in a cognitive task following a mood induction. This could lead to reduced age effects in positive/negative mood conditions compared to neutral ones. Also, in line with widely reported positivity biases, there might be different effects of positive and negative mood states in old age.

Results to date have been mixed and indicate that age differences in the effect of mood on cognition may be influenced by task demands. It has been found that negative mood disrupts older, but not younger, adults' planning performance (Phillips et al. 2002) but fails to influence either age groups recall memory performance (Emery et al. 2012) or working memory (Scheibe and Blanchard-Fields 2009). In contrast, negative mood impaired the performance of delayed intentions in younger but not older adults (Schnitzspahn et al. 2014). Concerning positive mood, an impairing effect on planning in younger adults was found (Phillips et al. 2002), which was even more pronounced in older adults. Furthermore, positive mood exacerbated false memories in older but not younger adults, whereas correct recall was not influenced (Emery et al. 2012). In contrast, the performance of delayed intentions was impaired under positive compared to neutral mood in younger but not older adults (Schnitzspahn et al. 2014). Thus, results range from reduced age effects of mood state on cognition to no age differences in mood–cognition interactions and to exacerbated age-related mood effects on cognitive performance.

The studies outlined above differed in the nature of mood manipulations used and cognitive tasks investigated. Clearly the understanding of how mood and cognitive functioning interact in aging is still in its infancy, and more research is needed to better understand age differences in mood effects on cognitive performance. More information is needed, through specific task manipulations on the pattern of age differences in mood–cognition interactions. It is possible that the interaction is similarly moderated by measurement type and cognitive resources as the positivity effect. Depending on the brain areas

associated with different cognitive functions and their overlap with the brain regions required during emotion regulation, cognitive performance in tasks measuring the respective functions may be more or less influenced. Besides qualitative differences between cognitive tasks, quantitative differences in their difficulty and hence requirement of cognitive resources may also influence mood effects. Relatively easy cognitive tasks may still be performed well under certain mood states, while performance in difficult tasks should be disturbed. However, task type and difficulty cannot explain the differential age effects observed in some of the studies described above. The most promising candidate here may be age benefits in emotion regulation processes which will be presented in more detail in the following section.

### **Aging, Cognition, and Emotional Skills**

The first part of this review focused on the influence of emotional factors (i.e., valence of the task material and mood) on cognitive performance and thus considered emotions as one possible factor influencing cognition in general and age differences in cognitive performance in particular. However, emotion–cognition interactions have also been examined in the field of emotional aging. The main research questions in this area are the lifespan development of emotional skills and the involvement or necessity of cognitive resources. The following paragraphs will focus on emotion regulation and emotion recognition, their development in aging, and the role of cognition.

Emotion regulation skills are involved in monitoring and controlling our inner experience of emotional states. There is substantial evidence of age-related improvements in emotion regulation skills to downregulate negative affect and promote positive affect (Kryla-Lighthall and Mather 2009). As already briefly mentioned above, successful emotion regulation requires active use of cognitive control strategies or executive functioning and leads to an attentional shift toward one's emotional state and away from other ongoing activities. Given reported age benefits in emotion

control, it has been suggested that emotion regulation could be less costly in a cognitive sense in older adults compared to younger ones as they have more experience, and therefore emotion regulation may become more effectively and automatized. This prediction was tested (Scheibe and Blanchard-Fields 2009) by asking younger and older adults to perform a working memory task after a neutral or a negative mood induction. Importantly, instructions were varied between participants in the negative mood group. Some participants were asked to try to maintain the intensity of their negative feelings, while others were asked to change the negative feelings as fast as possible into positive ones. While the instruction to regulate the negative mood after its induction did not affect older adults' performance in the subsequent working memory task, it impaired the performance among the young. This occurred despite evidence of a strong mood induction in both age groups and successful ability to follow emotion regulation instructions in both groups. This finding indicates that intentional downregulation of negative emotions may be less costly in older age. Indeed, the allocation of cognitive resources needed to effectively regulate emotions seems to vary by age.

Another research question that has attracted attention concerns cognitive mechanisms underlying differences between younger and older adults' emotion regulation and their predictive value for mood outcomes. Specifically, it has been suggested that age-related positivity effects in attention and memory that has been described above actually reflect motivated cognition operating in the service of emotion regulation (Isaacowitz 2012). Focusing on positive information while paying less attention to or remembering fewer negative aspects of stimuli could plausibly help to achieve or maintain well-being. This hypothesis has been addressed in several studies using eye tracking in order to examine differences between younger and older adults in visual attention to emotional material. Their findings show a greater preference for “positive looking” in older adults, resulting in a viewing behavior toward positive and away from negative material (Isaacowitz 2012). These age differences in

preferences have been replicated using different materials and seem strongest when participants are in negative mood state or are explicitly instructed to regulate their emotions. Positive looking has been found to help some older adults regulate their mood, but these effects were moderated by individual differences in attentional abilities. Thus, older adults with good attentional abilities were able to use attentional deployment in the form of positive looking to successfully regulate their mood. These findings confirm that positivity effects reflect top-down processes requiring cognitive resources when used to regulate their emotions by older adults.

Another important emotional skill is the ability to recognize the emotions of others. We use non-verbal cues from facial expressions, vocal tone, and body posture to decide whether other people are angry, sad, or happy. Meta-analyses on age effects in emotion recognition suggest an overall age-related decline (Ruffman et al. 2008). This finding is true across modalities (faces, voices, bodies/contexts, matching of faces to voices) and different basic emotions (anger, sadness, fear, surprise, happiness). Some emotions (anger and sadness) and some modalities (face–voice matching) create particular difficulties, while a trend for older adults to be better than younger adults at recognizing disgusted facial expressions was reported. It has been suggested that general cognitive decline might account for the age-related changes in emotion recognition. However, this seems unlikely because the pattern of age effects did not match the difficulty levels of the emotions, as younger and older adults showed difficulties in different emotions.

Reviewing the literature, the authors (Ruffman et al. 2008) conclude that there is no consistent evidence that general cognitive decline accounts for older adults' pattern of emotion recognition difficulties. Instead, it is suggested that specific neuropsychological changes in frontal and temporal volume and neurotransmitters may cause the observed age-related impairments (Ruffman et al. 2008). Interestingly, a positivity effect in terms of absent or reduced age effects in labeling positive emotions and clear age impairments when recognizing negative emotions could not

be confirmed in emotion recognition. It seems that older adults do not profit from their benefits in emotion control and their strong motivational focus on emotions and well-being in this specific domain. Recent studies indicate that older adults' poorer performance in recognizing emotions may be ameliorated by manipulations which improve the ecological validity, personal relevance, or motivational context of emotion recognition tasks. For example, it has been reported (Sze et al. 2012) that age-related declines in recognizing emotions from traditional stimuli such as photographs of facial expressions are reversed to result in age-related improvements when rating emotions online using more naturalistic stimuli, in this case videos of dyadic interactions which included contextual information.

### **Functions Combining Cognitive and Emotional Aspects and Their Development in Aging**

After considering the influence of emotional factors on cognition and the involvement of cognitive factors in emotional abilities, the final section will present the development of empathy and wisdom in aging. Both constructs involve cognitive and affective processes and thereby allow the study of emotion–cognition interactions and possible age differences within the same ability.

Empathy requires the cognitive understanding of another person's feelings as well as an appropriate affective response. The latter concerns the affective facet of empathy that comprises the degree to which one shares the feelings of another person and the capacity to experience and express sympathy or emotional concern. Results concerning age differences in empathy are mixed but suggest differential age effects for the different components. As reviewed above, older adults are often reported to perform worse than young on tasks of emotion recognition, which can be considered part of cognitive empathy. However, these age effects may depend on the motivational nature of the task. In one of the few experimental studies to directly look at age differences in cognitive and affective aspects of empathy within the same

paradigm (Richter and Kunzmann 2011), age effects in understanding another person's emotional state (cognitive empathy) were no longer observed when the person was talking about a topic of high relevance to older adults. Concerning the affective facets of empathy, older adults' competencies remain stable or even improve across adulthood: older adults report and express greater sympathy for others than younger adults (Richter and Kunzmann 2011). Taken together, cognitive facets of empathy may be more vulnerable to age-related decline than emotional facets. Accordingly, age differences in empathy may vary between studies depending on the type of measurement used and in how far it focuses more on the cognitive or affective facet.

Wisdom integrates several facets in terms of psychological functioning. The deep insight into self, others, and the world comprises the cognitive facet. Complex emotion regulation allowing the tolerance of ambiguity represents the emotional facet. The assumption of a positive association between wisdom and age is very common in the general population as experience cumulates with age, although most people consider old age as neither necessary nor sufficient for wisdom (Staudinger and Glück 2011). Empirical findings can be distinguished according to the type of wisdom measured. *Personal wisdom* refers to individuals' insight into their selves and their own lives and describes an ideal end point of personality growth. This approach is based in the tradition of personality research and mostly uses self-report measures. Studies do not report a linear positive relationship between personal wisdom and age and sometimes even observed negative relations (Mickler and Staudinger 2008). Declining cognitive resources may make abstract thinking, which is required to satisfy some wisdom criteria such as self-relativism, more difficult for older adults. In addition, lower levels of openness to experience and societal restrictions of growth opportunities in old age may hinder the further development of self-insight.

*General wisdom* describes individuals' insights into life in general. Approaches to the empirical study originated from cognitive research and are performance based. They have a

strong connection with an expertise approach but expand classical cognitive ability measures by including emotional and motivational aspects. In a typical paradigm, participants are presented with difficult and existential life problems and are asked to give advice. Responses are recorded and evaluated according to prespecified wisdom criteria. In general, older adults perform as well as younger adults in such tasks. Age benefits were observed on typical dilemmas of old age and when age has been combined with wisdom-related experiential contexts (e.g., professional training as clinical psychologist), while younger adults performed better on typical dilemmas of young adulthood (see Staudinger and Glück 2011 for an overview). Performance is best predicted by measures located at the interface of cognition and personality, such as a judicial creativity and moral reasoning, but not by fluid and crystallized intelligence or personality alone. The different age effects found depending on the measurement type assessing wisdom suggest that required cognitive resources may play an important role. Negative age effects may arise when measures heavily relying on complex cognition are used, while no age effects or even benefits can be expected in tasks allowing older adults to make use of knowledge and heuristics about life problems acquired through experience and practice.

## Conclusion and Outlook

Younger and older adults differ in the way that emotion and cognition combine. The empirical findings summarized above all seem to support the claim that age moderates emotion–cognition interactions as age differences were the rule rather than the exception. Importantly, many studies observed age benefits which may seem surprising given the general cognitive decline accompanying aging. Better emotion control and a strong focus on emotional well-being in older adults seem to make it easier for older adults to work on tasks requiring cognitive and emotional processes. Older adults seem to profit more than young from valenced task material, are generally cognitively less impaired by current mood states, and

are superior in emotion regulation skills: indeed emotion regulation seems less cognitively demanding for older people than young. Other age-related benefits include good performance in tasks requiring complex abilities such as empathy or wisdom, when the tasks allow them to use their emotional strengths and knowledge. These findings are very encouraging, as they show how motivational and emotional strengths can be used to compensate for age-related cognitive decline. However, there is clearly a limit for compensation, and as mentioned in several examples above, age benefits diminish or turn into age-related impairments when the (cognitive and emotional) tasks get too difficult or older adults do not have sufficient cognitive resources available. This pattern is predicted by the *dynamic integration theory* (e.g., Labouvie-Vief et al. 2014), which emphasizes that emotional gains in old age may be reversed where the demand on available information processing is exceeded. For example, older adults show greater interference between mood states and cognition where the cognitive task is very demanding, and older adults perform worse than young when decoding other people's emotions in situations devoid of context. Accordingly, recent conceptual developments build on the socioemotional selectivity theory and expand it by defining the limits of age benefits. Two of them will be outlined in the following.

The *cognitive control framework of aging and emotional well-being* (Kryla-Lighthall and Mather 2009) posits that older adults will experience emotional enhancement to the extent that they are capable of exerting cognitive control to direct attention and memory in ways that help satisfy emotional needs. Thus, cognitive control is suggested as the key mechanism underlying the transformation of age differences in goals into differences in emotional well-being. In line with the socioemotional selectivity theory, it is argued that cognitive control as an emotion regulation tool becomes increasingly useful with advancing age as emotional well-being becomes more important. However, the theoretical framework also describes limitations of age-related changes caused by neural structures. While the amygdala, considered as the primary affective appraisal

structure, remains stable with age, emotion and cognitive control regions of the brain including the prefrontal cortex deteriorate significantly. First findings suggest that healthy older adults can still maintain their emotional well-being to some extent by recruiting additional cognitive resources and thereby compensate for their losses by exerting more cognitive effort (Kryla-Lighthall and Mather 2009).

The theoretical *model of strength and vulnerability integration* (Charles and Luong 2013) adopts a broader, more applied perspective. In line with the socioemotional selectivity theory, it suggests that across adulthood, expertise and motivation to regulate one's emotions increase. However, it is further suggested that certain situations that increase in prevalence with age (i.e., social isolation, neurological dysregulation, and chronic stress) preclude the use of these emotion regulation strategies on a daily level. It is further argued that these situations will lead to equal or even lower levels of emotional well-being and greater physical consequences in the cardiovascular and the neuroendocrine systems in older compared to younger adults as a result of their physiological vulnerabilities.

To sum up, while old age is often characterized as a period of cognitive decline, there are also emotional gains during this time of life. Older adults are better at using their emotions to focus cognitive resources on the key aspects of a situation which will enhance mood. Older adults are also good at effectively and efficiently regulating their emotions in a way which might mean less impact of mood fluctuations on cognitive performance. These skills of managing emotions and cognition likely have positive impact on well-being in old age.

## Cross-References

- ▶ [Age-Related Positivity Effect and Its Implications for Social and Health Gerontology](#)
- ▶ [Cognitive Control and Self-Regulation](#)
- ▶ [Cognition](#)
- ▶ [Emotional Development in Old Age](#)
- ▶ [Memory, Episodic](#)

- ▶ Positive Emotion Processing, Theoretical Perspectives
- ▶ Prospective Memory, New Perspectives for Geropsychological Research
- ▶ Socioemotional Selectivity Theory
- ▶ Psychology of Wisdom

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## Employee Green Behavior and Aging

Thomas A. Norton<sup>1</sup>, Stacey L. Parker<sup>1</sup> and Neal M. Ashkanasy<sup>2</sup>

<sup>1</sup>School of Psychology, The University of Queensland, Brisbane, QLD, Australia

<sup>2</sup>UQ Business School, The University of Queensland, Brisbane, QLD, Australia

## Synonyms

Organizational citizenship behavior toward the environment; Organizational environmental sustainability; Proenvironmental behavior

## Definition

Older employee behavior performed at work, either voluntarily or as required by an organization, that contributes to the preservation of the natural environment by reducing harm to, or strengthening, the ecosystem.

## Employee Green Behavior at Work and Aging

Environmental sustainability is emerging as a driver of human activity in the twenty-first century. Evidence of this can be seen in global emissions targets and the investment in technology intended to enable societies to grow without compromising the natural environment or jeopardizing the livelihood of future generations (World Commission on Environment and Development 1987). It is likely, however, that to forestall or avoid the worst effects of human activity (anthropogenic climate change), human activity itself will need to change (Ones and Dilchert 2012).

Scientific evidence points to human economic activity as the key driver of environmental degradation (Ones and Dilchert 2012). Many organizations and industries have therefore taken it upon themselves to address their role and to attenuate their negative environmental impact while at the same time accentuating their positive impact (Robertson and Barling 2015). When we consider the amount of time many people spend at work throughout their lives (Terkel 1974), organizational efforts to increase employee activity that contributes to environmental sustainability (i.e., employee green behavior; Ones and Dilchert 2012) might well be a vital cog in the machinery of a sustainable society.

Environmental sustainability is one of several significant issues with implications for organizations. In addition to economic activity, climate change is also being driven by changes in global population (Intergovernmental Panel on Climate Change: 2014). In this regard, a contemporaneous issue facing many countries is an aging population, caused by increased longevity, a decline in fertility, and the procession of the baby boomer bulge into old age (McDaniel and Zimmer 2013). According to the Bureau of Labor Statistics (2015), over 67 million employees in the United States are aged 55 or over, representing approximately 43% of the total labor force. Looking to the future from a more global perspective, Kuenen et al. (2011) estimate that the dependency rate (number of people over 65 per 100 workers) will

double from 12% in 2010 to 25% in 2050 as the baby boomers exit the workforce. Organizational success in the twenty-first century will be determined in part by the ability of organizations to respond effectively to significant issues (Ones and Dilchert 2012), such as environmental sustainability and an aging population. The focus of this entry is to integrate research on aging and employee green behavior and provide insights into whether or not employees become greener as they gray.

### How Are Aging and Environmental Sustainability Interrelated?

As should be expected with concurrent issues of such magnitude, the issues of an aging population and environmental sustainability are interrelated. On the one hand, climatic changes pose health risks for older people – who are more vulnerable to changes in the environment. For example, research has shown that periods of extreme heat are associated with increased mortality rates among the elderly (Åström et al. 2011). Moreover, and as the Intergovernmental Panel on Climate Change (2014) has now established, periods of extreme heat are likely to become both more frequent and more extreme in future years.

At the same time, the members of an aging population and workforce have evolving needs (e.g., mobility, health; Klein et al. 2012) that place increased demands on natural resources, thereby incurring environmental costs. Although there is reason to believe that an individual's overall CO<sub>2</sub> emissions should decrease slightly above the age of 65 (Zagheni 2011), there are three additional important considerations that need to be appraised and that bring into question these presumptions.

First, the business sector uses considerably more energy and produces vastly more waste than the domestic sector (Davis and Challenger 2011). As a consequence, workplace activity is going to be the largest contributor to global emissions and a significant contributor to employees' carbon footprints (Goodall 2010). Second, governments are raising retirement ages to cope with the financial burden of supporting such a large cohort (Hertel and Zacher 2016). Third, while

overall emissions may trend downward, they are still expected to remain well above the minimum threshold (5.5 t per person) that MacKay (2009) suggests is necessary to avoid a worst-case scenario (i.e., concentration of CO<sub>2</sub> in the atmosphere exceeding 450 parts per million, which is associated with a 2 °C increase in average global temperature; Intergovernmental Panel on Climate Change: 2014).

With these issues in mind, and taking into account that many employees today work beyond what was once accepted as the traditional retirement age (65 years; Hertel and Zacher 2016), it seems reasonable to conclude that estimates of individuals' emissions decreasing after age 65 might not be as robust as currently thought. Moreover, even in the event that estimates of declining emissions after the age of 65 turn out to be correct, any decreases (while nominally positive) would be superficial because it would still exceed the proposed per person threshold for emissions by some 200% (Mackay 2009). In acknowledgment of the contribution of workplace activity to greenhouse emissions, and assuming that the longer a person works, the larger their own carbon footprint, the question of how an aging workforce engages with environmental sustainability becomes vitally important. We next provide an overview of the current state of research in relation to this question.

### Employee Green Behavior

Employee green behavior refers to individual actions in the workplace that contribute to environmental sustainability (Ones and Dilchert 2012). The need to define these behaviors in the context of the workplace arises because of the extent to which an individual has autonomy over his or her behavior. Whereas the decision to be environmentally friendly at home is largely volitional and driven by psychological (i.e., person) factors (Bamberg and Möser 2007), in the workplace it may be either encouraged or discouraged by social norms, expectations, and task demands (Ones and Dilchert 2012). Ones and Dilchert (2012) indicate that as much as 29% of green behavior at work is required by the organization. Considering the normalization of organizational

environmental sustainability through increased social, regulatory, and normative pressure (Klein et al. 2012), it is likely that companies will increasingly embed green behaviors into employees' required tasks. Accordingly, reviews on green behavior at work have a focus on constructs and processes unique to the workplace.

In response to an increase in organizational and academic interest in environmental sustainability (Ones and Dilchert 2012), several researchers have conducted reviews of employee green behavior (e.g., Norton et al. 2015). These reviews document the role of contextual factors such as policies and goals and person factors such as environmental attitudes and perceived green organizational climate in the green behavior of workers in general.

### Employee Green Behavior Among Older Workers

Although our understanding of aging and workplace behavior in general is relatively mature (Hertel and Zacher 2016), the impact of aging on employee green behaviors is in its infancy. Although the aforementioned reviews on employee green behavior have not investigated age specifically, subsequent analysis of the studies included in the largest and most recent review (Norton et al. 2015) does serve to highlight relationships between age and employee green behavior. Broadly, these studies form four categories: (1) report the effects of age, (2) control for age but do not report any effects, (3) report age as a demographic variable, and (4) do not measure age. Of the 69 studies included in the review, the majority (37) fell into the fourth category, while 13 fell into the third category and 3 are included in the second. Moreover, of the 16 studies that did report effects, findings were mixed. Nine studies reported no relationship between age and employee green behavior, two reported negative effects, and five reported positive findings. It should be noted, however, that most studies report bivariate correlations only. In short, there seems to be a lack of evidence regarding the specific relationship between age and green behavior in the workplace.

### Why Employees Might/Might Not Become More Green as They Gray

In light of a paucity of data from which to draw conclusions about aging and employee green behavior, it is necessary to consider explanations for how these two constructs might relate based on data from related areas. The following positions are drawn from the broader literatures on aging, general work behavior, and green behavior at home.

#### Arguments for a Positive Relationship

On the one hand, there is evidence that environmental values strengthen as people age, and green behaviors at home therefore become more prevalent (Whitmarsh and O'Neill 2010). In this regard, stronger environmental attitudes in older people may be explained from a cohort perspective. Research suggests that environmental attitudes (as a predictor of employee green behavior; Norton et al. 2015) are relatively stable after early adulthood (Inglehart 1990). Thus, the predisposition to green behavior among contemporary older employees might be explained by the emergence of an environmental discourse during their early adulthood (Wiernik et al. 2013).

Conversely, there is also evidence of a U-shaped relationship between environmental behavior at home and age (Klein et al. 2012), suggesting that the effect might not necessarily be straightforward. Specifically, green behavior at home is more prevalent in early and late adulthood, but less common during middle adulthood. This effect may be attributed to the prioritization of family-oriented rather than environmental values as people raise their children in middle adulthood (Hertel and Zacher *in press*).

In this regard, a life span perspective may be particularly helpful. Consider, for example, the concept of generativity, which refers to one of the motivations in Erikson's (1950) stages of psychosocial development. In this respect, generativity describes an individual's desire to help guide the next generation. From this perspective, and in light of omnipresent environmental issues, there might be justification to hypothesize that individuals should engage in more green

behavior as they age. In doing so, older employees might be seen to be attempting to limit their environmental impact, the costs of which future generations would incur. This also taps into a central belief at the heart of most definitions of environmental sustainability – which is to preserve the ecosystem for the benefit of future generations (World Commission on Environment and Development: 1987).

Another argument for why employees might become greener as they gray draws on positive relationships of age with conscientiousness and agreeableness (Hertel and Zacher 2016; Wiernik et al. 2013). First, conscientious employees are more likely to engage in citizenship behavior (Hertel and Zacher 2016; Wiernik et al. 2013), which encompasses approximately two-thirds of employee green behavior (Ones and Dilchert 2012). Second, and relatedly, older workers might be more agreeable to the idea of environmental sustainability if the organization demonstrates a value toward it (e.g., by announcing a shift to purchasing renewable energy). Both of these arguments implicate the important role of organizational values toward the natural environment. These establish a need within the organization for environmental initiatives, to which older adults might be more agreeable, and provide cues toward areas where citizenship behavior might be appreciated. For example, older employees in organizations with prominent environmental values might be more inclined to align their behavior to these values, including performing citizenship behaviors that contribute to the organization's environmental mission.

Finally, older adults are more inclined to value frugality by being economical and avoiding waste (Wiernik et al. 2013). This is relevant to environmental sustainability as environmental initiatives often focus on recycling, avoiding waste, and conserving resources (Ones and Dilchert 2012). Curtailing the consumption of resources is often an early step toward environmental sustainability, as reducing costs associated with waste provides direct financial benefits to organizations (Kane 2015). Pursuing frugal environmental behavior may also be a source of intrinsic satisfaction

(Lee et al. 1995). Thus, for older employees who value frugality, engaging in green behavior at work may have beneficial outcomes and contribute to overall job satisfaction.

A positive relationship between aging and green behavior would also provide organizations with three additional opportunities to benefit simultaneously from an aging workforce and move toward environmental sustainability. First, a positive effect of aging on environmental values might be effectively utilized by having older employees lead the way in communicating and championing green initiatives (Wiernik et al. 2013). Second, if older adults are in fact more conscientious than their younger colleagues, they might be more predisposed to prosocial activity such as making environmentally friendly suggestions or leading green teams. Third, older employees possessing a greater appreciation for frugality might in effect serve as environmental advisors to purchasing officers, emphasizing a need to resupply resources only when necessary and suggesting environmentally friendly alternatives. Such roles may have positive outcomes for older employees as well, such as intrinsic satisfaction derived from frugality (Lee et al. 1995). Alternatively, organizations might find that campaigns that emphasize the financial cost of leaving lights on are especially effective for older employees, who have a heightened appreciation for being economical. Thus, a positive relationship between aging and green behavior could make older employees valuable assets for organizations seeking to engage with environmental sustainability.

#### Arguments for a Negative Relationship

On the other hand, the idea that green behavior at home decreases with age is supported by the argument that, as people age, they have greater disposable income and therefore become less willing to sacrifice comfort and convenience (Wiernik et al. 2013). For example, whereas younger individuals might be more willing to open a window on a hot day, older adults may be more inclined to use air conditioning (Klein et al. 2012). Applied to the workplace, older workers might prefer to

engage in behavior that prioritizes convenience above environmental interests (e.g., printing documents to read instead of reading them on the screen). Alternatively, older employees may engage in non-green behavior out of necessity to optimize declining personal resources such as physical ability (Baltes and Baltes 1990). For example, an older employee might print a document to review with one page to a sheet because s/he wants a larger size print.

A life span perspective also supports a negative relationship between age and green behavior. According to this perspective, older adults might be less motivated by future consequences. Given that climate change is an intergenerational issue (Intergovernmental Panel on Climate Change: 2014), reduced sensitivity toward long-term consequences removes a significant motivation to behave in an environmentally conscious way (Klein et al. 2012). Accordingly, older employees might be less affected by environmental campaigns in the workplace that focus on future consequences of their behavior. This may be particularly relevant for initiatives with goals that extend into the future – beyond the expected retirement age of older employees.

Another argument for a negative relationship draws on the hypothesis that habits crystallize over a person's life span, and accordingly individuals become more resistant to change, including efforts to move to more environmentally sustainable ways of work. According to this argument, older employees would be less likely to replace old practices (e.g., traveling for meetings) with new practices that incorporate environmental interests (such as teleconferencing). The empirical evidence does not support this stereotype, however. In fact, there is evidence that resistance to change can even decrease with age (Hertel and Zacher 2016). In this regard, evidence that people become more agreeable and conscientious as they age suggests that people become *more* open to change as they age (Hertel and Zacher 2016). Nonetheless, there are valid reasons to conclude that people become less likely to engage in green behavior as they age and that older employees may demonstrate fewer green behaviors at work.

If in fact employees become less likely to engage in employee green behaviors as they age, organizations might need to install contingencies to mitigate such an effect. First, organizations could address the issue of convenience by (a) making green behavior more convenient and (b) reducing the impact of non-green behavior. An example of making green behavior more convenient is for managers to provide information and/or training on how to schedule computers to turn off and start up in order to avoid drawing power overnight and during weekends. Another example would be for organizations to provide tablet computers with styluses to allow people to make handwritten notes on documents without having to print them first. An example of a mitigating tactic would be to dedicate a printer for draft documents that uses recycled paper and ink cartridges and a default setting that saves ink and prints double-sided.

To address issues from a life span perspective, organizations might consider reframing environmental goals and messages to be more inclusive of older employees who see themselves close to retirement. Options for this strategy include creating short-term goals for projects that are likely to extend beyond older employees' tenure. Alternatively, listed companies could offer stock options as part of retirement packages so that older employees can maintain a vested interest in the company's performance beyond their employment. Another intervention targeting the life span perspective is to tailor environmental messages to encompass the broader effects of environmental sustainability for the general community and future generations.

Where environmental sustainability will require the adoption of new behaviors, organizations will likely need to implement interventions to change non-green habits. This could manifest in training programs that challenge assumptions about habitual behavior (e.g., that shutting down and powering up a computer uses more electricity than leaving it on or is bad for the device) and explain and demonstrate green alternatives. Such a strategy could be integrated with organizational values and norms for innovation and continuous

improvement, as messages utilizing social norms are particularly effective for older employees (Wiernik et al. 2013).

### Research Recommendations

With the emerging significance of an aging population and the need for organizations to become environmentally sustainable, there is a real need for research on how older employees might better engage with green behaviors. At the very least, researchers should report employee age as a variable in research on employee green behavior. Beyond this, it would be interesting to investigate the potential for cohort effects on environmental attitudes and behavior. In this case, the effect of aging on employee green behavior may be moderated by an individual's experience of the prevailing social attitudes during early adulthood, which have changed over time (Wiernik et al. 2013). In this regard, the environmental message individuals receive in early adulthood might be more important than the effects of aging. Alternatively the effects of aging might be moderated by personality traits (e.g., conscientiousness, agreeableness) or the degree of concern for future generations (i.e., generativity). In effect, the effects of aging on employee green behavior may vary from one person to the next.

In this entry, we have outlined theoretically grounded arguments for why aging might have positive and/or negative effects on employee green behavior. Only empirical evidence can elucidate the extent to which, and under what circumstances, these positions are true. Research providing insights in this area is likely to have significant practical implications for how organizations respond to the challenges of an aging working force and environmental sustainability. Should evidence support the argument for a positive effect of aging on employee green behavior, a next step might be to investigate the effects of such behavior on older employees' job satisfaction and work motivation. Conversely, evidence for a negative effect of aging on employee green behavior would shift the focus of research toward interventions designed to overcome an emerging resistance in older adulthood to employee green behavior.

## Conclusion

Aging and environmental sustainability are significant and contemporaneous issues with implications for organizations. In spite of the reality of an aging workforce and the need for organizations to operate in environmentally sustainable ways, there is practically no research to date that has studied the effect of age on employee green behavior. What empirical evidence does exist is insufficient in both quantity and consistency to infer any conclusions. From a broader perspective, there appear to be valid arguments for both positive and negative relationships between age and employee green behavior. When interpreting existing research on aging and environmental behavior more generally, it is important to acknowledge the possibility for cohort effects. Specifically, our current understanding is derived using data from a cohort who may not have been exposed to the same environmental messages as generations that will be entering older adulthood in coming decades. Nonetheless, from our understanding of aging and workplace behavior more generally, older employees may be particularly useful to organizational initiatives that promote green behavior.

## Cross-References

- ▶ [Age, Organizational Citizenship Behaviors, and Counterproductive Work Behaviors](#)

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## Employment of Older Workers

Judy McGregor  
AUT University, Auckland, New Zealand

### Synonyms

Aging labor force; Mature employees

### Older Workers

The growing number of men and women who are working longer and the aging of many labor markets are global phenomena without precedent. More older people are working, despite large country differences (OECD 2014). Many people in the world will live an additional 30 years after they have reached the traditional age of retirement from paid work, and this is forcing a reenvisioning of the future of work and what “retirement” means. A complex array of factors, such as increasing longevity, declining fertility rates, changing labor market dynamics, and retirement policies and practices, are creating a new demography of work.

Many countries are carrying out reforms to encourage longer working lives, to incentivize worker retention, and to respond to the looming

challenges of rapid population aging (Sonnet et al. 2014). In some countries this is a reversal of earlier policy aimed at early exit of older people from the labor force, when developed countries responded to recessionary times in the 1980s by pushing older workers out of the labor market through redundancies and early retirement.

### Definition

The definition of an older worker varies from country to country and from context to context. For example, to take chronological age as a start point, the OECD older workers scorecard uses the ages of 55 years to 64 years. Others use the age of 50 to begin discussions about “older workers,” and in some cases older workers are deemed to start from 45 years old. In the USA the Age Discrimination in Employment Act (ADEA) forbids age discrimination against people from the age of 40 years, which many might regard as the start point of middle age.

Whatever the chronological definition used, it is clear, however, that in many countries there is now a difference between the “young old” (those up to 65 years of age) and the “old old” those who may be in their seventies, eighties or even nineties and still in paid employment. It is startling to note the projection that in 35 years’ time, Japan is likely to have 550,000 people over the age of 100.

Clearly, too, thousands of older people are involved in work that is unpaid, particularly women who are often caring for older partners and other dependents. In some cases women are caring for both children and dependents. However, whether older workers are paid for their labor or not, responses to older workers are impacted globally by social attitudes and economic growth and stability. For example, policy in developed countries relating to the category of “older worker” is often indexed to a nominal age of retirement where individuals receive universal state or privately funded pension payments.

Looking at the markers of age for older workers, it is clear that some regard workers as old when their physical capacities decline and their stamina retreats impacting on job

productivity. Others suggest an older worker is marked by declines in cognitive or intellectual capacities impacting on performance. For others chronological age alone marks out an individual as an older worker particularly if that is linked to incentives for early exit from the labor market. There is evidence, too, that perceptions of age differ by gender.

### Population Aging and Work

The number of people worldwide aged 60 years and older is expected to triple by 2050, according to projections by the United Nations Population Division. Not only that, the share of the population in older age groups is increasing. At least four trends are apparent in population aging that impact on the employment of older workers in general. First, population aging is not confined to some countries only but is everywhere, including the youngest countries and developing nations. For example, the six Gulf countries, which have traditionally relied on expatriate workforces, acknowledge that their two main demographic challenges by 2050 will be population aging and a slowdown of the increase in national workforces. Second, population aging is a major life force and impacts not only on employment in terms of job demands but also health, economic security, and social cohesion. Third, population aging is occurring quickly and the pace is accelerating, and, fourth, it is taking place at different rates around the world. For example, in Asia, while Japan was the first country to face the “age wave,” South Korea and China follow and then India and Pakistan (Hayutin 2009).

The supply and demand of jobs in a global labor market is characterized increasingly by job mobility and migration to find work. Older workers are not immune from these trends. They are also crucial to vital sectors where worker shortages are profound. The World Health Organization in 2013 estimated that there would be a shortage of 12.9 million healthcare workers by 2035. In areas of great need like sub-Saharan Africa, shortages are particularly acute. Nursing, for example, is an occupation which is aging rapidly (Graham and Duffield 2010).

### The Diversity of Older Workers

While extending working lives will maximize older adults’ income security, not all older people want to work or can access jobs. There are many reasons why people work longer including both positive and negative factors, often referred to as either “push” or “pull” elements or supply- and demand-side factors. It is a mistake to assume that older workers are a homogeneous group and therefore one policy size will fit all.

Many women, in particular, are more likely to be forced to work longer because they have earned less over their working lives and they are living longer. Their earning potential may be influenced by women’s traditional occupational segregation in lesser-paid work (such as cleaning, clerical, and caring work) and/or because of work interruption when bearing and raising children and having primary or sole responsibility for family and domestic life. The global financial crisis also disproportionately impacted on older adults and saw many lose significant portions of their retirement assets at a time of intensified competition for jobs and resources. However, it has been shown that irrespective of age, women usually face dimmer job prospects than men.

Older workers are a multifaceted and diverse group. Categories of older workers include those who are retained in paid employment beyond the conventional retirement age when an employer needs their skills, older people who reenter the labor market for job satisfaction and feelings of self-esteem that the structure of work gives them, and those who downscale to different, lesser-paid jobs. The majority of older workers are part-time by choice or by demand, and many are employed on temporary contracts only because that is all that is available to them. Increasingly, too, there are thousands of older people who are self-employed including farmers in agricultural sectors and in small businesses around the world, including some older workers who “buy” themselves a job through self-employment.

The different types of older work have prompted new terms such as “job shifting,” which can mean moving from a highly paid and full-time position to a lesser-paid, part-time job as

an older worker, and “encore career,” a term covering thousands of Americans in particular who have shifted in the second half of their lives to second careers in areas like the environment, non-profit sectors which blend income and social impact (Freedman 2007).

### **Motivations for Working Longer**

Some people want to work longer at an older age. In some cases this aspiration is made easier by the general shift over time from manufacturing and service industry jobs, which required sustained physical labor and took a toll on older bodies, to the knowledge economy where physical body demands are less onerous. It is no surprise, for example, that in many countries, such as South Africa, Australia, Canada, and the United Kingdom, the education sector is one area which older workers find attractive in terms of retention of their skills and labor.

Others are compelled to work longer at an older age than their parents, for example, to increase their financial security. There is less certainty that some countries can absorb the full costs of their aging populations especially where there are limited existing retirement income schemes or state pensions.

It is clear that education matters. Across OECD countries, well-educated people are more likely to work longer than the less skilled. This gap, though, probably cannot be separated from the deepening inequality divide between those who are well educated and better-off and those who are poor and unskilled with low educational attainment, irrespective of age.

### **Perspectives About Working Longer**

It is clear that there are both challenges and opportunities associated with older workers. Two perspectives have traditionally dominated discussion about working longer. First, there is the perspective that sees working longer as beneficial to individuals, families, communities, and society. This is reflected in the title of a major OECD report

published in 2006 *Live Longer, Work Longer* (OECD 2006) which implicitly suggests that extending a working life will increase life span. Often this perspective is referred to as positive aging or active aging, and it is a policy framework used by Western governments in particular to place working longer in a favorable social context. In the positive aging context, older workers are seen as “productive,” contributing economically (Butler 2009) and increasing their own self-esteem and self-efficacy through the structure of work. In this optimistic scenario, the choice to continue on working as an older person is characterized by individual autonomy and the human rights of older people (Office of the Human Commissioner for Human Rights 2012). Humorist and writer George Bernard Shaw once said, “A perpetual holiday is a good working definition of hell.”

The second perspective suggests that older people may be more likely to be in “precarious work” (International Labour Organization 2012) as opposed to “decent work.” Precarious work is characterized as uncertain, risky, and unpredictable, sometimes without employment protections in the law, often casual work without certainty of hours from day to day or week to week, and mostly low paid and contingent (Sargeant and Frazer 2009). The idea has been popularized by Guy Standing’s work in which he describes the “precariat” as “the new dangerous class” (Standing 2011). He states that “old agers have become a source of cheap labour, paid low wages, given few benefits, easily sacked.” This is undoubtedly true of some older workers only, particularly women, ethnic minorities, and migrant workers, who are often in “precarious work” that creates greater economic inequality, insecurity, and instability.

### **Social Attitudes, Discrimination, and Older Workers**

Ageism, which constitutes negative societal attitudes about age, and age discrimination at work are of concern throughout the world. Age discrimination means older people are disadvantaged in

individual or cumulative aspects of work such as job hiring, pay and reward systems, promotions, job assignments, training opportunities, and fringe benefits. This is despite different cultural contexts in which older people are revered for their wisdom and knowledge and regarded as “elders” with dignity and respect in family structures and communities.

Age discrimination is often invisible and covert and often not easy to prove despite statutory prohibition in many countries. The emphasis on age discrimination is not necessarily because of a new appreciation of the need for fairness. Fredman (2011) says it gains its chief impetus from macro-economic imperatives, but this should not obscure the fact that it is unjust. The impacts of exclusion from the labor market of older people on the basis of age should not be underestimated in terms of poverty, ill-health, and depression, as well as self-esteem and social isolation.

Experiments in Spain, Sweden, Scotland, Germany, Norway, New Zealand, and Australia, among other countries, have shown that if matching applications from job candidates with equal qualifications are presented to employers, the younger applicant will be preferred. Older applicants were not preferred, not on the basis of merit or competencies, but simply on the discriminatory basis of their age (Wilson et al. 2007). However, employers seldom identify chronological age as the criterion on which they have preferred one candidate over another. It is often very difficult for a mature job seeker to establish that old age was the grounds on which they did not get a job.

Age discrimination laws usually include the whole employment cycle starting from job advertisements which are expected not to refer to the age of applicants through to exiting from the labor market through retirement or redundancy. Laws prohibiting age discrimination have been used by specific occupational groups such as airline pilots, judges, and university teachers, among others, to challenge mandatory retirement ages in various countries with mixed success. In the European Union, for example, the courts can say that an objective justification for not employing older people is the need for intergenerational fairness or to balance the age structure of an organization,

or the need for health and safety considerations, or the need to recruit and appoint young people.

The mass media, and the news media in particular, have been criticized for promoting the cult of youth as celebrities in sport, leisure, and fashion and in the world of work. This led to the comment that the “mass media has powerfully and negatively influenced both public opinion generally, and employers’ attitudes specifically, on the subject of older workers” (McGregor 2005). Concern has also been expressed consistently at the way older workers are stereotyped in print advertisements and commercials and online marketing, despite the potential purchasing power of older workers in paid employment (Treguer 2009).

## Changing Employer Practices

A variety of human resource strategies are necessary to attract, retain, and accommodate older workers, in addition to labor market and pension policies. Companies need to retain and transfer institutional knowledge, for example. They also need older workers to mentor and coach younger and intermediate workers. Corporates, companies, and small businesses need to manage diverse workforces that are representative of their own client and customer bases, and they need to be able to keep older workers productive.

Many transnational corporations and multinational companies can afford enlightened and progressive employer policies and practices that balance their workforces by age. Companies around the world, such as Singapore Health Services Ltd., with 20% of its 15,000 workforce above 50 years of age, have innovative human resource policies (Tan 2009). These include reemploying retirees, flexible work arrangements such as flexitime, project work and part-time work and customized employment contracts, job sharing, and telecommuting.

However, a challenge for many smaller organizations is that older workers are often the most expensive. Higher pay has often been linked to seniority and job tenure. Some employers wish to rationalize both succession planning and wage costs, without breaching age discrimination

legislation. Whether older workers, especially middle-class baby boomers, would accept or can afford lesser wages as retirees or be attracted to different jobs for less money is a moot point. However, tailoring wage and benefit systems accordingly may become urgent in some sectors.

## Employability of Workers

Many older workers, who have choice about whether to work or not, make an individual decision about job retention, on their own personal sense of employability. This could include consideration of their currency in the skills, knowledge, and technology required by their occupational choice. Sometimes this is professional registration, sometimes it is new software, and sometimes it is the inability to be productive and keep up in a factory environment. In some cases the decision is health related. Older workers may develop age-related illnesses or disabilities that curtail working longer and prompt exit from the labor market.

In other cases, inadequate workplace design such as insufficient lighting or inadequate ergonomic support (making computers easier to see, hear, and use) pushes an older worker out of the labor market. An English study showed older workers found it difficult to work in open-plan environments because of noise, light, and cold temperatures and older workers say they want to learn new technology at their own pace, in face-to-face situations rather than in environments where they are expected to either rely on Internet packages or compete with tech-savvy, younger workers (Myerson 2009). Work intensification and “job creep” in areas like aged care, where more is expected in less time along with increasing employer expectations, are other reasons older workers give for exiting.

An issue of increased salience to older workers is lifelong learning to sustain employability. Adult learning for job training either to refresh or renew job-related knowledge and skills and financial incentives to encourage it are not necessarily mainstream policy even in countries where older

workforces are impacting on economic growth. Global research shows that older workers often feel they are discriminated against in selection for training opportunities (McGregor and Gray 2002).

## Future Trends

There is much research “on” or “about” older workers. Comparatively little is known about the perceptions and experiences of older workers themselves, and their voices have become the “missing voices” in policy frameworks around older workers, aging, and employment. It is critical that future research addresses this omission. It is also essential that older workers are not viewed by legislators, policy makers, and employers as one homogeneous grouping. No other population groupings, such as children, or young people, or the middle aged, span 30–40 years of life. A single description whether it be old age or older worker is insufficient. It is therefore imperative that national statistical collections, censuses, and international data collections allow for disaggregation past the age of 65 years to develop a more sophisticated mapping of older people. This will help governments, policy agencies, employers, and older people themselves plan for the future.

The idea that older workers are taking jobs from young people and that this could provoke or incite intergenerational tensions with younger people has been largely discredited. The idea of a fixed number of jobs with winners and losers is a variation of what economists call the “lump of labor” fallacy. Research shows that there is no evidence that increasing the employment of older persons reduces either the job opportunities or wage rates of younger workers (Munnell and Wu 2013). Global problems of youth unemployment have many patterns and complexities that are different to those influencing older worker unemployment and access to employment. However, an under-researched area requiring future scholarship and debate concerns the intergenerational transfers and accommodations that will have to take place in workplaces of the

future. As the aging population increases and as the labor market gets older, how will older people work? What incentives will they require not to retire? Only some of the answers to these significant questions are known today.

## Cross-References

- ▶ [Organizational Strategies for Attracting, Utilizing, and Retaining Older Workers](#)
- ▶ [Recruitment and Selection of Older Workers](#)
- ▶ [Stress and Well-Being: Its Relationship to Work and Retirement for Older Workers](#)
- ▶ [Technology and Older Workers](#)

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## Encephalopathy

Sarah Borish<sup>1</sup>, Hannah Brunet<sup>1</sup>,

Victoria Liou-Johnson<sup>2,3</sup> and Joel Kramer<sup>1</sup>

<sup>1</sup>University of California, San Francisco, San Francisco, CA, USA

<sup>2</sup>University of California, San Francisco, CA, USA

<sup>3</sup>Sierra Pacific Mental Illness Research Education and Clinical Center, VA Palo Alto Health Care System, Palo Alto, CA, USA

## Synonyms

Autoimmune Disease; Encephalitis; Infections; Neuroinflammation; Prion Disease

## Definition

Encephalopathy is a broad term for any brain disease that affects brain functioning.

Encephalopathy refers to a broad category of conditions that disrupt normal brain functioning. Like many broadly defined conditions, etiology and clinical presentation vary extensively. Etiologies can include vascular conditions, autoimmune disorders, infectious and viral agents, cancer, paraneoplastic syndromes, hypoxia, systemic medical illness, neurodegenerative disorders, prion disease, medications, metabolic conditions, traumatic brain injury, and toxins. Symptoms may include delirium, altered mental status, seizures, cognitive deficits, motor impairment (e.g., weakness), psychosis, personality changes, and other psychiatric symptoms (Roos and Brosch 2012).

The average age of onset for these conditions varies somewhat according to etiology; however, older age is almost universally a risk factor for the development of encephalopathy, with the majority of patients presenting over the age of 50 (Paterson et al. 2012). Risk for developing encephalopathy increases with age, such that as adults move into their 40s, 50s, and 60s, risk for onset of these conditions intensifies.

The most common forms of encephalopathies present with clear changes in mental status and/or delirium. For example, hepatic encephalopathy presents in the context of liver failure with confusion, altered consciousness, and ultimately coma and/or death. Similarly, uremic encephalopathy can develop in patients with acute or chronic kidney failure. Subdural hematomas, most often secondary to traumatic brain injury, can cause an encephalopathy marked by headaches and changes in consciousness. Wernicke's encephalopathy (WE), caused by a thiamine deficiency secondary to chronic alcohol use, HIV/AIDS, and malnutrition, is marked by confusion, ataxia, and weakness (Weathers 2013). These acute medical disturbances are typically treated in primary medical settings and are unlikely to be seen by most geropsychologists.

However, several encephalopathies can present with a more insidious onset and with

predominant psychiatric and cognitive symptoms. These syndromes are more likely to present with subacute delirium that may not be immediately obvious. Unlike a classic delirium, subacute presentations are marked by cognitive changes over days and weeks rather than a more rapid, 24-h window (Flaherty 2011). As such, these conditions are frequently misdiagnosed as neurodegenerative diseases or psychiatric illnesses. Practitioners who work with older adults must be familiar with these diseases in order to make appropriate referrals for diagnosis and treatment, especially given that so many of these disorders are treatable and reversible.

This entry will give a brief overview of several types of encephalopathies that are more likely to present outside of traditional acute care settings or neurology clinics. First, this entry will review anti-NMDA receptor encephalopathy (ANRE), which presents with predominant psychiatric features. Next, the entry will review voltage gated potassium channel encephalopathy, Hashimoto's encephalopathy, herpes simplex encephalopathy, and spongiform encephalopathy (i.e., prion disease) all of which often present with marked cognitive changes. Notably, both cognitive and psychiatric changes are common among individuals with these encephalopathies and understanding core symptom profiles may be helpful in making appropriate referrals.

## Anti-NMDA Receptor Encephalopathy

*N*-methyl-D-aspartate (NMDA) receptors are glutamate receptors found throughout the central nervous system and are thought to be involved in cognitive functioning and psychiatric illness, particularly psychosis. Anti-NMDA receptor encephalopathy (ANRE) is an autoimmune disease, a condition in which the body mounts an immune response against itself. In the case of ANRE, the immune system develops antibodies to attack NMDA receptors in the brain. ANRE is characterized by acute psychiatric and neurological symptoms including psychosis, seizures, fatigue and/or reduced consciousness, breathing difficulty, and abnormal movements (Vitaliani

et al. 2005). While the median age of onset is 24, cases of ANRE have been reported in older adults up to 76 years of age (Dalmau et al. 2008). ANRE is often associated with a type of tumor, an ovarian teratoma, which is found in almost 59% of patients with the disease. In the subset of cases that are associated with malignancies, the immune response to the tumor also attacks parts of the central nervous system, which is known as a paraneoplastic syndrome. In a case series by Dalmau et al. (2008) the median age of onset was 23 and predominantly female (91%). The symptom presentation is often dominated by psychiatric symptoms including psychosis. In a popular book published in 2012, author Susannah Cahalan provides a first-hand account of her experience with this disease. Her initial symptoms included psychosis and emotional lability, and providers diagnosed her with an alcohol use disorder and schizoaffective disorder (Cahalan 2012). This is not uncommon for patients with ANRE; many have gone undiagnosed for months because they were thought to have primary psychiatric disorders. Other features include seizures (76%), reduced alertness or unresponsiveness (86%), autonomic dysfunction, such as difficulty breathing and slowed heart rate (69%). Ultimately, Cahalan (2012) was transferred to an inpatient neurology department in response to onset of seizures. Many patients also exhibit abnormal movements, often orofacial dyskinesias such as grimacing or chewing movements, or limb posturing, which can sometimes be mistaken for seizures (Dalmau et al. 2008). Nonspecific flu-like symptoms (e.g., fever, headache) are also common just before the onset of the acute neurological and psychiatric symptoms (Sansing et al. 2007).

While many patients exhibit seizures as part of the ANRE clinical syndrome, most patients will exhibit abnormalities on electroencephalogram (EEG) monitoring, including slowing without overt epileptic activity (Dalmau et al. 2008). Approximately half of patients exhibit abnormalities on magnetic resonance imaging (MRI), which most commonly consist of hyperintensities observed on T2 and FLAIR images in medial temporal structures and the cerebellum (Sansing et al. 2007). Impairments on cognitive testing are

common. Diagnosis is confirmed by testing the cerebrospinal fluid (CSF) for antibodies to the NMDA receptor (Sansing et al. 2007). For Cahalan, it took over a month to receive an accurate diagnosis (Cahalan 2012). Accurate diagnosis is critical because ANRE is responsive to treatment, which usually involves immunotherapy, such as corticosteroids or plasma exchange, as well as surgical tumor removal (Dalmau et al. 2008). Many patients achieve full recovery or exhibit only mild lasting deficits; however, some patients experience severe lasting effects and the disease can be fatal (Dalmau et al. 2008).

### **Voltage Gated Potassium Channel Antibody Associated Encephalopathy**

Voltage gated potassium channel encephalopathy (VGKC) is an autoimmune condition that is particularly common in adults over 50 and presents more often in males than females. In healthy adults, voltage gated potassium channels regulate neurotransmitter release but with abnormal expression of these antibodies, an encephalopathy may develop.

The clinical profile of VGKC is marked by acute cognitive changes, seizures, and hyponatremia (Bettcher et al. 2014). Some research suggests that seizure activity may represent the first symptom of VGKC, although they may not be clinically obvious if they are focal temporal seizures that do not generalize and present with tonic-clonic movements. In a comprehensive literature review, Radja and Cavanna (Radja and Cavanna 2013) found that seizures were present in 85% of patients diagnosed with VGKC; seizures often preempted subsequent cognitive changes. Severe episodic memory impairment is a core feature of VGKC; over 97% of patients present with memory impairment (Radja and Cavanna 2013). Changes in executive functioning and language have also been observed. Neuropsychological tests measuring verbal fluency and set-shifting appear to be particularly sensitive to the language and executive functioning changes associated with VGKC (Bettcher et al. 2014). Finally, psychiatric symptoms are

also common in this population, affecting approximately 33% of patients (Radja and Cavanna 2013). Specific symptoms include agitation, insomnia, hallucinations, and depression. In case studies, patients have presented with schizophrenia-like syndromes that progress to delirium, stressing the presence of affective symptoms in this disorder (Parthasarathi et al. 2006).

MRI findings among patients with VGKC are consistent with the neuropsychological profile; in particular, the medial temporal lobes appear to be hyperintense on imaging in approximately 80% of patients (Bettcher et al. 2014; Radja and Cavanna 2013). This is consistent with a limbic encephalopathy in which autoimmune diseases primarily target the limbic system. Phenotypically, limbic encephalopathies are associated with neuropsychiatric symptoms (e.g., psychosis, anxiety), subacute behavioral changes, cognitive decline, seizures, and fluctuating course. Neuroimaging in limbic encephalopathy cases can present with abnormalities in the medial temporal lobes, although this is not identified in all cases (Paterson et al. 2012). These conditions rarely affect the medial temporal lobes in isolation, and for VGKC, additional involvement of the lateral frontal lobes, basal ganglia, and white matter structures has been identified.

VGKC is highly responsive to treatment with immunosuppressants (Radja and Cavanna 2013). Over time, cognition typically improves markedly, and patients report subjective improvements in all cognitive domains and psychological domains, as well as remission of seizures (Radja and Cavanna 2013). However, longitudinal evidence suggests that some patients continue to have cognitive difficulties in one or more domain even after treatment (Bettcher et al. 2014).

### Hashimoto's Encephalopathy

Hashimoto's encephalopathy (HE) is a rare condition that was first characterized by Brain et al. (1966) in a 48-year-old male who presented with stroke-like symptoms of aphasia and right hemiplegia (Brain et al. 1966). The causes of HE are not clearly understood, but it is thought to be

associated with Hashimoto's thyroiditis (HT), an autoimmune disorder in which antibodies attack the thyroid gland. In rare instances, the autoimmune reaction may cause an inflammatory response in the thyroid receptors of the brain's limbic system. Although the autoimmune reaction is not limited to the limbic system, it is nonetheless referred to as a limbic encephalopathy. Only a small fraction of Hashimoto's thyroiditis patients may develop HE; it is estimated that HE occurs in only 2.1/100,000 people (Ferracci et al. 2004), while HT occurs in approximately 1/1000 people. Hashimoto's encephalopathy may present in patients of all ages, including older adults, with a mean age of onset in the mid 40s (Chong et al. 2003). Approximately 80% of reported cases are female. Due to the heterogeneity of presentation, subtypes have been proposed: steroid-responsive encephalopathy associated with autoimmune thyroiditis (SREAT) (Castillo et al. 2006) and nonvasculitic autoimmune inflammatory meningoencephalitis (NAIM) (Caselli et al. 1999). Regardless of type, a defining trait of HE is that it is steroid-responsive. High serum antithyroid antibody must be present in order to diagnose HE, while other diagnostic tests may vary (Wood-Alum and Shaw 2014).

Patients who present with HE may display a wide range of symptoms, which can make the syndrome difficult to identify. Older adult patients often present with more subtle symptoms, such as anxiety or cognitive impairment, but they may also exhibit other psychiatric symptoms including psychosis, fluctuating states of consciousness and attention. Many patients may present with stroke-like symptoms such as aphasia, hemiparesis, weakness, blindness, headache, gait unsteadiness, and seizures can also occur (Weathers 2013; Chong et al. 2003; Wood-Alum and Shaw 2014). Because of these varying characteristics, patients presenting with these symptoms may be misdiagnosed and thus treated inappropriately. Additionally, elevated antithyroid antibodies may be present with other nonthyroid related autoimmune disorders; therefore, blood labs alone cannot diagnose HE. Other diagnostic tests may include electroencephalography and/or neuroimaging (Wood-Alum and Shaw 2014).

The treatment of HE is varied due to the rarity of the disorder; therefore optimal dosage, duration, and course of treatment is unknown. The initial case identified by Brain and colleagues (1966) reported symptomatic remission with levothyroxine treatment alone (Brain et al. 1966). Subsequent studies have reported an approximate 65% effectiveness with levothyroxine alone, while steroid treatment alone has yielded an estimated 98% effectiveness (Wood-Alum and Shaw 2014). Additional treatments may include a combination of medications and/or intravenous immunoglobulin therapy or plasmapheresis for more resistant cases. Despite the lack of clear diagnostic and treatment criteria, steroidal treatment generally yields good prognoses and remission of symptoms.

### Herpes Simplex Virus Encephalitis

Encephalitis caused by the herpes simplex virus (HSE) is the most common form of sporadic and fatal encephalitis in the world (Whitley et al. 1998). Unlike HE, VGKC, and ANRE which are caused by autoimmune disorders, HSE is caused by viral infection. Approximately 1250 cases are diagnosed annually, half of the cases are diagnosed in adults over 50 (Tyler 2004), and HSE affects men and women equally (Berk and Myers 2010). Typically, the herpes simplex virus-type I (HSV-1), commonly known to cause orofacial lesions, causes HSE. The HSV-2 variant associated with genital lesions and neonatal infections is the source of only 10% of documented HSE cases. Patients with compromised immune systems appear to be particularly vulnerable to HSE. Primary HSV-1 infections among individuals with no previous history of HSV-1 antibodies are responsible for approximately 1/3 of HSE cases, while recurrent infections cause the remaining 2/3 of HSE cases (Widener and Whitley 2014).

In HSE, HSV-1 produces inflammation in the CNS that leads to hemorrhage and necrosis of brain tissue (Widener and Whitley 2014). HSE most frequently affects the medial temporal lobes and the orbitofrontal regions of the brain,

but cases have been documented with focal lesions in the brain stem rather than the cortex (Tyler et al. 1995). At present, the particular triggers for onset of HSE remain unclear. Researchers hypothesize that HSV-1 targets the cortex through the olfactory bulbs, thereby leaving the orbitofrontal and medial frontal lobes particularly vulnerable to the deleterious effects of the disease (Widener and Whitley 2014). However, others have argued that the trigeminal nerve serves as the primary pathway through which the virus targets the CNS (Tyler et al. 1995).

Initial symptoms associated with HSE include changes with cognition including altered mental status and speech deficits as well as concurrent fever and headache (Berk and Myers 2010). Given the vulnerability of temporal regions in HSE, patients frequently show neuropsychological deficits in language, (e.g., naming and semantic knowledge) as well as episodic memory. As with other types of encephalitis, early symptoms are frequently psychiatric. In cases of HSE, acute personality change and olfactory hallucinations are common. The presence of olfactory hallucinations and nasal field defects are important potential indicators for HSE (Berk and Myers 2010). Additionally, patients with this diagnosis often experience temporal lobe seizures and hemiparesis.

In addition to carefully reviewing symptoms, diagnosis can be confirmed by CSF analysis, EEG, and imaging. Early in infection, CSF will show elevated lymphocytes and red blood cells suggestive of hemorrhage and/or damage to the blood–brain barrier (Berk and Myers 2010; Widener and Whitley 2014). EEG pattern is typically abnormal with slow waves most notable in the temporal lobes; occasional lateralization is also highly suggestive of HSE. Finally, MRI scans are highly sensitive to HSE-related brain changes, particularly in early stages of the disease. Early MRI changes reveal edema and hyperintensities in the orbitofrontal and medial temporal lobes. Additionally, early imaging often identifies changes in the insula and external capsula with later involvement of the cingulate (Widener and Whitley 2014). Although brain biopsy used to be the only definitive diagnostic mechanism of HSE, polymerase chain reaction (PCR) now represents

the gold standard for both assessing the presence of HSV in the CNS and monitoring treatment response in patients with HSE (Widener and Whitley 2014).

Early diagnosis and treatment with acyclovir for HSE is imperative. Without treatment, the mortality rate for HSE is over 70% (Berk and Myers 2010; Widener and Whitley 2014). Even among patients who receive treatment, long-term cognitive consequences are frequent; only 2.5% of patients diagnosed with HSE ultimately recover normal neurological and cognitive status (Ward and Roizman 1994). Prognosis is directly related to prompt treatment as level of consciousness at treatment onset is correlated with outcomes (Berk and Myers 2010). Additionally, worse prognosis is associated with older age at onset and symptom duration longer than 4 days prior to treatment initiation (Widener and Whitley 2014).

## Prion Diseases

Prion diseases, also referred to as spongiform encephalopathies, are responsible for a variety of rapidly progressive dementias. Normal prion proteins are found in the membranes of cells. Prion diseases are caused by misfolded prion proteins that propagate throughout the central nervous system. Prion diseases can occur spontaneously, as a result of an inherited genetic mutation, or acquired through infection or other mechanism of transmission. In the USA, the incidence rate of prion disease is about 1 in 1 million, and sporadic Creutzfeldt-Jakob disease (CJD) comprises most of the diagnosed cases. As it represents the most common form of prion disease, and often presents with cognitive, motor, and behavioral symptoms, CJD will be discussed in more detail. Geschwind (Geschwind 2015) described the clinical syndrome and diagnostic considerations in CJD and other prion diseases (Geschwind 2015).

Many dementias caused by neurodegenerative conditions, such as Alzheimer's disease, progress slowly and gradually over many years. In contrast, CJD is characterized by a very rapid course; the median length of survival is 5 months and most

patients do not survive past 1 year. The disease most often affects older adults with the typical age of onset falling between 55 and 75. Patients in this age group presenting with a rapid decline in cognitive functioning should raise concern for CJD or another spongiform encephalopathy (Geschwind 2015).

The clinical syndrome for CJD includes behavioral symptoms, gait abnormalities, extrapyramidal symptoms such as dystonia and Parkinsonism, and myoclonus (muscle twitching). Initial symptoms most commonly include cognitive symptoms, characterized by memory loss, language dysfunction, executive functioning difficulties, and confusion. Other early symptoms that occur in about one third of patients include fatigue, headache, dizziness, and changes in appetite and sleep. Almost half of patients experience behavioral symptoms at some point during the disease course, which include agitation, depression, aggression, apathy, or personality change, and are therefore often misdiagnosed with psychiatric disorders. One third of patients experience language dysfunction (aphasia), difficulty with motor planning (apraxia), neglect, and difficulty with arithmetic calculations. CJD affects vast areas of the brain and because of the variability in symptom presentation it can be challenging to accurately diagnose (Geschwind 2015).

Diagnostic tests include EEG, MRI, and CSF. EEG abnormalities may not appear until later in the disease course. MRI, particularly fluid-attenuated inversion recovery (FLAIR) and diffusion-weighted imaging (DWI) sequences, reveals abnormalities in the deep gray matter nuclei as well as hyperintensity in the cortical gyri, known as cortical ribboning. CSF tests may not always reveal abnormalities in patients with CJD but a minority of patients may have elevated proteins found in CSF (Geschwind 2015).

## Wernicke's Encephalopathy

Wernicke's encephalopathy (WE) results from thiamine (vitamin B1) deficiency often secondary to poor nutrition and poor vitamin absorption in those who chronically abuse alcohol. In addition

to poor diet and alcohol misuse, other risk factors include bariatric surgery, chronic vomiting or diarrhea, and chemotherapy in those undergoing treatment for cancer (Sechi and Serra 2007; Zahr et al. 2011). Some individuals also have a genetic susceptibility for reduced thiamine affinity (Guerrini et al. 2005). Thiamine is involved in important neurological processes such as the production and maintenance of myelin, communication between neurons, and producing neurotransmitters such as GABA. Lesions in brain areas most vulnerable to thiamine deficiency can be observed after as little as 3 weeks of thiamine depletion (Schenker et al. 1980).

WE is rare with 2% prevalence rates in the USA, and it affects men almost twice as often as women. The classic triad of WE symptoms includes altered mental status, eye movement changes, and unsteady gait, although these symptoms are not universal. Altered mental state secondary to WE includes confusion, slowed thinking, apathy, reduced awareness, and concentration difficulties (Sechi and Serra 2007). Eye movement abnormalities occur in approximately one third of patients and can include gaze palsy and involuntary quick jerking of the eyes known as nystagmus. Motor and gait abnormalities most often present with poor coordination and unsteady gait. Gait ataxia in WE patients is typically characterized by a wide stance with short, unsteady steps (Lough 2012). Psychiatric symptoms such as agitation and hallucinations have also been reported (Zahr et al. 2011).

WE can occur with or without Korsakoff's syndrome, although the majority of patients with untreated WE will develop Korsakoff's syndrome. Patients with Korsakoff's syndrome exhibit profound anterograde amnesia with relatively preserved implicit learning and general intelligence. Confabulation often accompanies the memory impairment, particularly in the earlier stages of the syndrome. Executive functioning deficits are also common (Zahr et al. 2011). Korsakoff's syndrome is associated with atrophy of the thalamus, mammillary bodies, and frontal lobes, which can be observed on imaging. CSF is usually normal in patients with WE/Korsakoff's syndrome, and EEG abnormalities do not appear

until later in the disease course (Sechi and Serra 2007). Unfortunately, this syndrome does not improve even with treatment to correct thiamine deficiency (Butters 1980).

WE is important to identify correctly because if untreated, it can lead to coma and death. WE can be differentiated from more commonly seen neurodegenerative disorders in older adults based on the rapid onset. In addition to the clinical signs, blood tests to determine thiamine levels and MRI findings have the most diagnostic utility (Lough 2012). However, the nonspecific nature of the symptoms make it easy to misdiagnose. Early symptoms often include headache, fatigue, and irritability and can present differently across individuals. Furthermore, symptoms can be difficult to differentiate from acute alcohol intoxication when patients present to medical settings (Thomson 2002).

## Conclusions

Encephalopathies are varied in etiology and presentation. Despite this variability, there are certain categories of symptoms that are common across these syndromes. Cognitive changes, fluctuations in consciousness, and psychiatric symptoms are highly prevalent in encephalopathies, regardless of specific etiology. With disease progression, seizures are common. Given that patients with these symptoms may present in primary care clinics, geriatric medical clinics, as well as psychiatry and psychology departments, it is important that providers outside the scope of neurology practices are familiar with potential presentations of these disorders. Additionally, older adults are at increased risk for encephalopathy, and it is important for providers to be aware of the varied etiologies and symptoms that are associated with these conditions. Symptoms that indicate any alteration in brain functioning, such as cognitive and psychiatric changes, should raise suspicion for encephalopathy. Notably, onset of encephalopathy symptoms is typically acute rather than gradual. However, the onset of a subacute delirium with more gradual symptom onset (i.e., over days and weeks rather than hours) is common

among the atypical encephalopathies described here. The presence of seizures often triggers a referral to a neurologist, but this symptom often manifests later in disease progression. Patients with encephalopathy, particularly those presenting with cognitive and behavioral changes, may go undiagnosed for many months. Immediate treatment is associated with the best outcomes, therefore recognizing early signs and symptoms of these disorders in older adults is imperative.

## Cross-References

- ▶ [Cognition](#)
- ▶ [Behavioral and Psychological Symptoms of Dementia](#)
- ▶ [Delirium](#)
- ▶ [Geriatric Neuropsychological Assessment](#)

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## End of Life Care

Brian D. Carpenter  
 Department of Psychology, Washington  
 University, St. Louis, MO, USA

## Synonyms

Death; Dying; Hospice care; Palliative care; Terminal illness

## Definition

The end of life can occur at any age, though it most often occurs in later life, when people are most vulnerable to the range of diseases and illnesses that compromise physical health. The end of life is preceded by *dying* and culminates in *death*, a technical distinction of some importance because both dying and death are distinct phenomena about which people have varying expectations, fears, and wishes. In its most clinical definition, dying refers to the process of physiological decline that leads to a complete cessation of vital bodily functions such as respiration and circulation. The dying process can be short or protracted; of a single cause or multifactorial; painful or relatively peaceful; brought about by a person's own hand, by another's hand, or by accident; a result of internal processes or external forces; and wished for or fought against. Clearly, dying is a multifaceted experience, with biological, psychological, and social elements. Death, meanwhile, is the end product of dying. Dying is the process, death the result.

*End-of-life care* refers to the wide range of services and supports that can be provided not only to an individual who is dying but also to family members and friends. It also involves a variety of professionals who provide the care, but of course have thoughts and feelings about the experience themselves. This care has many facets and attributes, such as its intensity, location, scope, and financing. Those facets and attributes often evolve in response to the specific reasons why a person is dying. For instance, acuity of the situation calls for different interventions: a person who has a sudden, massive heart attack will need different things than someone experiencing gradual decline associated with a slow-growing tumor. The cause of the situation might also demand different interventions: dying as a result of a natural disaster will involve a different experience than dying as a result of a common, age-related disease. Timing also matters: dying while still in early childhood is vastly different from dying past age 100.

Across these facets, the goal of end-of-life care is, in general, to enhance the quality of life near

the end of life for people with a life-limiting illness and their care partners. There are, of course, many ways to achieve that quality, which themselves span biological, psychological, and social strategies. In practice, end-of-life care usually (and optimally) includes a collection of strategies and interventions, designed and implemented by a team of caregivers, all striving to enhance a person's experience in this important, ultimate developmental milestone.

### **Life Span Developmental and Biopsychosocial Perspective**

Dying and death can occur at any point in the life span, and the timing of those events matter. It is useful to consider three different contexts in order to gain a comprehensive understanding of a person's dying and death. The first is to recognize that dying and death occur at a particular time in the development of the *individual*. As a person progresses through life, she grows in many different domains – physiological, psychological, social, and spiritual – and the point of her development influences her experience of dying and death. For example, the psychological resources available to a person who is dying are likely to be different for a younger person than an older person. Not only do basic cognitive functions (e.g., insight, reasoning, judgment) evolve and change across a person's life span, but so too does their perspective on life, based on the accumulation of experiences they have had and their relative place in their own history. Likewise, from a social perspective, death is more expected, more of an “on-time event,” for an older adult than it is for an adolescent. Therefore, the death of any 16-year-old, regardless of circumstances, can seem more tragic than the death of a 90-year-old who has had a lengthy life.

The second important context is that of the *family*, the most central social network for most people. When an individual begins to die, she does so within a family network that is itself changing over time, with its own developmental history and milestones. When a parent is dying, the family will experience it differently if the

children are very young, if the children are young adults launching their own lives, if the children are middle aged with their own growing family, and if the children are old and might even predecease their parent. In all these scenarios, the parent is still a parent, but the family itself is in a different developmental place. Consequently the parent's dying will affect the family in different ways, just as the family will affect the parent in different ways.

The third important context is the *culture*. This context incorporates specifics about the nation, region, state, province, principality, neighborhood, community, and at the most minute level, perhaps even the building where a person lives. Broadly speaking, the location in which a person is dying influences the experience, with its unique structure, resources, and systems. So too do the set of norms and values that characterize the group of people in which the dying person is situated. This context also incorporates the particular point in history at which a person is dying. Dying and death in the late 1800s were different processes than dying will be in 2050: changing technology, medical advances, mores and values, legislative policies, reimbursement structures, and other features all influence a person's journey through dying.

To return to the original point, dying is a unique experience for that *person*, in that *family*, in that *culture*, and at that place in *time*.

### **Mental Health at the End of Life**

People near the end of life grapple with a variety of challenges that could have an impact on their mental health. These include serious medical conditions that bring a host of symptoms such as pain, fatigue, dyspnea, nausea, and constipation; intrusive treatments that often have side effects as debilitating as the disease they are meant to treat; functional limitations that interfere with activities of daily living and prompt increased dependence on others for assistance; the sheer amount of time spent in organizing and attending appointments with health-care providers, requiring a person to step out of the routine most people follow and live

instead according to other people's schedules and availability; financial obligations related to treatments and short or long stays in institutional settings; and, of course, living with the knowledge of one's foreshortened future and the uncertainty of what that future might bring. It is no wonder, then, that people who are dying are vulnerable to sadness, worry, and dread. Still, not every person who is dying is distressed.

The World Health Organization defines mental health as, "A state of well-being in which every individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to her or his community" (World Health Organization 2001). Note that this definition does not focus on the *absence* of significant psychological distress, but instead the *presence* of activities that promote continued engagement with life, even as death nears. Therefore, psychological assessment and intervention should focus on classic mental health symptoms, such as depression and anxiety, but they should also address ways to enhance psychological well-being more broadly. People who are dying also may benefit from interventions that help them clarify their goals and values, adopt useful coping skills, use effective communication strategies, maximize remaining abilities, and grapple with questions about identity and meaning in the face of mortality.

Moreover, to assume that dying is an entirely negative experience overlooks the varied positive outcomes that some people experience. That includes an incentive, however unintended, to review one's life and to reach a level of understanding and appreciation of what one has accomplished. An enhanced depth of relationship with friends and family is also possible, as is achieving a clarity of purpose necessitated by limited time remaining. Getting one's "house in order" can lead to reconnection, reconciliation, and renewal in unexpected ways.

Significant psychiatric problems do occur as people are dying, however, and their detection and treatment should be pursued with the same diligence as would be the case in any other group. Frank clinical syndromes are common in people with severe illnesses. These include depressive

disorders (e.g., major depressive disorder), anxiety disorders (e.g., panic disorder, specific phobias), trauma- and stressor-related disorders (e.g., posttraumatic stress disorder), substance-related disorders (e.g., alcohol-use disorder), sleep-wake disorders (e.g., insomnia disorder), and, perhaps more rarely, eating disorders (e.g., anorexia nervosa, bulimia nervosa). These are the syndromes listed and described in taxonomic systems such as the International Classification of Diseases (ICD) and the Diagnostic and Statistical Manual of Mental Disorders (DSM-5). Equally influential to quality of life is the presence of subsyndromal symptoms that, though less severe, are nonetheless distressing. Examples of those symptoms include apathy that leads to unhelpful social isolation, restlessness that depletes energy that could be spent on more affirmative activities, and rumination that distracts from important contemplation. Subsyndromal symptoms are common and deserve equal attention and intervention.

Mental health considerations are relevant to family and friends as well. Even before death, symptoms of grief may appear in a caregiver, and that sadness may be a natural response to an impending death. For example, in the case of a patient with advanced dementia, caregivers may begin to grieve as the disease follows its natural course, sometimes years before death. After death, grief is also a natural response. Although some experiences are common during bereavement (disbelief, sadness, longing, guilt), they are not ineluctable in sequence or duration. Variations in the experience are likely depending on the circumstances of the death, nature of the relationship with the person who died, and the time since death, among other factors. However, there is a difference between expected grief and *prolonged grief disorder*. The former is a natural emotional reaction to loss that does not impair a person's functioning to any great extent and typically resolves with time. The latter, on the other hand, is a more severe form of grief with a distinct symptom pattern that can include intense yearning for the deceased, bitterness over the loss, and difficulty accepting the loss. Prolonged grief disorder also appears to have a different response to treatment (Prigerson et al. 2008).

## Psychological Assessment

Caring for people at the end of life requires knowing how they are thinking and feeling about their experience. Therefore, astute psychological assessment is the linchpin of care. When learning about a person with serious illness, psychologists will want to investigate traditional mental health symptoms, such as current and past anxiety and depression, but a comprehensive assessment will extend far beyond those symptoms. It is equally important to know about a range of topics covered in a usual clinical interview – a person’s educational and work history, social support network, financial concerns, and spiritual philosophy – but also other features of a person’s psychology that may matter to their current circumstances, preferred learning style, past coping strategies, and personality. Of course, extensive knowledge about a person’s medical circumstances represents an important foundation for many, if not most, conversations. That includes asking patients about their understanding of their disease, prognosis, and current treatment regimen (and comparing that to information provided by the patients’ health-care team, noting any discrepancies). A comprehensive psychological assessment involves multiple methods that may include interviews, questionnaires, and observations. Moreover, a comprehensive psychological assessment is multimodal and may involve input from patients themselves but also family, friends, medical records, and an array of health-care providers.

Given that some people who are dying may be quite limited in their ability to provide information themselves, due to cognitive or physical limitations, thought and care need to be given to how and when to obtain assessment details. Clinicians will need to consider the impact of sensory limitations, speech and language abilities, stamina, and consciousness that may fluctuate due to disease, treatments, and the dying process. Maximizing a patient’s communication abilities means understanding these factors and managing the assessment, so tools (e.g., reading glasses, large-print materials) and timing (e.g., at the patient’s best time of day, when there are few distractions

and symptoms are well managed) are to the patient’s benefit.

When a person is dying, there are likely urgent or at least proximate medical needs that dominate the situation, but it would be a mistake to overlook the role that frank psychopathology may play in the quality of a person’s life at the end of life. The prevalence of psychiatric symptoms is quite high in people with life-limiting illness, and clinicians should investigate their presence as they would in any referral. Although studies vary widely in their estimates, mood and anxiety disorders may be present in more than a third of patients (Solano et al. 2006), and disorders based on DSM-5 or ICD-10 diagnostic criteria should be fully investigated. Self-report questionnaires can be used to assess symptom severity (as well as progress in treatment). Well-validated instruments include the Hospital Anxiety and Depression Scale (HADS), the Patient Health Questionnaire (PHQ-9), the General Health Questionnaire (GHQ-12), the Geriatric Depression Scale (GDS), and the Geriatric Anxiety Inventory (GAI).

One overarching suggestion in any kind of assessment is to remain mindful of the overlap between physical and psychiatric symptoms. It can be difficult, but very important, to tease apart symptoms that are due to a disease or its treatment from symptoms due to a psychological process. Indeed, the two may be interrelated. For instance, low energy may be a symptom of depression or an effect of chemotherapy, or both. Dyspnea may be a symptom of anxiety or related to chronic obstructive pulmonary disease, or both. Consequently, focusing on cognitive symptoms (e.g., hopelessness, worthlessness, guilt, fear, dread, rumination) may be more useful when determining the reason for a patient’s symptoms (American Psychological Association 2007).

A final consideration has to do with the challenge of measuring constructs that are manifestly important when talking with patients who have serious illnesses but that defy the tools we have available. Patients (and caregivers) talk about forgiveness, acceptance, peace, dignity, and readiness to die, but scale development and assessment innovation have not been as important to the field as those concepts are to patients.

## Psychological Interventions

Psychological challenges appear throughout the experience of living with serious illness. Psychological support can be useful throughout the experience as well. Beginning with the point at which a life-limiting diagnosis is made, psychologists can help patients understand their diagnosis, manage emotional reactions, communicate treatment preferences, and mobilize supports. As illness progresses, psychologists can offer both supportive and change-oriented interventions to promote adaptation to shifting circumstances. Following death, psychologists can provide services to the bereaved. Psychological interventions are relevant not only to patients but also to their informal caregivers and to their health-care providers, who may from time to time seek opportunities to help them cope with the stress of working in end-of-life care.

Selecting a treatment approach depends on the goals of the patient and targets for intervention. Treatments for psychopathology or subsyndromal symptoms that have been validated in other patient populations are reasonable alternatives to consider: evidence-based cognitive-behavioral, interpersonal, and brief psychodynamic approaches may be useful, though those treatments have not been validated in patients with serious illness, and modifications may be needed in end-of-life circumstances (Kasl-Godley 2011). Other approaches may contain elements with obvious face validity for people who are dying. Acceptance and Commitment Therapy (ACT) (Hayes et al. 2012), with its focus on acknowledging symptoms rather than trying to change or dismiss them, may help patients whose symptoms may, in reality, not improve. Likewise, existential therapies that concentrate on meaning making in the face of mortality have obvious application (Spira 2000).

Recently, several new types of psychotherapy have been developed that are specifically designed to address the psychological well-being of patients near the end of life. The two with the most empirical data so far regarding their efficacy are Dignity Therapy and Meaning-Centered Group Therapy. Dignity Therapy (DT)

(Chochinov et al. 2005) uses a set of facilitated questions posed by the therapist to help patients identify past accomplishments, values, and goals. Themes that are addressed include generativity, the continuity of self, role preservation, the maintenance of pride, hopefulness, and concerns about the aftermath of one's death. DT sessions can be recorded, and a transcript can be used to create a "legacy document" that captures the patient's life in a form that can be shared and retained by family members. Patients and family member report that DT is helpful, although its impact on anxiety, depression, and quality of life is less clear. Meaning-Centered Group Therapy (MCGT) (Breitbart et al. 2004) combines existential and cognitive-behavioral techniques to help very ill patients restore meaning to their life. MCGT involves eight, weekly group sessions, 90 min in length that include didactics, discussion, and experiential exercises to help patients understand their illness and sustain hope and meaning. Recent evaluations of MCGT have found significant improvement in sense of meaning, faith, and spiritual well-being and significant decline in symptom-related distress and a desire for death.

## Competence in Diversity and Inclusion

People arrive at the end of their life having traveled many different paths. Therefore, although dying ends in the same, universal cessation of basic biological functions, how it happens, and how people feel about it, vary widely. Each person has a unique developmental history that shapes his/her experience at the end of life, and health-care providers need to consider how individual differences might matter. Moreover, differences across nations, regions, and cultures can affect how an illness is experienced, how choices are weighed, how the health-care system operates, and the dynamics of personal and professional relationships. Generalizations about how racial or ethnic groups approach end-of-life issues may be a starting point, but only a starting point. It may be more useful to pay attention to cultural scripts, but recognize variability within groups based on socioeconomic status, acculturation, spiritual

beliefs, and other factors likely to vary from person to person (Smith et al. 2009).

In the usual domains of psychological practice – assessment and intervention – several considerations are important. Norms on many common assessment instruments are rarely available for particular groups based on age, gender, race/ethnicity, and socioeconomic status, and they are even more rare for people within those groups who are dying. Consequently, there is relatively little information about what is “normal” at the end of life in terms of psychological constructs in the domains of emotion (e.g., variations in positive and negative affect), cognition (e.g., decision-making processes), and personality (e.g., locus of control). In terms of evidence-based psychological treatments, interventions designed for the end of life are so fledgling that there have been virtually no systematic evaluations of their effectiveness in subgroups of diverse patients. Therefore, providers will have to be flexible and open-minded in their practice, making sure to inquire about the background, experience, beliefs, and preferences of the particular patient and family with whom they are working.

### **Palliative Care and Hospice**

One common point of confusion among the public, and even some health-care professionals, is the relationship between palliative care and hospice. Palliative care is a broad category of care designed to help people coping with serious illness. This type of specialty care is, according to the World Health Organization, “an approach that improves the quality of life of patients and their families facing the problems associated with life-threatening illness, through the prevention and relief of suffering by means of early identification and impeccable assessment and treatment of pain and other problems, physical, psychosocial and spiritual” (<http://www.who.int/cancer/palliative/definition/en/>). As such, palliative care is provided to people throughout the disease trajectory, from diagnosis to death; in a variety of care settings, from home to outpatient and inpatient; to any type of patient, from children to older adults;

and with any type of severe disease. Palliative care generally involves a holistic, interprofessional approach to care that can benefit both patients and family members. A growing body of research suggests that not only does palliative care improve quality of life, but it also extends life for some patients while at the same time reducing costs (Higginson and Evans 2010; Morrison et al. 2011).

Hospice, by contrast, is a particular type of palliative care. This service adopts a palliative care philosophy when supporting patients very near the end of life. Like palliative care, hospice can be offered to any type of patient, with any type of life-limiting illness, and can be provided at home or in a residential or institutional setting. In the United States, hospice has included a suite of services, reimbursed by the Medicare Hospice Benefit, as a complement to other health-care services a patient might receive. Traditionally, patients are eligible to receive hospice care when a physician certifies that a patient has fewer than 6 months to live. In addition, hospice is offered if patients are no longer pursuing curative treatments. In recent years there has been some movement to reduce these restrictions, with some pilot programs testing more relaxed eligibility criteria. In general, however, hospice is reserved for patients very close to death, whereas palliative care is appropriate, and perhaps most beneficial, when initiated early in the course of a disease.

### **Interprofessional Collaboration**

Because end-of-life care aims to enhance quality of life broadly, it addresses patient needs in many domains. A biopsychosocial-spiritual approach to care recognizes the complex interplay among a patient’s medical condition and treatments, psychological adaptation to serious illness, the social context in which the experience of illness occurs, and a person’s spiritual interpretation of their circumstances. As a result, a team of professionals is typically involved in providing end-of-life care. That team can include a broad range of professionals from many disciplines, all of whom have something important to add to a patient’s care.

A typical palliative care team, for instance, includes a physician, nurse, social worker, and chaplain. In some settings, end-of-life care is also provided by psychologists, psychiatrists, occupational therapists, physical therapists, speech-language pathologists, pharmacists, dieticians, aides, and homemakers. Hospice also utilizes volunteers for peer support. Of course the most essential members of the team are the patient and the family, who bring their own perspective, expertise, expectations, and needs.

The concept of collaborative care has evolved in recent years, as the importance of an integrated effort has become more apparent. Teams were first known as “multidisciplinary,” with professionals from different disciplines developing their own independent treatment plans for patients that were later shared among team members. The terminology changed to “interdisciplinary teams” when team members from different disciplines were encouraged to assess and develop a treatment plan collaboratively. More recently, the term “interprofessional team” has come into widespread use, with an even greater emphasis on team members understanding and appreciating the contributions of each discipline. Therefore, a true interprofessional team that provides end-of-life care would concentrate its efforts on sharing information and expertise to develop an integrated care plan that involves several disciplines, each contributing unique expertise that dovetails with that of other disciplines. Effective interdisciplinary care depends on several factors, including timely and comprehensive communication among team members, a shared philosophy about care, transparent decision-making, a clear delineation of roles, respect for the competencies each discipline brings to the care plan, and provision of mutual support (Hanks et al. 2009). This model of care is likely to become even more preeminent as its benefits become more widely substantiated.

### Supporting Formal Caregivers

Emotions run high in much of end-of-life care because the decisions are complex, time is limited, and the stakes are high. Stress is unavoidable,

and a genuine challenge for providers is finding a way to manage it. Without doing so, burnout is likely. Signs of burnout include emotional exhaustion, pessimism, cynicism, and self-doubt (Maslach 2001). Providers who are burned out may find themselves disengaging from patients, maintaining a more safe emotional distance in order to avoid any disappointment or sadness. Risk factors for burnout include occupational time pressure, frequent exposure to suffering, interprofessional team conflicts, and uncertainty about one’s professional competence. At the same time, protective factors include having ample time to spend with patients and families, receiving adequate training about communication principles, stable personal and professional relationships, and positive professional appraisal (Pereira et al. 2011). In the face of burnout, effective interventions involve obtaining peer consultation and supervision, seeking continuing education, establishing a satisfying work-life balance, and recognizing when down time is needed and taking it (Vachon 2006).

One role that psychologists can play in end-of-life care is supporting other providers in their work. With expertise in the interplay among thoughts, emotions, and behavior, psychologists are in a unique position to educate and intervene to help individuals and teams manage the challenges of the intensity of end-of-life care. As they educate staff about the mental health needs of their patients, so too can they educate staff about how to promote their own mental and physical health. Psychologists also may be called in to facilitate support or process groups to help teams work more effectively.

### Ethical Issues

That so many ethical issues arise in end-of-life care is perhaps an indication of the importance of this moment in a person’s life. It brings to a close every other chapter of life that preceded it, and it is therefore invested with great meaning for individuals, families, and cultures. At the same time, ethical issues arise in end-of-life care because it is a nexus for complicated, fast-moving, multifaceted

situations that involve many people and many difficult decisions. Broadly, many of these ethical issues center on autonomy: the extent to which an individual has the opportunity (and ability) to live and die when, where, and how they wish. People have strong preferences regarding the end of their lives, and those preferences intersect with beliefs within the family, proscriptions dictated by faith traditions, and guideposts articulated by legal doctrine and public policy. Ethical quandaries arise when there is tension between opposing beliefs or ideas. For example, ethical principles are in conflict when deciding whether a patient who is in severe pain should be treated with morphine (respecting the ethical principle of beneficence), even though that treatment might lead to the patient's extreme sedation and might even hasten death (the ethical principle of nonmaleficence). Many health-care organizations have in place trained ethics committees to help patients, family, and staff weigh complex decisions, though these decisions are rarely easy.

## Conclusion

Dying and death are universal human experiences, yet conversations about them are relatively rare in contemporary society. That is generally true within the field of psychology as well, although there is an obvious role for the discipline in research, education, and practice in this area. Indeed, as science reveals the increasingly interconnected nature of the body and the mind, and as health-care adopts integrated, interprofessional models, psychology has much to add to end-of-life care. Assessments and interventions with patients and families are foundational contributions, even if they are in their fledgling stages of development. There are great opportunities, great challenges, and great satisfactions in this work, present at the zenith of life.

## Cross-References

- ▶ [Acceptance and Commitment Therapy](#)
- ▶ [Anxiety Disorders in Later Life](#)

- ▶ [Cognitive Behavioural Therapy](#)
- ▶ [Decision Making](#)
- ▶ [Distance-to-Death Research in Geropsychology](#)
- ▶ [Family Therapy](#)
- ▶ [Grief and Bereavement: Theoretical Perspectives](#)
- ▶ [Interpersonal Psychotherapy](#)
- ▶ [Mental Health and Aging](#)
- ▶ [Mindfulness Approaches](#)
- ▶ [Palliative Care](#)
- ▶ [Psychodynamic and Humanistic Approaches](#)
- ▶ [Subsyndromal Psychiatric Disorders](#)

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## English Longitudinal Study of Aging (ELSA)

Nina T. Rogers<sup>1</sup>, James Banks<sup>2,3</sup>, James Nazroo<sup>3</sup> and Andrew Steptoe<sup>1</sup>

<sup>1</sup>Department of Epidemiology and Public Health, University College London, London, UK

<sup>2</sup>Institute for Fiscal Studies, London, UK

<sup>3</sup>School of Social Sciences, University of Manchester, Manchester, UK

### Synonyms

Aging cohort; Health; Lifestyle; Retirement; Panel studies

### Definition

The English Longitudinal Study of Ageing (ELSA) (Steptoe et al. 2013a) is a multidisciplinary panel study that collects a comprehensive array of measures on a representative sample

of men and woman aged 50 and over who are living in England. Repeated measures covering health, economics, psychology, lifestyle, and social connections are collected from the same individuals over time, allowing researchers to study the dynamics of the aging process.

### The ELSA Sample and Study Design

ELSA is sampled from the Health Survey for England (HSE), a large annual cross-sectional survey on the health of the population of England (Mindell et al. 2012). Sample members recruited at wave 1 (2002/2003) were individuals who had previously taken part in 1 of 3 years of the HSE (1998, 1999, and 2001) and were aged 50 or over at the time of the wave 1 interview. Subsequent ELSA data collection waves have taken place biennially, in 2004/2005 (wave 2), 2006/2007 (wave 3), 2008/2009 (wave 4), 2010/2011 (wave 5), 2012/2013 (wave 6), and 2014/2015 (wave 7). The eighth and ninth waves of data collection are planned for 2016/2017 and 2018/2019, respectively.

New study participants are recruited during some waves in order to compensate for the aging sample population and to refresh the younger age groups. This serves to maintain representation of all ages 50 and over in ELSA. Refreshment sampling to date has recruited members aged 50–52 at wave 3 (HSE 2001–04), aged 50–74 at wave 4 (HSE 2006), aged 50–55 at wave 6 (HSE 2009–11), and aged 50–51 at wave 7 (HSE 2011–12), with plans to continue to recruit new sample members aged 50–51 at future waves.

The “core members” of the ELSA sample are individuals aged 50 and over, living in private residences, who were recruited through HSE at either the first wave of ELSA or at any of the subsequent refreshment samples. The data also includes interviews with “young partners,” who are individuals under the age of 50 whose partners are core members and “new partners” in the correct age range who entered relationships with core members after those members were recruited to ELSA.

## Mode of Interview

Data are collected from respondents in their own home, every 2 years and by means of a computer-assisted personal interview (CAPI) that is delivered by a trained interviewer. The CAPI includes questions on the respondents' demographics, household membership, work and retirement activities, economic circumstances, health, and behavior. A self-completion questionnaire includes questions on well-being, social participation, quality of life, and social networks, along with questions considered to be sensitive. The main interview takes approximately 85 min to complete for an individual interview and around 2 h when two people within the same household are interviewed concurrently.

At waves 2, 4, and 6, core members who completed a main interview were offered a visit from a qualified nurse, where a blood sample was taken and a series of performance and biomedical tests were conducted. The nurse visits took place soon after the main interviews and were of similar duration to the main interviews.

Unless they expressly ask to leave the study, all participants who decline to be interviewed in a given wave are offered a full interview at each future wave. From wave 3 onward, individuals electing to leave the study, or those who had declined to take part in two consecutive face-to-face interviews, were offered a telephone interview as an alternative to the standard interview. The telephone interviews were approximately 10 min long and respondents were asked a small number of questions about their health, work and benefits, marital status, and accommodation. As well as providing limited information in their own right, these telephone interviews are also a useful strategy for retaining sample members who might otherwise leave the study, with some agreeing to a full interview at future waves.

Individuals at wave 1 were not recruited if they lived in institutions such as retirement homes, elderly care facilities, hospices, or prisons. From wave 3 onward, any respondent who had previously taken part in a main interview at wave 1 but had later transitioned into a care home or other institution was deemed eligible for interview. As a

consequence of this, researchers now have the opportunity to study the circumstances that surround a respondent's move from a private residence to an institution. In situations when study participants have been unable to consent to an interview for themselves, because of a physical, mental, or cognitive disability, a proxy informant, usually a close family member or friend, has been asked to complete a 20-min interview on the participant's behalf. The proxy interview focuses mainly on key demographic information and general health status, omitting attitudinal questions that a third person is unlikely to be able to answer. Prior contact with a respondent who later requires or requests interview-by-proxy gives opportunity to researchers to ascertain what factors and mechanisms might contribute to later life disability or impairment.

An end of life (EOL) interview was introduced into ELSA at wave 2. The EOL interview aims to capture important information about how a deceased study member's life might have changed in the years before their death and how their assets were distributed after their death. Like proxy interviews, EOL interviews are generally undertaken with a close family member or friend and include questions on the health of the deceased, any care or support they had received, their mood and memory, problem behavior and financial questions such as funeral expenses, inheritances, and private health care. EOL interviews have taken place at waves 2, 3, 4, and 6 with a response rate of 66% ( $n=135$ ), 54% ( $n=375$ ), 58% ( $n=242$ ), and 74% ( $n=242$ ) from all issued cases, respectively.

## Response Rates

Cross-sectional response rates at a given wave of ELSA are calculated by dividing the total number of respondents by the total number of individuals deemed eligible for that wave. Response rates are based on core members and not on those who have died, who have moved to an institution or care home, or who are living outside the UK. Waves 1, 2, 3, 4, 5, 6, and 7 have achieved response rates of 66%, 82%, 73%, 74%, 80%,

78%, and 77%, respectively. These response rates include both those who were eligible for wave 1 and refreshment sample members who joined the study at later waves. By wave 6, 56% of all eligible wave 1 core members had given an interview at every wave of ELSA.

Much like other panel studies, the success of ELSA is dependent on the retention of respondents for follow-up interviews. Loss to follow-up can occur because respondents are no longer eligible for interview, and for ELSA, this includes those who have died or who have moved outside of the UK. The majority of respondents who are deemed ineligible to participate in ELSA are participants who have died: 23.5% ( $n=2680$ ) of the core sample members at wave 1 ( $n=11,391$ ) had died by wave 6. There is strong evidence to suggest that within the ELSA sample, participants with higher numeracy are less likely to drop out of the study compared with their less-numerate counterparts. Higher levels of education also appear to predict lower levels of attrition, but this association appears to be limited to younger respondents (i.e., those aged 50–64) (Banks et al. 2011). Lower retention rates have also been reported in ELSA compared with HRS, but the mobility of respondents, maturity of the study, interviewer quality, and sampling methods were not found to be sufficient to explain the gap in attrition between the two studies; rather it was suggested that higher incentivization in HRS compared with ELSA and cultural differences in the willingness of the two populations to take part and remain in scientific surveys might explain the difference (Banks et al. 2011).

**Weighting:** Cross-sectional and longitudinal weights are produced to minimize any bias resulting from differential nonresponse and to ensure that the respondent sample is representative of the population of interest (adults aged 50 and over living in private households in England). At wave 1, a weight was derived to minimize any unrepresentativeness of the sample population due to nonresponse at HSE, refusal to be interviewed post-HSE, and nonresponse at wave 1. Derivation of the weight involved calibration of the age-sex profile of core member

respondents to that of the population represented by the Census 2001. Wave 2 weights were calculated to adjust for differential nonresponse between waves 1 and 2 and population representativeness. From wave 3, refreshments were added to the main sample, requiring the need for separate cross-sectional and longitudinal weights. Separate weights have been produced to address differential nonresponse for interview completion, completion of the self-completion questionnaire, participating in a nurse visit, and giving a blood sample at waves 2, 4, and 6. A detailed description of the weights can be found in the user guides and technical reports that can be accessed at <http://www.elsa-project.ac.uk/>.

**Linkage to administrative data:** Since ELSA's inception, respondents have been asked to give their permission to link their survey data to National Health Service (NHS) Hospital Episode Statistics (HES) data, which contain details of diagnosis, treatment, length of stay, and type of discharge. Respondents have also been asked to give permission to link their records to the NHS Central Register mortality data and cancer registration data. Year and age of death information for deceased respondents is available. Analysts who wish to utilize the detailed mortality data, HES, or cancer data are able to request special permission to access this data. Permission from respondents was also obtained to link survey data to official records of national insurance contributions, welfare and benefit receipt, and details of any tax credits they may be claiming, and these data will be available to analysts shortly.

## Data Access

Anonymized archived data from ELSA are available from the UK Data Service (UKDS, <https://www.ukdataservice.ac.uk/>). The main dataset is made available to *bona fide* researchers on submission of a request to UKDS. The archive data are used primarily by academics and government departments. Requests for restricted data (geographically more detailed and/or relating to administrative data linkages) can be made by

application to the ELSA Linked Data Access Committee; an application form can be found at [www.ifs.org.uk/elsa](http://www.ifs.org.uk/elsa).

## International Comparisons of Health at Older Ages

To enable cross-country comparisons, ELSA has been developed with close consideration of its two sister studies, the Health and Retirement Study (HRS; USA) and the Survey of Health, Ageing and Retirement in Europe (SHARE; 20+ European countries and Israel). HRS, ELSA, and SHARE have also been used as models for the development of other aging studies such as the Irish Longitudinal Study on Ageing (TILDA), the Northern Ireland Cohort for the Longitudinal Study of Ageing (NICOLA), the China Health and Retirement Longitudinal Study (CHARLS), the Korean Longitudinal Study on Ageing (KLoSA), the Mexican Health and Aging Study (MHAS), the Japanese Study of Aging and Retirement (JSTAR), and the Brazilian Longitudinal Study of Health, Ageing and Well Being (ELSI-Brasil). Understanding which factors drive national differences in factors such as retirement, chronic disease, and mortality is pivotal for informing policies aimed at improving health and well-being. For example, comparison of disease rates in ELSA and HRS populations revealed that at every wealth level the English population in late middle age has lower levels of diabetes, hypertension, heart disease, myocardial infarction, stroke, lung disease, and cancer and lower mean levels of C-reactive protein, high-density lipoprotein, and cholesterol levels than their US counterparts (Banks et al. 2006). Although older adults in the USA appear to suffer higher burdens of chronic disease, they have been reported as being cognitively healthier than older adults in England (Langa et al. 2009), and when health is operationalized into functional domains that include measures of pain, cognition, disability, depression, and physical performance rather than defined by absence of disease, English adults were found to be only slightly healthier than US adults (Cieza et al. 2015).

## Content of Waves 1–7

Respondents are not always subject to the same questions at every wave of ELSA. Instead some questions are rotated on and off successive waves of the study, often to allow time to include new questions. The information in Table 1 provides a broad overview of the content included in ELSA. The primary content of the survey is arranged in separate modules that broadly focus on health, work, financial circumstances, cognitive function, and psychosocial measures. A number of substudies are also ongoing and each primary module and substudy is briefly detailed below.

### Health Module

The health module includes self-report measures of general health and physician-diagnosed conditions including mental illnesses, longstanding illness/disability, symptoms indicative of particular health conditions and health behaviors. There are also objective measures relating to gait speed, physical performance, anthropometrics, and biological markers. During wave 6, a module on sexual relationships and activities was introduced to the study. A report covering sexual activity, problems with sexual functioning, and concerns about sexual health has subsequently been published (Lee et al. 2016). Information on drug prescription and adherence data was first collected during the nurse visit at wave 6 and will be repeated at wave 8, with the aim of producing a unique national longitudinal dataset on medication use in an aging population. The name of each prescribed medicine was recorded and allocated a code number corresponding to the British National Formulary (BNF) listing. Collection of polypharmacy data should provide an opportunity for a deeper understanding of the factors that contribute to successful use of prescribed drugs in older people. At wave 7, an objective measure of hearing ability was introduced to the study to further complement the self-reported hearing questions that were already present in the survey. The HearCheck device, developed and produced by Siemens (Munich, Germany), is a handheld device with an ear cup that is held against the respondent's ear (Parving et al. 2008).

**English Longitudinal Study of Aging (ELSA), Table 1** Information collected in the ELSA, waves 1–7. For measures not administered at every wave, the brackets denote the wave of data collection

<p><b>Demographic data</b></p> <p>Household membership</p> <p>Living relatives</p> <p>Marital status</p> <p>Ethnic group and country of birth</p> <p>Educational qualifications</p> <p>Age completed full-time education</p> <p>Occupation of main carer when respondent was 14 years old</p> <p>Parents age and cause of death</p> <p><b>Income and assets</b></p> <p>Earnings</p> <p>State benefits</p> <p>Sources of income</p> <p>Financial and physical assets</p> <p>Primary housing wealth and mortgage debt</p> <p>Business wealth</p> <p>Debt</p> <p>Life insurance</p> <p>Lifetime receipt of inheritance and gifts (6,7)</p> <p><b>Pensions</b></p> <p>Current pension plan and past pension details</p> <p>Current contributions</p> <p>Accrued pension wealth (self-reported)</p> <p>Knowledge of female state pension age (3–7)</p> <p>Knowledge of male state pension age (6,7)</p> <p>State pension deferral (4–7)</p> <p><b>Employment</b></p> <p>Job details, normal pay and hours</p> <p>Health and work disability (2–7)</p> <p>Age and reasons for retirement if retired</p> <p>Employer name and permission to contact</p> <p>Desired, offered, and requested workplace adaptations (2–7)</p> <p><b>Social and civic participation</b></p> <p>Provision of unpaid help</p> <p>Informal caregiving and volunteering</p> <p>Civic, social, and cultural participation</p> <p>Accessing local amenities and services (1–2,4–7)</p> <p>TV watching (4–6)</p> <p>Social networks and support</p> <p>Social isolation and loneliness</p> <p>Transport</p> <p>Social capital (1, 3,7)</p> <p>Perceived discrimination (5)</p> <p>Religiosity (5)</p> <p>Digital inclusion (6,7)</p> <p><b>Psychosocial factors</b></p> <p>Control and demand</p> <p>Effort–reward balance (2–7)</p> <p>Subjective social status</p> <p>Age at which middle age ends and old age begins (1,3,7)</p> <p>Self-perceived age (2,4,6,7) and desired ages (2,4)</p> <p>Experience and perceptions of aging ( )</p> <p>Sense of collectiveness (4)</p> <p>Altruism (4)</p> <p>Pet ownership (5)</p>	<p><b>Consumption</b></p> <p>Housing (rent and mortgage)</p> <p>Vehicle and durables ownership</p> <p>Fuel, leisure, clothing (2–7), food, health insurance</p> <p>Transfers, charitable giving/child trust funds (2,4–7)</p> <p><b>Expectations</b></p> <p>Mortality, employment, inheritances, and bequests</p> <p>Income</p> <p>Adequacy</p> <p>Ability to work</p> <p>Movement into nursing home (2, 6, 7)</p> <p>Perceived financial position (2–5)</p> <p>Future housing and care needs (6,7)</p> <p>Paying for care and knowledge of care funding (7)</p> <p><b>Health</b></p> <p>Self-reported health</p> <p>Disability and mobility; aids, sources of help, who pays</p> <p>Eyesight and hearing (self-report)</p> <p>Objective HearCheck hearing test (7)</p> <p>Dental health (3,5,7)</p> <p>Physician-diagnosed conditions (self-report)</p> <p>Falls, fractures, pain and joint replacements</p> <p>Urinary incontinence and bowel incontinence (6,7)</p> <p>Menopause (4–7)</p> <p>Sexual function and attitude (6)</p> <p>Cancer screening (5, 6,7)</p> <p>Polypharmacy (6)</p> <p>Psychiatric and emotional problems</p> <p>General health questionnaire (GHQ-12)</p> <p>CES-D depression scale</p> <p><b>Health behaviors</b></p> <p>Physical activity – in general and at work</p> <p>Alcohol consumption</p> <p>Smoking status and history</p> <p>Consumption of fruit and vegetables (3–7)</p> <p>Sleep duration and disturbance (4,6)</p> <p><b>Cognitive function</b></p> <p>Memory: word list recall, immediate and delayed recall</p> <p>Memory: prospective (1–5)</p> <p>Executive function: letter cancellation – accuracy and speed of mental processing (1–5)</p> <p>Executive function: word finding (1–5 and 7)</p> <p>Numerical ability (1,4,6,7)</p> <p>Literacy (2,5,6,7)</p> <p>Fluid intelligence (6)</p> <p>Backward counting from 20 (7)</p> <p>Serial 7s counting backward from 100 (7)</p> <p>Naming objects (7)</p> <p>Quality of cognitive interview (interviewers assessment)</p> <p>Proxy interview of cognitive function – IQCODE scale (2–7)</p> <p><b>Physical examination and performance</b></p> <p>Walking speed (for ages 60 and over)</p> <p>Height and weight; waist and hip circumference (2,4,6)</p> <p>Blood pressure</p> <p>Lung function</p> <p>Chair stands; balance, leg raises, and grip strength (2,4,6)</p>
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*(continued)*

**English Longitudinal Study of Aging (ELSA), Table 1** (continued)

Psychological and social well-being Quality of life (CASP-19) Satisfaction with life scale – (2–7) Ryff well-being scale (2 subsample) Positive affect (5) –6? Personality (5) Time use and affect (6,7) ONS well-being questions (6,7)	<b>Blood assays</b> DNA extraction and storage (2,4,6) Total LDL and HDL cholesterol and triglycerides (2,4,6) C-reactive protein, fibrinogen (2,4,6) Glucose, glycated hemoglobin (2,4,6) Hemoglobin and ferritin (2,4,6) White blood cell count (4,6) IGF-1, DHEAS (4) Vitamin D (6) Biological samples: Cortisol – from hair (6), from saliva (2,4)
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The participant is asked to indicate when they hear a beep, and a detection threshold is recorded.

### Financial Circumstances Module

ELSA captures detailed information on all aspects of the household budget and on economic circumstances including wealth holdings, household income, pensions, consumption, future expectations, employment, and retirement and work disability (see Table 1). In an aging world, where individual pension provision is becoming an increasingly important issue and more complex decisions need to be made at increasingly older ages, it is vital that individuals are able to understand the financial choices available to them in terms of savings, annuitization, insurance, and other related choices. Using these data, it has been shown that numeracy levels are strongly correlated with knowledge and understanding of pension arrangements, perceived financial security, measures of retirement saving, and investment portfolios, even after controlling for factors such as cognitive ability and educational qualifications. This suggests that simple retirement planning information could be beneficial to low-numeracy and low-education adult groups (Banks and Oldfield 2006).

Engagement of older adults in paid work is becoming a policy issue of major importance, in part because of the economic pressures of an aging population. ELSA captures details on many aspects of employment including current work status, types of work performed, and reasons for remaining in or for leaving work. The study also contains questions on whether health problems limit the respondent's ability to carry out paid work and the level of physical activity

required to carry out a current job. It is not only through paid work that older adults contribute to society as many partake in productive activities such as volunteering and caring and details of these activities are also captured in ELSA.

In recent years, there has been an increasing focus on the wealth holdings of older people, especially with respect to different types of costs that older adults will face, such as funding their future retirement needs and payment for long-term care. To help understand these issues, a new set of questions on perception of social care were added to the existing social care questions at wave 7 and included questions on whether respondents expect to need formal social care at home, whether they expect to pay for it, and their knowledge of care funding.

### Cognitive Function Module

The cognitive measures in ELSA are designed to assess cognitive ability across a number of dimensions, including learning and memory, word-finding ability, executive function, speed of processing, and numerical ability. At wave 7, the cognitive function questions were adapted to temporarily remove a measure of fluid intelligence and to add questions to identify early signs of dementia. New measures of cognitive function, taken from the mini-mental state examination were added at wave 7, which involved asking the respondent to count backward in ones from 20, to count backward in sevens from 100, and to name items and people from a standardized description. Cognitive test scores used in ELSA have been demonstrated to indicate risk of death from a number of chronic diseases (Batty et al. 2016).

### Psychosocial Measures Module

ELSA includes a significant number of measures related to psychological well-being, including scales for determining depression (CES-D), satisfaction with life (SWLS), and quality of life (CASP-19). Notably, these scales have been used in conjunction with other markers of health and physical performance in an attempt to understand the complex relationship well-being forms with physical health. High levels of well-being are a significant contributor to healthy aging, but maintaining positive well-being can present a challenge in older adults who are experiencing ill health, caring for a sick or disabled spouse, or suffering from bereavement. Higher levels of happiness and enjoyment have been found to be associated with reduced later life disability and mobility (Steptoe et al. 2014a), and increased pleasure and enjoyment of life have been linked to a reduced risk of incident frailty in ELSA participants (Gale et al. 2014). A sense of purpose and meaning in life has also been linked to increased survival (Steptoe et al. 2014b). It is clear that determinants of well-being in older adults extend beyond health concerns and higher levels of well-being have been reported in respondents who participate in social activities such as volunteering and paid work, providing that they felt adequately appreciated for their contributions (McMunn et al. 2009).

In addition, ELSA contains questions on social activities such as going to the museum, theater, cinema, and eating out and participation in organizations such as social clubs, religious groups, or committees. Data on the emotional closeness and amount of contact with a spouse or partner, children, and friends are also collected. It has been demonstrated that higher levels of social isolation, defined in terms of contact with family and friends and partaking in civic participation, is an independent predictor of survival (Steptoe et al. 2013b). ELSA collects information on the use of the Internet and email, and these measures have been linked to reductions in cognitive decline in older adults (Xavier et al. 2014). Questions on perceived discrimination were introduced to ELSA at wave 5. A recent study using data on perceived age discrimination revealed that individuals who

were older, less wealthy, and more educated and who had retired were more vulnerable to this type of perceived discrimination (Rippon et al. 2014).

### Substudies

#### Objective Physical Activity

Self-reported measures of physical activity have been used to demonstrate that taking up physical activity in later life is associated with reduced risk of developing major chronic disease, depressive symptoms, and physical and cognitive impairment (Hamer et al. 2014). Physical activity measures based on self-report are limited because they rely on accurate recall and accurate reporting. Respondents often fail to take into account the totality of their activity throughout the day, thus the need for objective data. During wave 6, a subsample of 330 respondents were given wrist-worn accelerometers for 7 days so that objective measures of physical activity could be recorded. The data are currently being analyzed.

#### Risk Preferences

A risk module aimed at measuring participants' willingness to take risk and to delay reward was carried out in wave 5 on a subsample of 1060 ELSA respondents. The module involved two incentivized tasks and the chance to win small amounts of real prize money. The risk module was designed as a computer-assisted self-administered interview but with a computer-assisted personal interview (CAPI) for those who wanted, or needed, the interviewer to assist them with operating the laptop.

#### Dementia

The inclusion of an assessment of dementia in the sample is vital if ELSA is to contribute to the better understanding of cognitive impairment at older ages. ELSA will conduct interviews in 2017 with about 1,000 ELSA participants aged 65 and older who have previously participated in four to eight waves of data collection. Respondents will be asked to complete additional cognitive tests that will provide accurate information about

cognitive abilities applicable to the diagnosis of dementia and the identification of mild cognitive deterioration. The tests will match those administered in HRS and which are themselves derived from the Aging, Demographics, and Memory Study (ADAMS).

### Retrospective Life History Interview

At wave 3, data from 7,855 participants were collected on upbringing, early life adversity, family structure, schooling, employment and earnings, parity and reproductive history, living conditions in residences at different stages of life, relationship with parents when they were a child, childhood health, smoking, and other important events in their lives. To aid recall of past events, a “Life History Calendar” was used to help individuals remember past circumstances more accurately. The aim of the interview was to collect data to understand the life course of respondents and to analyze associations between earlier life experiences and well-being, health, and economic circumstances in later life. A recent study that utilized these measures revealed that material poverty in childhood is linked to higher levels of depression, poorer memory, and slower walking speed in later adult life (Tampubolon 2015). A separate study has reported associations between early parenthood, larger family size, and poorer health outcomes in older adults (Grundy & Read 2015).

### Anchoring Vignettes

Interpretation of measures across different groups within a population sample, or across national contexts, is problematic because different groups may interpret similar situations differently. To try and circumvent this problem, respondents were asked in wave 3 to complete supplementary self-completion questionnaires on health or work disability that contained anchoring vignettes. Respondents were first asked to rate, on a five-point scale, various aspects of their own circumstance; they were then asked to do the same thing

for a hypothetical person with the same background and age as the respondent. Differences between the ways respondents rated hypothetical persons compared with themselves were then examined. Anchoring vignettes have recently been used to show that cultural differences in terms of mental health norms explain some of the differences in self-reported depressive symptoms between respondents in ELSA, SHARE, and HRS (Mojtabai 2015).

**ELSA Genome-Wide Association Study:** It is seldom that large-scale population studies possess both genome-wide genotyping data as well as a large array of phenotypic data. The inclusion of such information in ELSA has great potential to augment what is already known about how genomic variation is linked to disease risk and how certain characteristics interact to modify genetic susceptibility. In 2013/2014, we used the Illumina Omni 2.5–8 chip (Illumina Inc, San Diego, Ca., USA) to perform genome-wide genotyping of around 2.5 million single nucleotide polymorphisms (SNPs) and related genomic features for approximately 7,400 ELSA participants. The same genotyping chip had previously been used in HRS, enabling direct comparisons of the ELSA and HRS samples to be carried out without the need for imputation-based meta-analysis. The ELSA GWAS data have been deposited in the European Genome-phenome Archive (EGA) and are available to *bona fide* researchers. Data access is regulated by the ELSA Genetic Data Access Committee (EGDAC). Applicants can request access to the ELSA GWAS data with or without linkage to phenotypic information or can apply to commission genotyping, because not all the SNPs have been genotyped.

**Ethics:** All participants gave written informed consent at the recruitment wave to participate in the study and have given separate written permissions to allow linkage of their data to administrative data sources. At each subsequent wave, the participants’ consent to participate was reaffirmed in writing. Telephone interviewees gave verbal consent to participate.

Ethical consent for the study was granted by the NHS-REC and by the University College London Research Ethics Committee.

## Management of ELSA

From inception until 2014, the principal investigator of the study was Professor Sir Michael Marmot. In 2014, Professor Andrew Steptoe took over this role and is the current principal investigator and Professors James Banks and James Nazroo have been co-PIs of the study since its inception. Dr Nina Rogers manages the study. ELSA is a collaboration between the Department of Epidemiology and Public Health at University College London, the Institute for Fiscal Studies, the University of Manchester, and NatCen Social Research. The study has been supported in specialist areas by expert groups at the University of East Anglia, the University of Cambridge, the University of Exeter, and the University of Nottingham.

## Funding

Around half of ELSA's funding since wave 1 has come from the US National Institute on Ageing (NIA). Various UK government departments have provided substantial amounts of funding to ELSA and current sponsors include the Department for Work and Pensions, the Department of Health, and the Department for Transport. Previous funders of the ELSA include the UK Department of Education and Skills, the Department for the Environment, Food and Rural Affairs (DEFRA), Her Majesty's Treasury, the Department of Trade and Industry, Her Majesty's Revenue and Customs (formerly the Inland Revenue), the Office of the Deputy Prime Minister, and the Office of National Statistics (ONS). The Economic and Social Research Council currently coordinate funding between the UK government funders and ELSA.

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## Entrepreneurship and Aging

Rebecca Funken and Michael M. Gielnik  
Institute of Strategic HR Management, Leuphana  
University of Lüneburg, Lüneburg, Germany

### Synonyms

Elder entrepreneur; Gray entrepreneur; Second career entrepreneur; Senior entrepreneur; Third age entrepreneur

### Definition

Older entrepreneurship is the discovery, evaluation, and exploitation of future goods and services when in age 50 and above.

### Introduction

The world’s population will age dramatically. Increased life expectancy, declining fertility

rates, and the aging baby boom generation lead to a rising proportion of older people. By 2050, people aged 65 and above will constitute over 26% of the population in developed countries (Cohen 2003). The increase in older people will affect how and to what extent older people remain active participants in the workforce. A growing number of older people will stay in their jobs or remain economically active through other means (Kautonen et al. 2011). An interesting aspect of this changing involvement of older people in the economy is the phenomenon of the older entrepreneur (de Bruin and Dupuis 2003), also known as gray entrepreneur, senior entrepreneur, third age entrepreneur, elder entrepreneur, and second career entrepreneur (Weber and Schaper 2004).

### Definition of Older Entrepreneurs

Entrepreneurship is defined as the discovery, evaluation, and exploitation of opportunities to create future goods and services (Shane and Venkataraman 2000). This definition implies that entrepreneurship is a process with different phases of discovering, evaluating, and exploiting rather than a single event (Baron and Shane 2008). Outcomes of entrepreneurship include new businesses (i.e., new venture creation) but also business growth and innovations when managing the business. Entrepreneurship can thus be a continuous, lifelong process.

There is no agreement in the literature about what age the term “older” comprises (Weber and Schaper 2004). A possible cutoff point could be the retirement age, which is around 65 in many countries (Weber and Schaper 2004). However, many issues that confront older people in the workforce are also relevant for people in their fifties (de Bruin and Dupuis 2003). Some authors include people as young as 45 years of age, whereas for others the term “older” includes people of 60 years and above (Weber and Schaper 2004). Most scholars opt for a midpoint and define older entrepreneurship as starting a new business or being self-employed with age 50 and above (Ainsworth 2015).

Older entrepreneurship can thus be defined as the discovery, evaluation, and exploitation of future goods and services when in age 50 and above.

It is important to distinguish older entrepreneurs from older business owner. Older entrepreneurs recognize and evaluate business opportunities and then exploit or implement these opportunities to create something new (Shane and Venkataraman 2000). They can do this in the start-up phase to create a new business or within an existing business to grow and develop this business. Older business owners, in contrast, are defined as owning and managing a business, but they do not necessarily act entrepreneurially in the sense of identifying, evaluating, and exploiting new business opportunities. Older business owners own the business because they have either founded the business themselves or gained ownership through purchase or inheritance of the business. When the business owners have founded the business themselves, they have acted entrepreneurially at that time. Business owners who do not continue to identify and exploit new opportunities are not considered to be entrepreneurs. Thus, the tasks of the older entrepreneur differ from the tasks of the older business owner. The older entrepreneur deals with the identification and exploitation of new opportunities, whereas the older business owner manages an operating business. The difference between the concept of older business owner and older entrepreneur is also evident in data on the prevalence of older entrepreneurship.

### Prevalence of Older Entrepreneurship

In general, the probability of being a business owner increases with age (Blanchflower 2001). People are gradually more likely to become a business owner through founding, buying, or inheriting a business and thus “flow into entrepreneurship” (Blanchflower 2001). Once being self-employed, many business owners manage their businesses until retirement or at least for a time of several decades.

In contrast, the probability of being an entrepreneur and starting a new business follows an

inverse U-shape (Kautonen et al. 2014). Start-up activity gradually increases up to middle age and then decreases (Reynolds et al. 2004). The age group of 25–44 is more likely to start a business than any other age group (Reynolds et al. 2004). Consistently, the interest in becoming an entrepreneur decreases with age (Blanchflower 2001). Even though older people possess more human, social, and financial capital to start a business than younger people (Kautonen et al. 2011; Weber and Schaper 2004; Rogoff 2007; Singh and DeNoble 2003), they are less interested in self-employment (Blanchflower 2001). Hence, older people do not lack the skills or requirements for entrepreneurship but are less interested in entrepreneurship than younger people. Among workers in employment aged 50–75, only 14% would prefer to be self-employed (Curran and Blackburn 2001). The main reasons against self-employment are “no guarantee of income” (65%), “to late/feel to old” (60%), and “no job security” (50%) (Curran and Blackburn 2001).

### Research on Motivation and Older Entrepreneurship

It is important to distinguish between research on older entrepreneurship as an outcome and research on older entrepreneurship as a predictor. The first line of research seeks to understand factors that drive or inhibit older people to engage in entrepreneurship. The second line of research examines older entrepreneurship as a predictor for performance measures. This paragraph describes the first line of research on older entrepreneurship as an outcome. The subsequent paragraph describes the second line of research on older entrepreneurship as a predictor.

### Time Allocation Model

The time allocation model posits that the decreasing interest in entrepreneurship is the result of an age effect (Zacher and Gielnik 2014). The model suggests that the relative return of a business reduces as people become older. People allocate their time between income generating activities and leisure time to maximize the expected utility.

Waged labor results in an immediate income. In contrast, starting a new firm requires spending a certain number of weeks or months to exploit the opportunity. It takes time before a new firm is established and generates revenue. Consequently, the resulting income is delayed to some point in the future. As people age, the amount of time left is decreasing. As a result, people depreciate the value that is given to delayed income from entrepreneurship. Furthermore, with age the income from waged labor is increasing due to accumulated work experience. Thus, as people age, the opportunity costs to engage in entrepreneurship rise. Taken together, the delayed income from entrepreneurship and high opportunity costs compared to waged labor make it less attractive for older people to start a business.

### **Opportunity–Necessity Model**

The opportunity–necessity model seeks to distinguish between different pathways that lead to entrepreneurship at older age (Rogoff 2007). According to the model, there are two different pathways why older people engage in entrepreneurship. Older people engage in entrepreneurship because they either have to (“necessity”) or want to (“opportunity”) (Rogoff 2007). The two different pathways are important to understand older people’s underlying motivation for entrepreneurship. There are economic and social reasons that make it necessary for older people to engage in entrepreneurship (“necessity pathway”). One of the main economic reasons for older people to engage in entrepreneurship is that retirement funds shrink with negative effects on older people’s wealth. To compensate for the shrinking retirement funds, older people remain motivated to earn a salary (de Bruin and Dupuis 2003). Self-employment then becomes an attractive option when older people are not able to stay in their jobs or find a new job. One of the main social reasons is that aging is often seen as a time of decline. Negative stereotypes against older workers are thus common in the population (de Bruin and Dupuis 2003). Age discriminatory practices in recruitment make it difficult for older people to remain in or enter the traditional labor market (Kautonen et al. 2011; Zacher and Gielnik

2014). Thus, starting a business might be a viable option for older people to stay economically active and have an income.

According to the opportunity argumentation, older people have characteristics that are favorable for entrepreneurship (Curran and Blackburn 2001). During their working lives, older people gain experience, acquire knowledge, build professional networks, and accumulate financial assets (Singh and DeNoble 2003). These factors facilitate discovering and exploiting opportunities.

### **Early Retirement: Self-Employment Model**

Scholars describe in a deductive model the motivation of older workers who chose entrepreneurship as a transition into (or out of) retirement (Singh and DeNoble 2003). Entrepreneurship offers flexibility that makes it an attractive form of bridge employment for older workers. Entrepreneurs can more easily vary their hours and conditions of involvement (de Bruin and Dupuis 2003) and thus balance demands from personal life and work (Ainsworth 2015). Three types of early retirees that start a business are differentiated (Singh and DeNoble 2003). The “constrained entrepreneur” always wanted to become self-employed but was not able to follow this dream because of established or perceived constraints (e.g., liquidity, family). The “rational entrepreneur” compares his or her current career options with self-employment. This comparison is often based on financial reasoning but can also include non-monetary aspects (e.g., respect, fulfillment). The “reluctant entrepreneur” becomes self-employed because of a lack of employment opportunities on the traditional labor market.

### **Contingency Model**

The contingency model posits that the assumption of a general decline of entrepreneurial activity with increasing age is too simplistic (Kautonen et al. 2014). Rather, older people’s engagement in entrepreneurship is dependent on contingency factors like perceived age norms (Kautonen et al. 2011) and type of business (Kautonen et al. 2014).

**Age Norms.** Perceived age norms influence entrepreneurial intentions of older people

(Kautonen et al. 2011). These age norms refer to perceiving entrepreneurship as socially acceptable at any age and especially at the third age. Three mechanisms transfer the effect of perceived age norms on entrepreneurial intentions (Kautonen et al. 2011). The effect of perceived age norms influences entrepreneurial intentions via how positive individual's attitudes toward entrepreneurship are, how the individual perceives the amount of support from family and friends, and how the individual perceives their own ability to become an entrepreneur (Kautonen et al. 2011).

**Business Type.** The relationship between age and the engagement in entrepreneurship depends on the type of business people pursue (Kautonen et al. 2014). Scholars identified three different types of businesses that differ regarding the risk involved and regarding the prevalence in different age groups (Kautonen et al. 2014). First, "owner-managers" are growth-oriented and have ambitions to hire others. Being growth-oriented and ambitious requires having a higher-risk propensity. With age, the risk propensity declines and with it the willingness to engage in entrepreneurship as an owner-manager. In accordance with the model of Lévesque and Minniti (2006), the relationship between age and entrepreneurship follows an inverse U-shape for owner-managers. Second, "self-employers" want employment for themselves but are not intending to invest in the business or hire others. Similar to waged labor, self-employment involves a low-risk propensity and profit is distributed rapidly. The relationship between age and entrepreneurship for self-employers is significantly different from that of owner-managers. The close resemblance to waged labor and the human capital of older people lead to an increase in self-employment with age even for people in their 60s. Third, "reluctant entrepreneurs" are pushed into entrepreneurship because of a shortage of other employment options. They mostly engage in low-risk forms of self-employment and have a shorter investment horizon. Research shows that for reluctant entrepreneurs, the effect on entrepreneurship is relatively unaffected by age. In summary, with increasing age, entrepreneurs shift from

growth-oriented businesses to low-risk businesses, such as simple forms of self-employment.

## Research on Older Entrepreneurship and Performance

Research on older entrepreneurship as a predictor of performance suggests that the performance of older entrepreneurs differs from the performance of younger entrepreneurs (Weber and Schaper 2004). Being an older entrepreneur might be advantageous but can also be a possible constrain. Whether older entrepreneurs outperform younger entrepreneurs (or vice versa) depends on the performance measure like survival rate, growth, or family succession. It is important to note that in entrepreneurship research, all these performance measures are considered to be relevant.

**Survival Rate.** In general, survival rates among new businesses are relatively low with 63% of firms surviving after 4 years (Robb et al. 2010). The likelihood of success in the first 4 years significantly increases if the primary business owner is older than age 45 (Robb et al. 2010). Entrepreneurship scholars argue that older people possess human, social, and financial capital favorable for the survival of a business (Weber and Schaper 2004; Ainsworth 2015). During their working lives, older people gained professional knowledge and build up formal and informal networks that can increase the likelihood of survival (Weber and Schaper 2004). In addition, older people are more likely to have accumulated financial assets through prior employment which can be invested into the business (Singh and DeNoble 2003).

**Growth.** Even though businesses of older entrepreneurs have a higher survival rate (Robb et al. 2010), these businesses are less likely to grow (Autio 2007; Gielnik et al. 2012). The age group of 18–34 years starts 45% of growth-oriented start-ups compared to 22% in the age group of 45–64 years (Autio 2007). Furthermore, age is negatively related to business growth in terms of sales, profit, transaction volume, income, and number of employees (Gielnik et al. 2012). Scholars argue that the negative effect of age on

business growth is a result of a decrease in people's focus on opportunities (Gielnik et al. 2012). Focus on opportunities is a cognitive–motivational construct that describes how many new goals, plans, options, and opportunities people believe to have in their personal future (Gielnik et al. 2012). Research showed that companies with CEOs high in focus on opportunities increased their number of employees on average by 2.24 employees over a period of 4 years, while companies with CEOs low in focus on opportunities remained with the same number of employees over this time period. Similarly, companies with CEOs high in focus on opportunities increased their sales level by 38% percent over 4 years, while companies with CEOs low in focus on opportunities did not change their sales level over this period (Gielnik et al. 2012). With age several individual and contextual factors negatively influence people's focus on opportunities. Individual capabilities (e.g., information processing capabilities), which are important to maintain a focus on opportunities, decrease with age. In addition, contextual factors like age-related norms and environmental constraints may lower people's focus on opportunities. However, the decline in focus on opportunities and venture growth is not inevitable (Gielnik et al. 2012). Mental health buffers the negative effect of age on people's focus on opportunities. This means that for business owners who remain in good mental health, age does not have a negative effect on their focus on opportunities and business growth.

**Family Succession.** With age, family succession becomes more important for business owners (Zacher et al. 2012). Age is often seen as a general time of decline and withdrawal (de Bruin and Dupuis 2003). According to the socioemotional selectivity theory (Carstensen et al. 1999), age is not simply a matter of decline but can be considered in terms of shifting goal priorities. With increasing age, people are more aware that time is limited. As a consequence, goal priorities shift from advancing one's own career to passing on knowledge and skills to the younger generation (Zacher et al. 2012). With increasing age, family business owners increase in generativity which

means that they direct their focus to generative motives (Zacher et al. 2012). Older family business owners focus less on their own career goals, occupational gains, or accomplishments and direct their focus to developing and guiding members of the younger generation (e.g., their children or grandchildren) in the family business (Zacher et al. 2012). Older business owners' generativity is an important mechanism in the family succession process. Generativity explains why older family business owners are more successful in finding a successor and in smoothly managing the succession process (Zacher et al. 2012).

## Conclusion

The topic entrepreneurship and aging gains more and more attention because of the ongoing sociodemographic changes in our society. There is no clear-cut relationship between age and entrepreneurship, but people's ontogenetic development has benefits as well as drawbacks for entrepreneurship. Factors that influence whether or not age positively affects entrepreneurship can be found on the cultural/societal level, the firm level, and the individual level. Thus, a comprehensive approach taking into account all levels is necessary to fully understand the relationship between age and entrepreneurship.

## Cross-References

- ▶ [Age Stereotypes in the Workplace](#)
- ▶ [Age Stereotyping and Discrimination](#)
- ▶ [Aging, Inequalities, and Health](#)
- ▶ [Attitudes and Self-Perceptions of Aging](#)
- ▶ [Distance-to-Death Research in Geropsychology](#)
- ▶ [Early and Unplanned Retirement](#)
- ▶ [Job Attitudes and Age](#)
- ▶ [Late Life Transitions](#)

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## Environmental Influences on Aging and Behavior, Theories of

Hans-Werner Wahl

Department of Psychological Aging Research,  
Institute of Psychology, Heidelberg University,  
Heidelberg, Germany  
Network Aging Research (NAR), Heidelberg  
University, Heidelberg, Germany

### Synonyms

Ecology of aging; Environmental psychology of aging

### Definition

Focusing on environmental influences on aging and behavior, this entry particularly addresses theories that help to describe, explain, and modify/optimize the psychological relationship between the aging person and his/her physical environment.

### Introduction

More than four decades ago, (Lawton and Nahemow 1973) conceptualized the maintenance and augmentation of positive affect, the avoidance of negative affect, and the adaptation in later life at large as a dynamic that largely depends on the existing competence of an aging individual (person variable, P) and the environment (E) in which the individual is operating. The fundamental idea that contexts (and not merely genes, physical-biological conditions, or personality factors) may drive aging processes and outcomes has a long-standing tradition in social gerontology

and its emphasis on social relations and the social contexts of aging. However, the role of the immediate physical, spatial, and technical environment put forward by Lawton and Nahemow's work has largely been neglected in geropsychological research (e.g., Wahl 2001; Wahl et al. 2012). This is surprising, because in child and adolescent psychology (Bronfenbrenner 1999), as in life span developmental science at large, co-construction, the assumption that developing individuals are shaped by contexts and vice versa, always has been a widely accepted view (Valsiner 1994; Youniss 1987). Going further, it is important to argue that – particularly in its early and late phase – the human life span is highly sensitive if not vulnerable to environmental input and P-E interactions, including the physical component of the environment.

Research targeting the relationship between the environment and the aging individual has had a strong link with psychology from the beginning (e.g., Lawton 1977; Lawton and Nahemow 1973; Wahl 2001), although it has also been seen as an important interdisciplinary area. Therefore, terms such as *environmental gerontology* and *ecology of aging* used in this entry are intended to emphasize the strong behavioral component of the field and its role within geropsychology.

### **A Case History: When Aging in Place Fails**

Ms. A is an 89-year-old woman who lives in her medium-sized house in a small, urban community in Kansas. She had been married for 66 years to her husband Will, who passed away 3 years ago. Ms. A has a daughter living with her family near NYC, which is rather far away; no other relatives live closer than 4 h away by car. However, social support conditions are working well; her neighbors and some friends provide help when needed. Although Ms. A has good health overall, significant cognitive decline started about 2 years ago, during which substantial mobility and vision impairment have occurred. Ms. A increasingly has to struggle with her place and enjoys it as her place in the world. For example, she now

experiences her home, neighborhood, and spatial infrastructure for the first time in life as a barrier: She now has anxiety when using the staircase, the bathroom, and the kitchen. The garden no longer is “her” garden and indeed is now unused, and driving the car evokes feelings of insecurity and incompetence, but driving is necessary to maintaining independence. Dealing with her physical-spatial living situation over the next 2 years increasingly impacts her daily routine and negatively affects her well-being and feelings of autonomy, with the latter belonging to the things she always was very proud of in her life. It also becomes increasingly difficult to keep her informal support network going, and due to ongoing cognitive decline, she is now entering a phase in life in which “full control” in some necessary tasks is no longer possible. One question becomes an intrusive one: “How long will I be able to tolerate this struggle with my place and indeed survive the struggle mentally in good shape?” At the age of 93 years, she will have arranged, together with her daughter, relocation to a nursing facility located 20 miles from her hometown. “Her” place and long-standing and highly valued day-to-day social interactions are left behind.

One may ask what would have happened to Ms. A in another physical setup (e.g., no large distance to next shopping mall, staircase, optimal housing modifications, installation of a computer with Skype and e-mail possibilities, etc.). One may also ask what it likely meant to Ms. A to undertake this relocation and spend her last years at a different place than the one in which she lived for decades. These are key questions of an environmental perspective on aging, as well as of late-life development at large. Let's follow these questions based on a treatise of a number of P-E concepts and theories and a selection of empirical findings.

### **Fundamental Principles of Psychological Aging and the Environment**

Three principles build the cornerstones of environmental perspectives on aging: (1) importance of P-E transaction and developmental

co-construction, (2) importance of explicitly considering the environment with a focus on the physical-spatial dimension, and (3) importance of optimizing ecological validity in research. First, the classic formula dating back to German psychologist Kurt Lewin – that behavior is a function of the person’s as well as the environment’s characteristics ( $B = f[P,E]$ ) – has found a central place in the social and behavioral sciences; aging is no exception. Environmental gerontology also has close affinity with *environmental psychology*, in which the concept of “person-environment transaction” has been promoted as a key issue (Altman and Rogoff 1987). A major assumption is that it is difficult – if not impossible – to separate P from E and that the understanding of an ongoing complex and mutual shaping of P and E throughout the life span is adequate. Moreover, it may be that this intimate intertwining of P and E grows along the life span and may indeed reach its climax in old and very old age (Zingmark et al. 1995). Furthermore, life span development is seen as a never-ending sequence of ecological transitions in which new P-E territories are continuously conquered, while other P-E territories are left behind. A major transition in late life (see again Ms. A) is the transition to a sheltered environment, such as a nursing home.

Second, Powell M. Lawton (1977), a key figure in the psychology of aging and the inauguration of environmental gerontology, has defined the environment in the first edition of the *Handbook of the Psychology of Aging* very broadly; this definition includes social others and social groups, as well as all its physical components (the natural or man-made ones). However, the predominant contribution of environmental gerontology to geropsychology can be seen in its emphasis on the physical and spatial environment (Wahl 2001; Wahl et al. 2004, 2012) such as features of the objective home environment (e.g., lighting in kitchen, barriers in bathroom) and distance between one’s home and public transport. Wahl and Gitlin (2007) have suggested the term *physical-social environment* to address the issue that the physical component of the environment is hard to separate from its social component and vice versa (see also Wahl and Lang 2004).

For example, a certain space infrastructure (e.g., distance between rooms) in a nursing home may provoke or hinder social communication (see already Lawton’s “environmental docility hypothesis”; Lawton 1977, 1982). Third, environmental gerontology always put much emphasis on the need to enhance ecological validity in psychological aging research (e.g., Wahl 2001). Focusing on issues such as under which conditions older adults are “feeling at home” (Oswald and Wahl 2005) or offering a detailed description of the role of environmental barriers in the home or immediate surrounding directly brings research to the daily ecology of old age. More generally put, environmental gerontology’s argument is that older adults always operate in naturally occurring physical-social environments; therefore, reconstructing daily ecologies of aging must have a high priority. It is interesting to mention in this context that the issue of ecological validity seems to have increased in importance at large in geropsychology in the past two decades or so, via event-sampling in situ research strategies and ambulatory-assessment strategies (Hoppmann and Riediger 2009).

### **Mission of Environmental Gerontology within Geropsychology**

In light of the three principles outlined in the previous section, the overarching aim of environmental gerontology is to describe, explain, and modify/optimize the relationship between the aging person and his/her physical-social environment. With regard to *description*, environmental gerontology puts strong emphasis on day-to-day contexts of aging individuals, reinforcing the notion that daily ecology settings deserve strong attention in gerontological research. A major reason for this emphasis is that older people spend most of their time (i.e., about three-quarters of their daytime) in the home and immediate home environment (Baltes et al. 1999; Oswald and Wahl 2005). Furthermore, older individuals tend to live in the same place for a long period of time, typically for decades, not for years (Oswald and Wahl 2005). Such long-term living and aging at the

same location seems to evoke rich cognitive and affective ties to the place one lives, known in German as *Heimat* (homeland) – or, put in scholarly language, addressed as place identity and place attachment to the very specific genius loci of “my place.”

The phenomena to be *explained* in environmental gerontology are classic outcomes in aging research and gero-epidemiology, such as positive and negative affect (Lawton 1977), well-being (Oswald et al. 2011), and autonomy (Oswald and Wahl 2005; Oswald et al. 2007). Furthermore, there is a set of specific variables addressed by environmental gerontology theories and empirical studies, such as the emergence of feelings of being at home, place attachment (and detachment) processes, place identity, usefulness of one’s physical environment, and housing-related control beliefs (Oswald et al. 2007). Also, explaining the experience and outcome related with enduring change of space/place, such as transitions to long-term institutions and assisted living (but also from home to home), has been a classic area of environmental gerontology (e.g., Wahl and Oswald 2010).

Striving for *optimization* reflects the ambition of environmental gerontology to improve aging by means of “place improvement” or, as it also has been coined, “place therapy” (Wahl and Weisman 2003). Major examples include evidence-driven home modifications, adding to the development of new housing solutions for the diversity of aging individuals, or designing public spaces and “age-friendly” environments at large.

## **Established Theoretical Accounts and a Selection of Empirical Findings**

### **Impact of Physical Environments**

A classic view has been the Ecological Theory of Aging (ETA; Lawton 1982, 1989; Lawton and Nahemow 1973; Scheidt and Norris-Baker 2004). The basic assumption of this theory has been that the capacity to adapt behaviorally to existing physical-social environmental pressure profoundly decreases as people age, due to an increasing number of functional limitations.

Thus, older people need to react to environmental pressure in order to remain independent and feel well in terms of high positive affect and low negative affect (Lawton 1982). The ETA was criticized for portraying the role of the aging individual as too passive. Consequently, in a later extension of the ETA (Lawton 1989), the environmental proactivity hypothesis was introduced, which assumes that older adults are not simply “pressured” by their environments but that they also strive to change proactively environmental conditions according to their own needs and goal priorities in order to maintain independence and well-being. For example, new cohorts of older individuals seem to increasingly make goal-directed P-E transitions, such as moving to an assisted-living facility or closer (but not too close) to their families, in order to prevent being overwhelmed by environmental pressure in the foreseeable future.

The ETA has since gained considerable, though not consistent, empirical support (Scheidt and Norris-Baker 2004; Wahl and Oswald 2010). For example, Wahl et al. (2009) provided a literature analysis of all studies published between 1997 and 2006 in peer-reviewed journals, which addressed relationships between the physical home environment and endpoints such as activities of daily living, amount of help and support needed, and falls. A total of 21 studies found supportive or at least partially supportive evidence for substantial linkages between environmental barriers and hazards in the home and disability-related outcomes, while only four did not. The subset of studies also considering the fit or lack of fit between the aging persons’ functional limitations and the given physical barriers revealed the strongest relative linkages with disability-related outcomes. The drawback of the available body of empirical work is that most studies have been cross-sectional, thus not allowing any causal interpretation.

### **Role of Perceived Physical Environments**

Major concepts in this area include place attachment, place identity, and the meaning of home. Theories on place attachment and place identity (Altman and Low 1992; Brown and Perkins

1992; Stedman 2002) point to a gamut of processes – operating when people form affective, cognitive, behavioral, and social bonds to the environment (Burholt and Naylor 2005) – transforming by this means “space” into “place” (Altman and Low 1992; Rowles and Watkins 2003). Often, these aspects of physical, social, and personal bonding are assessed by global attachment evaluations – e.g., on indoor versus outdoor place attachment (Oswald et al. 2005) – but there are also efforts using qualitative methodology to empirically approach place attachment and identity (Oswald and Wahl 2005).

Empirical research in this area, for example, supported the age-related increase of place attachment and place identity (Zingmark et al. 1995). Similarly, the work of Burholt and colleagues (e.g., Burholt and Naylor 2005), Scharf and colleagues (2005), and Peace (2005) provided evidence confirming that attachment to place is an important feature of quality of life in old age – particularly in old and very old individuals – underpinning core elements of the aging person such as self, identity, and quality of life. Aspects of meaning of home have gained particularly strong attention in the now-classic work of Rowles (1983) and Rubinstein (1989; see also Oswald and Wahl 2005).

### **Need for Simultaneous Consideration of Objective and Subjective Person-Physical Environment Relations**

At the core of the framework suggested by Wahl et al. (2012) is the assumption that two processes, experience-driven P-E belonging and behavior-driven P-E agency, help to better understand and integrate existing P-E interchanges as people age. P-E belonging reflects a sense of positive connection with the physical-social environment (e.g., Bakan 1966; Baumeister and Leary 1995), while P-E agency refers to the process of becoming a change agent in one’s own life by means of intentional and proactive behaviors imposed on the physical-social environment (e.g., Bandura 1991).

In contrast, processes of P-E agency include the full range of goal-directed behaviors related to making use of the objective physical-social

environment, such as environment-related cognition and perceived control over the environment. These behaviors include reactive and proactive aspects of using, compensating, adapting, retrofitting, creating, and sustaining places, which is especially important in old age because of decreasing functional and cognitive capacity. The model also assumes that both P-E belonging and P-E agency must be considered in any qualification of P-E relations in later life.

Emerging empirical evidence for the model came from the ENABLE-AGE project, in which, for the first time, a maximum of indicators regarding P-E belonging as well as P-E agency have been assessed in parallel in advanced old-age individuals in a range of European countries (Iwarsson et al. 2007). As has been found, for example, P-E fit processes and housing-related control processes speaking to objective constellations of remaining competence and respective objective physical-social home environments – as well as P-E belonging processes – contributed to the prediction of endpoints such as autonomy, well-being, and depression (Oswald et al. 2007).

Most recently, Golant’s model of residential normalcy highlights subjective environmental experiences of residential comfort and mastery as well as related adaptive coping strategies to maintain or achieve residential normalcy in existing objective physical environments (Golant 2015). According to the model, if older people feel comfortable and in control of their environment at home, they have achieved residential normalcy and may no longer feel the need to change anything. However, if there is a perceived incongruence on the behavioral or experiential level, they perceive themselves as being out of their mastery and/or comfort zone. Consequently, they will try to re-achieve residential normalcy by ways of assimilative or accommodative coping strategies (Brandtstädter and Greve 1994) with respect to the immediate home environment.

### **Technology as a Major New Environment of Aging**

The Internet, the “automation” of everyday technology (e.g., teller machines, ticket machines,

computer and telephone voice menus, car technology), and sensor- or GPS-based assistance are rapidly changing the way older people organize and experience their everyday life (e.g., Schulz et al. 2014). Future cohorts of older adults will benefit from a full range of technology products designed to support them as they “stay connected” and age well, despite accumulated loss experiences. This requires a full new set of empirical research including outcome studies that are currently only available to a limited extent (see again Schulz et al. 2014).

### Reconsidering the Case of Ms. A and an Outlook

Environmental perspectives on aging can be considered a major part of geropsychology, able to add the role of the physical-social environment to the understanding of aging processes and outcomes. Furthermore, there is the need in many areas of geropsychology to pay full attention to technology environments (such as those dealing with social relations (e.g., social interaction via the Internet)), in the experience of vulnerable phases late in life (e.g., care robotics), as well as in developmental regulation at large (i.e., technology as a means to exert control over one’s environment; see again Valsiner 1994). Environmental gerontology may become an important helper in order to enrich these key areas of geropsychology.

Returning to Ms. A’s case, a sole “personal” view of her situation appears to be too narrow, in light of P-E theories. The place she lived for years had become a major part of her quality of life, and leaving this place late in life – likely close to the end of her life – appears, through the lens of environmental gerontology, to be a major loss and psychological threat. At the same time, making the best use of housing modifications and the installation of technological aids, such as Skype or the use of a robotic system, may have had the potential to prevent or significantly delay her relocation to a nursing home. On the other hand, the progression of her cognitive vulnerabilities may also have undermined the efficiency of even the

most optimized environment. In a sense, the situation of many older individuals, particularly those in advanced old age, appears in environmental gerontology terms as an ongoing “struggle with place.” In future cohorts, agency and proactive dealing with this struggle may be expected to increase, for example, via increased competencies to use all kinds of technology and accept a smart home environment. This may indeed also allow individuals to stay put, even in the face of major cognitive impairment.

It is a limitation that most ongoing longitudinal studies of aging only measure the physical and technical environment in which aging individuals live to a minor extent. Such a tendency toward “decontextualization” of aging seems problematic and hinders the empirical testing of environmental theories based on longitudinal data.

### Cross-References

- ▶ [Aging and Psychological Well-Being](#)
- ▶ [Contextual Adult Life Span Theory for Adapting Psychotherapy \(CALTAP\) and Clinical Geropsychology](#)
- ▶ [Gerontechnology](#)
- ▶ [Stress and Coping Theory in Geropsychology](#)

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## Ergonomics and Demographics

Susan Freiberg<sup>1</sup>, Rinat Saifoulline<sup>2</sup> and Hanna Zieschang<sup>1</sup>

<sup>1</sup>Institute for Work and Health of the German Social Accident Insurance, Dresden, Germany

<sup>2</sup>Faculty of Business Administration, University of Applied Sciences, Dresden, Germany

### Synonyms

Human factors and ergonomics; Work design and aging; Personnel development in an aging workforce.

## Definitions

The implications of the demographic change have long been known. Falling birthrates and a steady increase in life expectancy lead to considerable changes in the age structure of the workforce. Older employees will be more numerous in the future, and they will have to remain in employment for longer.

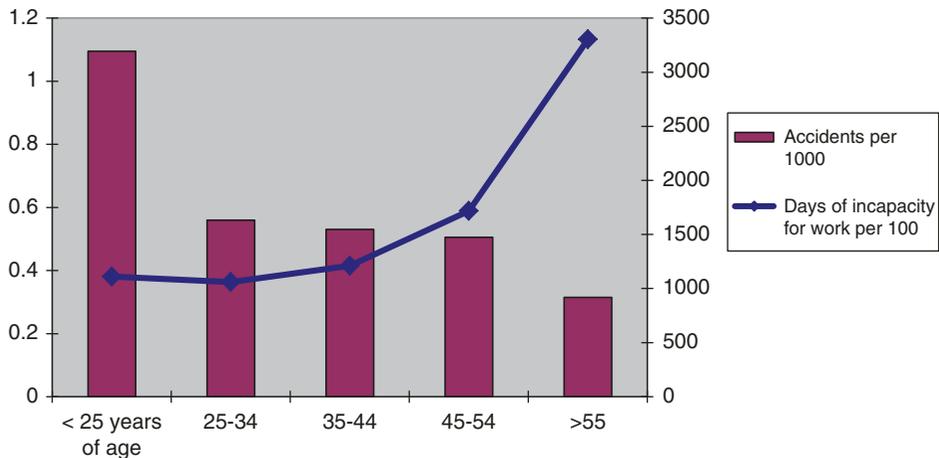
The purpose of designing workplaces for older employees is to give consideration to age-related impairments in their performance, whilst at the same time exploiting and fostering their particular abilities. Following analyses of the physiological changes and identification of the specific hazards faced by older people, design measures for workplaces for older employees were developed and implemented in practice for demonstration purposes at a selection of model workplaces. Work ability of older employees can moreover be retained and enhanced through well-planned personnel development.

In the end it is important not to focus especially on older employees. Each age or generation has its own capabilities and challenges which have to be considered in order to preserve a healthy workforce with high work ability.

Demographics is currently a buzzword, with its impact upon both the private lives of individuals and the world of work. Older people are becoming more numerous as a group, younger people less numerous. Two main trends are driving this development. Firstly, average life expectancy is rising; secondly, the birthrate is falling. For the world of work, this means that the average age of workforces is rising, and younger personnel are becoming increasingly hard to recruit. What are the consequences of this for preventive occupational safety and health activity? How can work be organized such that it can be performed equally well by younger and ageing workforces?

## What Changes Can Be Seen in the Performance of Older Workers Over Their Working Lives, and What Are the Impacts of These Changes?

Views of older and ageing workers' performance differ widely. "Old and wise" was a phrase that



**Ergonomics and Demographics, Fig. 1** Incapacity for work in days (data from the German Social Accident Insurance Institution for the woodworking industry (Holz-BG), 2006) and accidents per 1,000 equivalent

full-time workers (data from the Holz-BG, 2007). The intention here is not to compare the absolute figures (which are from different years), but to illustrate the trends within each of the two curves

reflected the value attached at one time to the wisdom and experience of age. By contrast, modern society is strongly biased towards youth, whether in advertising, in the recruitment of labour, or in the desire to remain young or at least to appear to be so.

Who exactly are these “older workers”? At what age does one become “older”: 45, 50, 60? And what actually changes?

### Who Exactly Are the “Older” People?

Many publications or studies define older people as persons aged 45 (or 50) and over. By contrast, the gerontologist Andreas Kruse of the University of Heidelberg asserted in 2006 that ageing is a lifelong process beginning at birth and ending at death. Since this process is continual, and changes take a somewhat different form and occur at different times from one person to the next, it is virtually impossible, and also not constructive, to define a calendar age above which one belongs to the older demographic. A definition proposed by the Organisation for Economic Co-operation and Development (OECD) has gained currency, according to which older workers are persons “in the second half of their working lives, not yet in retirement and in good health.”

It is evident that “older workers” are an issue for the social insurance systems. The statistics show that although older people are ill less frequently, when they do fall ill they are incapacitated for work for longer periods than their younger counterparts (Fig. 1). This pattern also applies to absences from work owing to illnesses unrelated to work and to occupational accidents. Absences from work by older employees thus give rise to higher costs for both the health and accident insurance institutions.

### What Changes Occur as People Get Older?

Any individual will notice for themselves that ageing is accompanied by numerous changes. Often, only characteristics or abilities that deteriorate are considered (deficit model; see for example (Landau and Weißert-Horn 2007)):

- *Age-related hearing loss*

Age-related hearing loss primarily affects the higher frequencies, which older persons are no longer able to discern as clearly as before.

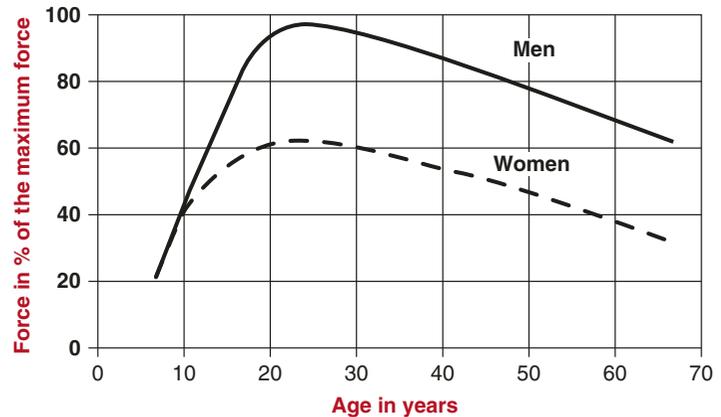
- *Presbyopia*

Even people with good eyesight typically begin to need glasses when they reach the age of around 45. The useful field of vision that can

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**Fig. 2** Mean values of the physical forces exerted by men and women, plotted against age. Data from Åstrand, Bengtsson, Burke, Dementjeff, Hettinger, Müller, Lehmann, Quételet, Reindell, Reys, Rodahl, Rutenfranz, and Schochrin. According to (Hettinger and Wobbe 1993), p. 99



be viewed without movement of the head also drops with increasing age (Boyce 2003).

- *Need for more light*

Generally speaking, it is assumed that at the lower end of the illuminance range, older people require approximately twice the illuminance at their workplaces than younger people.

- *Decrease in physical performance*

This includes several aspects. Firstly, general agility deteriorates with rising age. Beyond that, muscular performance and maximum physical force also decrease. The cardiovascular system is also no longer as fit as it was in younger years.

However, Fig. 2 shows clearly that the decrease in physical force is not limited to older age. Human physical force peaks at the age of 20–25. If a person does not then train, their physical force deteriorates continuously. The average force values for women are consistently around 30% lower than those for men. There is therefore no clear point at which a person becomes “old” in terms of physical performance.

- *Increase in recovery time*

This increase is a direct consequence of the deterioration in physical performance: when the performance of the cardiovascular system is reduced, the body takes longer to reach the rest state (resting heart rate) following physical exertion.

- *Increase in reaction time*

Researchers have demonstrated that older people’s reactions are slower in certain situations. The differences are, however, in the

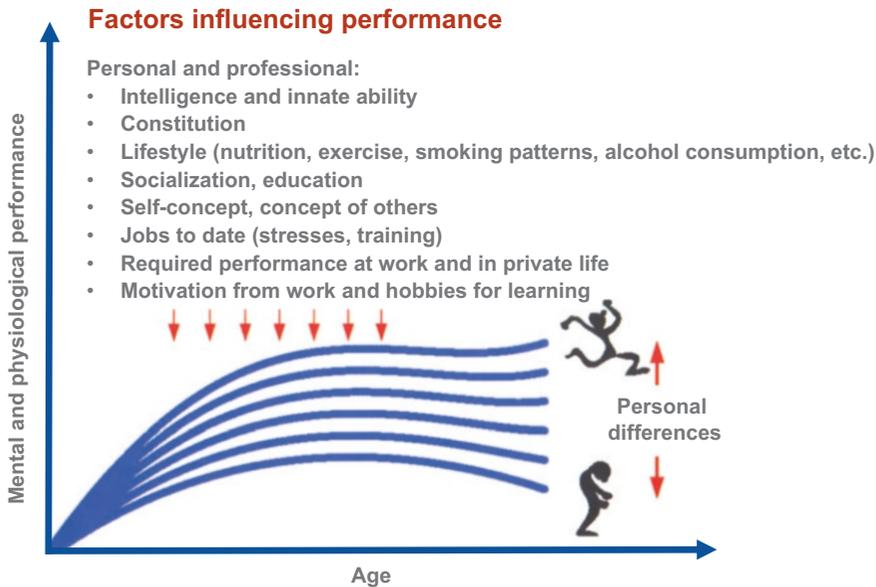
order of milliseconds. The question therefore arises as to what work situations exist in which the longer reaction time is actually relevant.

- *Deterioration in mental performance*

Different age groups exhibit differences in terms of memory and the ability to retrieve stored information. However, older people do not always perform less well than their younger counterparts. Older people are often better than younger people at retrieving consolidated knowledge stored in the long-term memory. Other abilities, such as the capacity for coping with stress and confidence in decision-making are also frequently better among older people.

Some of these abilities can be trained. It is known, for example, that regular training of muscles enables their performance to be maintained at a high level even as a person ages. Well-trained male athletes aged between 65 and 70 can still attain peak oxygen uptake values – a measure of the muscle’s endurance capacity – that exceed the average values for women across all ages (Hollmann and Hettinger 2000, p. 315).

Not every aspect of deteriorating physical performance can be compensated for by training. Sensory performance in particular is improved only marginally by training. It can, however, be supported by technical aids. In addition, the performance curves differ widely from one person to the next. The values shown in Fig. 2 are average values. A range of factors are at play here that assist in compensating for deficits in old age and



**Ergonomics and Demographics, Fig. 3** Changes in the characteristics of human beings as they age occur at different points in time and vary strongly from one individual to the next (Modified in accordance with (Buck et al. 2002))

also in strengthening or developing new abilities. This shows that ageing has a strong biographical component and is also linked to an individual's employment history (Fig. 3).

Abilities that are enhanced in older age or are more and more attained until then include (competence model, refer for example to (Maintz 2003)):

- *Interpersonal skills*  
Older people have more experience in dealing with other people. This includes dealing with customers, as well as colleagues.
- *Effective communication*  
Owing to their greater social competence, older workers are often more successful in discussions with customers. Firstly, they are more familiar with their company's products or services; secondly, their long experience makes them more familiar with frequently recurring customer needs.
- *Experience*  
Older people can deal with vocational challenges better owing not only to their occupational experience but also to their life experience as a whole. Occupational and life

experience can often be linked or are mutually beneficial.

- *Regained flexibility in use of time*  
As a rule, older employees no longer have children at home to look after. They can therefore often manage their time more flexibly than young parents. Their commitments to caring for family members can, of course, restrict this flexibility.
- *Company loyalty*  
Surveys have shown this to be a characteristic particularly valued by employers: where employees have had the opportunity to work continuously for a company over a long period of time and to experience recognition within it, their loyalty to their employer is also very strong. This can make them more reliable.

### Strategies for Corporate Action Against the Backdrop of Demographic Change

Analysis of the deteriorating and improving abilities of ageing employees reveals key areas in which companies or employers can take measures to support and assist their staff. According to

Ilmarinen and Tempel (2002), companies can address the following four fields of action:

1. Promotion of good health
2. Training and skills development
3. HR management and corporate culture
4. Work design and organization

Design of workplaces suitable for older workers is not sufficient on its own. It is important that ageing be understood as a process. A corporate strategy that merely reacts to deficits as they arise is not effective. Mental and physical fitness in old age is the result of a lifelong process. Both the accident and health insurance institutions are on hand to provide expert advice to companies.

The example below from the field of action of work design and organization addresses the area of workplace design.

## Design of Workplaces

In order for the health and performance of older workers to be retained within the work process and beyond, ergonomic measures at the workplace are absolutely essential. Firstly, attention must be paid to the optimum design of tools and work equipment; secondly, however, the proper use of these elements and health-conscious behavior on the part of the workers are relevant.

### Constraints and Hazards at the Workplace

Section “[What Changes Can Be Seen in the Performance of Older Workers Over Their Working Lives, and What Are the Impacts of These Changes?](#)” showed that human beings change as they age. Many abilities remain virtually unaffected by the ageing process or mature only in the course of an individual’s life. Some skills, however, are largely or even completely lost. Examples of changes in old age that tend to make coping with the flow of work more difficult or that can lead to additional health risks include the following:

- Deteriorating vision
- Changes in the perception of noise and deteriorating hearing ability

- Deterioration in general agility
- Reduction in muscle performance, i.e., loss of physical strength
- Reduction in the performance of the cardiovascular system

Should vision deteriorate, poor or uneven lighting, for example, may lead to hazards and a higher accident risk (Zieschang and Freiberg 2006). Should the work require the exertion of substantial muscle force, the worker may be able to perform it only with restrictions, or not at all.

## Ergonomic Workplace Design: Model Workplaces

Ergonomically, sound design of workplaces can mitigate or even fully compensate for age-related loss of performance. Good ergonomic design and the necessary adjustments to specific workplaces for the minimization of health risks also benefit younger coworkers at the same workplaces, since they increase occupational safety in general. Special workplaces for older workers, or sheltered workplaces, which are also more likely to be rejected by older workers owing to their special status, then become superfluous.

The workplaces should be designed in the first instance according to the following principles:

- Inherently sound workplace design in accordance with human engineering and ergonomic criteria results in only a small number of additional special measures being required in order for workplaces to be adapted to the needs of older employees.
- Younger employees also benefit from good ergonomic workplace design.
- The aim is not for special “workplaces for old people” or “sheltered workplaces” to be created. Younger workers are also to be able to work at the redesigned workplaces. Social exclusion resulting from age is thus prevented.
- Wherever possible, consideration should be given to the particular abilities of each individual employee.

Good ergonomic design and productivity should not and need not be mutually exclusive (Zieschang and Freiberg 2006). Various design elements are explained below with reference to model assembly and video display unit workplaces.

#### Model Workplace for an Assembly Task

The workplace was first to be designed according to good human engineering practice and equipped with basic elements. These include:

- An adequately dimensioned and nonreflective work surface
- Assembly trays located appropriately for the task within the worker's reach
- A height-adjustable work chair
- An adjustable footrest
- Adequate lighting

In order for materials and the corresponding tools to be matched more easily, it is advantageous for the assembly trays for the screws and the corresponding screwdriver bits to be color coded.

Various elements were then adapted (Fig. 4) that are geared to the needs of older workers and facilitate performance of the work or indeed make it possible in the first instance (Hoffmann and Zieschang 2005):

- *Design of the lighting*

Older workers require up to 100% more light. In order to meet this requirement, two lamps were installed for supplementary use as needed. The European standard EN 12464-1 (2003) requires a maintained illuminance value of 300 lx for moderately fine assembly tasks in the metal manufacturing and processing industries and of 500 lx for other industrial sectors. The lamp employed at the model workplace yields an average illuminance of 1,200 lx in the working area on the assembly bench. Switching on an additional lamp of the same type approximately doubles the illuminance to 2,300 lx. Since older workers are more sensitive to glare, it must be ensured that this is not caused by the installation of additional lamps.



**Ergonomics and Demographics, Fig. 4** Model workplace for an assembly task (Source: IAG)

The combination of two lamps at the model workplace did not give rise to glare.

- *Design of the legibility*

An illustrated description of the individual assembly steps, with clearly structured diagrams, assists in understanding and learning the procedure and avoiding mistakes. High legibility was attained by means of a sufficiently large font, clear contrast, and large images.

- *Reducing the physical stress*

In order to relieve the locomotor system, a holding fixture was used for the power screwdriver, and trolleys provided for the delivery of materials to the workplace and roller conveyor belts for dispatch of the assembled workpieces. If possible, the weight of the loads to be manipulated was to be kept low.

A forearm rest provides relief and improves fine-motor performance. These rests can be fitted to the table and removed from it quickly and easily as required by the individual.

A holder, fitted to the edge of the assembly bench and removable at any time, into which the workpiece subassembly can be inserted during assembly, prevents the parts from slipping out of the worker's hand. Less stress is thereby placed upon the worker's motor functions, and assembly can be performed more quickly. Should no holder be present, a rubber surface can be used as an alternative to assist the worker in gripping small parts. The color selected for the surface should provide a clear contrast to the parts to be handled.

An assembly bench with electrical height adjustment enables each worker to adjust the bench to the working height most suitable for them. Where permitted by the task, the worker should alternate between a seated and standing position, thus preventing imbalanced posture and muscle tension. Should budgetary constraints or other reasons rule out purchase of a height-adjustable bench, other measures must be taken to ensure movement and variation in activity at the workplace.

Further organizational tasks such as collection of the components and transport of the finished subassembly to a location a few meters away also have the function of promoting more movement at the workplace. The worker is forced to stand up in order to put the workpiece aside. Although this entails additional time, the resulting movement at the workplace counters the onset of fatigue, which in turn has a positive influence upon productivity.

#### Model Workplace for VDU Tasks

This workplace was also designed in the first instance with consideration for ergonomic aspects and equipped with basic elements. These include:

- A nonreflective desktop of adequate area
- An office chair with height adjustment and armrests adjustable for height and width
- An LCD display
- A light-colored keyboard with dark characters
- A standard mouse
- Adequate general lighting

If an ergonomic sitting posture necessitates an adjustable footrest, one must also be provided.

The issue most frequently raised regarding the design of video display unit (VDU) workplaces for older employees is the relationship between age-related deterioration in vision and VDU work. Conditions in the work environment, such as noise, the climate, and the space requirement, must also be considered.

With increasing age, the lens of the eye becomes less elastic, resulting in a deterioration in its accommodative ability. The continual change in focus between screen, keyboard, and documents used for the work increases the strain upon the eyes, consequently leading to premature fatigue. Workers suffering from complaints such as impaired vision may attempt to compensate for them by adopting unfavorable sitting and head postures. Optical aids such as reading glasses, varifocal glasses, or contact lenses often fail to meet the particular requirements posed by a VDU workplace. Under certain circumstances, presbyopia (age-related vision impairments) can be corrected by means of suitable spectacles specially designed for use for work at video display units. In this case, the working conditions and viewing distances for the individual at the workplace must be determined beforehand, in addition to the examination by an eye specialist. The correct relationship between VDU work and recovery time or task alternation can also prevent excess strain upon the eyes.

The model workplace is adapted to the needs of older workers as follows (Fig. 5):

- *Design of the lighting*

Presbyopia and deteriorating ability to adapt to lighting conditions can be compensated for in part by increased illuminance. The European standard EN 12464-1 requires a maintained illuminance of 500 lx for VDU and office work (EN 12464-1 2003). A mean illuminance of 850 lx was measured at the model workplace with general room lighting. The value was increased to 1,600 lx by means of an additional asymmetrical workplace lamp suitable for VDU work. The glare effects caused by high illuminance values were

## Ergonomics and Demographics,

**Fig. 5** Model workplace for VDU tasks (Source: IAG, Floss)



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avoided by suitable design of the display (character display in positive video).

- *Noise abatement*

Older people are more easily disturbed by background noise than are young people. Where possible, sources of noise (such as printers, photocopiers, and fax machines) should be kept away from the workplace. Where several workplaces are located in a single room, telephone calls and conversations may constitute sources of noise. These can be controlled by sound-absorbing elements such as acoustic ceilings, front panels of cabinets, or suitable partitions.

- *Reducing the physical stress*

Asymmetric stress and a lack of movement, caused, for example, by a seated work position at a video display unit, accelerate the natural age-related wear of joints, intervertebral disks, and the spine. In order to promote movement, the model workplace was equipped with an electrically powered desk that permits work in either a seated or standing position. Alternatively, a high-level desk, either free-standing or adapted to the existing desk, can be used.

Organizational measures, such as locating the printer in an adjacent room or placing the telephone at a higher level in the immediate working area, for example on a side table, force the worker to stand up and exercise.

In order to ensure sufficient movement during sitting, swivel office chairs are recommended that ensure active sitting, i.e., alternation between sitting in forward, middle, and rearward positions.

### Preventive Activity for All Age Groups

The purpose of designing workplaces for older workers is to give consideration to age-related impairments in their performance, while at the same time exploiting and fostering their particular abilities. Following analysis of the physiological changes in older people and identification of the specific hazards facing them, the design measures described in section “[Ergonomic Workplace Design: Model Workplaces](#)” for workplaces for older employees were developed and implemented in practice for demonstration purposes at various model workplaces. In the process, it was frequently observed that once a workplace had been designed with consideration for good ergonomic practice, only minor further adjustments to the particular needs of older employees were then needed. Workers in all age groups benefit from the preventive health benefits of ergonomic design. That all age groups benefit has also been shown by a study in which persons of different ages performed assembly tasks at a model workplace. The evaluation revealed no significant differences between the older and younger

workers. In other words, the workplace is equally well suited to persons of any age.

The model workplaces illustrate the need for ergonomic design, and can therefore be used for the purpose of training on the subject, and also in the context of consulting with companies.

However, good ergonomic design of workplaces also has its limits. Some occupations present considerable physical or mental stresses when performed over a long period of time and cannot be performed through to the statutory retirement age. How the work ability and health of the affected workers can be retained despite this is described in the next section.

### **Personnel Development for Occupations of Limited Duration: How Can Employability Be Assured Through a Change in Occupation?**

Construction worker, metal production worker, nurse, forester – in many sectors of the economy, occupations are found that can be performed only for a limited duration. According to Behrens (1994), occupations of limited duration are those that, primarily for health reasons, cannot be performed by the majority of workers through to the statutory retirement age and often not even to the age of 50.

In the long term, the high stresses in these occupations lead to premature attrition and high levels of strain upon the workers. Older workers are particularly affected by the cumulative effects of the stresses in occupations of limited duration. They are often unable to work through to the statutory retirement age and must instead leave the occupation prematurely.

Two approaches are conceivable by which the worker's employability can be assured. The first approach involves all measures for extending the time spent working in the occupation in which the individual was trained (see section "[Design of Workplaces](#)"). This should always be the preferred approach. These measures may, however, not suffice, in which case the second approach

must be taken. The second approach involves the timely provision of advice and training for a change in task or occupation. The consulting concept developed for this purpose is based upon a number of empirical studies (Ulbricht and Jahn 2010; Jahn and Ulbricht 2011; Rahmfeld and Jahn 2012; Seibt and Seidler *in press*; Saifoulline and Jahn 2015). In these studies, a comprehensive risk analysis was performed for the model occupations of nurse, cleaner, construction worker, teacher, and metal caster. Experts with many years' vocational experience, individuals who had successfully changed vocation, occupational physicians, and managers with responsibility for personnel were interviewed in the course of these studies.

The consulting concept essentially comprises four steps:

1. Identification of early-warning indicators
2. Analysis of the risk factors in the current occupation
3. Requirements for a follow-on occupation
4. Provision of advice on a switch to a suitable occupation

#### **Identification of Early-Warning Indicators**

The effects of occupational stresses are often not recognized until an advanced stage and sometimes not until it is already too late. It is important that they be recognized and addressed early in order for retention of employability to be assured. The early-warning indicators are a sign of occupational health hazards and risks that could lead to the employee leaving his or her occupation prematurely.

#### **Early Warnings from Superiors**

Often, it is direct superiors who realize at an early stage that a worker's health and performance are suffering. A drop in work performance or more frequent absences from work may be indicators. The task of the worker's superior is to discuss with the worker what the reasons could be for the impaired work performance and health. Together with the worker, the superior examines whether the impairments could be counteracted by

changes in the organization or design of the work. It is then the superior's responsibility to implement these changes.

Such discussions with personnel can be conducted as part of the regular annual interviews, after 10 years' employment at the company, following changes in a worker's family situation, in the event of variations in performance, or when a worker indicates a need for them.

#### Early Warnings from Occupational Physicians

During occupational medical prophylaxis, occupational physicians are in a position to identify early-warning indicators of health impairments of occupational origin. A relationship based upon trust between the physician and the employee and between the physician and the company is a criterion for sound diagnosis and for effective, early consultation when a risk of work-related disease first becomes apparent.

The following diseases may be early-warning indicators in a metal production worker aged under 45:

- Degenerative diseases of the musculoskeletal system (e.g., signs of attrition in the spine region)
- Rheumatic diseases
- Coronary diseases, vascular changes
- Diseases of the respiratory tract (such as asthma)
- Mental disorders (such as depression)
- Sleep disorders

#### Analysis of the Risk Factors in the Current Occupation

If early-warning indicators are diagnosed during occupational medical examinations, the employee is offered a consultation. Responsibility for the consultation can be assigned to the occupational physician, the employee's immediate superior, the human resources department, the staff council, or the disability manager. The demands of the present job and sources of stresses in the family and social context are analyzed during the consultation. In addition,

the employee's skills and his or her career development goals are determined by a skills analysis.

#### Requirements for a Follow-On Occupation

The outcome of the requirements and skills analysis is a definition of the criteria to be met by an alternative job or occupation which eliminate the critical stresses associated with the existing job and which best match the employee's skills.

#### Provision of Advice on a Switch to a Suitable Occupation

Based upon the results of the analysis, the employee is advised on possible alternative jobs or alternative occupations. Alternative career paths are first developed in conjunction with the employee. Following the decision for a particular career, an integral part-time training concept is developed for preparation for the follow-on job/occupation. Career matrices can be used for this purpose. These include:

- A vertical career path within the company
- A sideways career move within the company
- A change to a job or occupation outside the company

An example of a career matrix is shown in Table 1 with reference to the metal sector.

Vertical career paths leading to management positions are forms of personnel development that, where permitted by the employee's performance, exploit his or her knowledge and experience and counteract health risks before health impairments arise. Such career paths should be opened to middle-aged employees in the company in particular.

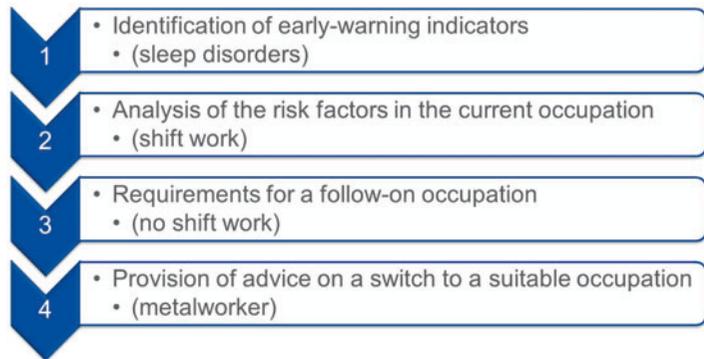
Sideways career moves channel the vocational knowledge and experience and permit their transfer between different departments, thus benefiting the company. The purpose of the change in job is often to prevent or minimize health risks. For large companies in particular, it is the easiest way of bringing about a change.

Figure 6 shows by way of example how this consulting approach is implemented.

**Ergonomics and Demographics, Table 1** Vertical career paths and sideways career moves in companies with reference to the example of the metal sector

	Change in job	Change in occupation
In the company	<p><b>Vertical career path</b>                      For example, as a foreman:                      Shift foreman                      Day foreman                      For example, as a technical employee:                      Quality assurance employee                      Production planning employee</p> <p><b>Sideways career move</b>                      To early shift                      For example, as a metal caster in continuous casting</p>	<p><b>Vertical career path</b>                      For example, in occupational medicine:                      Paramedic in the emergency services                      Employee in occupational medicine</p> <p><b>Sideways career move</b>                      To early shift                      For example, as a mold builder in the mold workshop                      As an employee in the logistics department</p>
Outside the company	<p><b>Vertical career path</b>                      For example, as a technical employee:                      Self-employment (own production company)                      Engineering degree</p>	<p><b>Sideways career move</b>                      Return to previous occupation (e.g., truck driver, cook)                      In a new occupation (e.g., caretaker, metalworker, media designer)</p>

**Ergonomics and Demographics, Fig. 6** A strongly simplified example of careers advice for a change of occupation (Saifoulline and Jahn 2015)



**Example**

1. The occupational medical examination of a metal caster in a casting plant identified sleep disorders as an early-warning indicator of significant impairments to well-being and in particular to cognitive performance.
2. The requirements analysis revealed the most critical factor for stress to be shift work against the background of the employee’s family obligations and his 10-year history of shift work.
3. The following requirements were defined for the follow-on occupation, in consideration of the employee’s many years of

experience in the casting plant and his close affinity to the occupation:

- No shift work
  - Flexible working hours, in order to reconcile work and family life
  - An additional qualification building upon existing vocational knowledge and experience
4. An alternative career in this case is training as a metalworker.

**A Digital Guide for a Sideways Career Move**

In the “Horizontal career changes” project, the approach described here for identification of a suitable occupation for a possible career change was extended to all skilled vocations. A digital

guide was developed in this project that provides companies with assistance in suitable personnel planning. Taking the form of an information portal, it supports affected individuals in the search for an alternative occupation that is as equivalent and as suitable as possible. An integrated ICT instrument contains a database of occupational profiles of all skilled vocations. A person looking for an alternative occupation creates their own personal profile by completing an electronic questionnaire. A specially developed algorithm compares the properties of the personal profile with those of the occupational profiles. The properties considered in the profiles can be divided into three categories: qualifications, preferences, and health. The result is a list of suitable alternative occupations, ranked by match level. The ICT instrument also permits detailed analysis of the results.

The alternative occupations proposed by the ICT instrument constitute preliminary information that cannot and should not replace a personal consultation. Rather, the digital guide is intended to draw attention to the problem of occupations of limited duration and to generate interest in a change of occupation. It is important that this then be followed by a personal consultation.

The digital guide is available for use free of charge on the Internet (in German only) at <http://wegweiser-berufsumstieg.de>.

## Conclusion

Owing to the demographic shift, the proportion of older workers has been rising rapidly for some years and will continue to rise in the future. This increasingly shifts the focus to the retention of work ability. Through knowledge of the performance criteria for older employees, ergonomically optimized design of workplaces, and well-planned personnel development, work ability can be retained and enhanced. The beneficiaries are ultimately not only the ageing workforces but also younger employees.

## Cross-References

- ▶ [Age Diversity at Work](#)
- ▶ [Age-Related Changes in Abilities](#)
- ▶ [Human Resource Management and Aging](#)
- ▶ [Personality Disorders in Older Adults](#)
- ▶ [Technology and Older Workers](#)
- ▶ [Work Design and Aging](#)

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## Event-Related Potentials

Robert West  
Department of Psychology, Iowa State University,  
Ames, IA, USA

### Synonyms

Electroencephalogram; Evoked potentials

### Definition

Event-related brain potentials (ERPs) represent the synchronous activity of populations of cortical neurons measured at the scalp. This entry considers age-related differences in ERPs related to language, episodic memory, and outcome processing.

### Overview

Event-related brain potentials (ERPs) represent the synchronized activity of populations of cortical neurons measured noninvasively at the scalp that are time-locked to some event of interest (e.g., the onset of a stimulus or a button press) (Luck and Kappenman 2012). ERPs provide excellent temporal resolution to examine the unfolding of information processing over time that is superior to hemodynamic measures such as functional magnetic resonance imaging (fMRI) or near-infrared spectroscopy (NIRS). In contrast, the spatial resolution of ERPs is inferior to that of fMRI, although distributed source analysis in combination with multivariate statistical techniques may provide a reasonably precise method for estimating the cortical generators of the ERPs. The ERP technique has been widely used to study information processing related to perception, cognition, emotion, and action (Luck and Kappenman 2012).

ERPs have been used extensively to examine age-related differences in neural recruitment related to topics of interest to cognitive and social neuroscientists including age-related variation in the automaticity of sensory processing, the slowing of processing speed, the encoding and retrieval of episodic memories, and the monitoring of response conflict and errors (Friedman 2012). The direct measure of neural activity makes the technique well suited for studies of neurocognitive aging as issues related to age-related variation in the coupling of the vascular and neural systems inherent in fMRI are not an issue for ERP researchers. This entry provides an overview of the effects of aging on a number of ERP components related to cognitive information processing. For those interested in the effects of aging on ERPs associated with early sensory or perceptual processing, Friedman (Friedman 2012) provides an excellent review of this literature.

### The P3s

The P3 or P300 is the most extensively studied ERP component that represents at least two

distinct components (i.e., P3a and P3b) that can be dissociated based upon their psychological characteristics, neural generators, and neuropharmacological underpinnings (Polich 2007). The components contributing to the P3 are most commonly observed in the oddball task that compares the ERPs elicited by a frequent standard stimulus relative to a lower-frequency target stimulus (i.e., oddball) and/or a task-irrelevant distractor stimulus. The P3a/P3b components are both observed with auditory, visual, and somatosensory stimulation, indicating that they reflect information processing beyond the primary sensory systems. The amplitude of the P3a is maximal over the frontal midline, while the amplitude of the P3b is maximal over the central–parietal midline (Polich 2007). The P3a commonly peaks between 250 and 400 ms after stimulus onset, while the P3b can peak from anytime time between 300 and 600 ms after stimulus onset depending upon task demands. The P3a is thought to reflect stimulus-driven attentional orienting, and the P3b is thought to reflect the allocation of attention to stimulus categorization that facilitates subsequent memory processing (Polich 2007). A P3a-like component has been described in a number of different paradigms resulting in various labels being applied to this component of the ERPs including the P3a, the novelty P300, and the no-go P300. Systematic comparison of the ERPs elicited in various paradigms using multivariate statistical techniques demonstrates that these three “components” in fact reflect the same phenomenon (Polich 2007). In complex tasks used in the cognitive aging literature, the ERPs measured at the scalp often reflect a mixture of the P3a, P3b, and other components that share temporal–spatial overlap. This makes it important to carefully consider aspects of paradigm design and/or utilize statistical techniques that allow one to tease apart the contribution of different components during study design and data analysis.

The P3 has been used extensively in studies examining the effects of aging on information processing (Friedman 2012). The underlying topography of the P3a and P3b appears to be similar in younger and older adults, although this may be obscured in the manifest scalp-recorded

ERPs. Consistent with the speed of processing theory of cognitive aging, the latency of the P3 increases in a fairly linear fashion from 20 to 80 years of age (Polich 1996). This effect may be somewhat stronger for auditory than visual stimuli, increase as target frequency decreases, and be greater for oddball tasks requiring counting responses relative to button presses. The age-related slowing observed for the P3 is greater and more consistently observed than the effect of aging on earlier ERP components related to sensory processing (Polich 1996), which may highlight differences between sensory and cognitive aging (Friedman 2012).

In addition to the age-related increase in the latency of the P3, a number of investigators have reported that the distribution of the P3 becomes more anterior in older adults relative to younger adults, reflecting an “anterior shift” in the oddball task (Fabiani et al. 1998). The anterior shift appears to be stronger for older adults with lower executive function than those with higher executive function. The reason for the anterior shift has been debated in the literature. It appears that the effect may at least partially result from the greater contribution of the P3a to the ERPs elicited by target stimuli in older adults than in younger adults, while the P3b distinguishing target from standard stimuli may be relatively preserved in later adulthood. Age-related differences in the contribution of the P3a and P3b elicited in the oddball task and other paradigms highlight the potential importance of using carefully designed paradigms in combination with appropriate statistical techniques to gain a clear understanding of the effects of aging on the latent ERP components that are manifest in the scalp-recorded ERPs.

### The Medial Frontal Negativities

Over the last two decades, there has been an explosion of interest in transient negativities observed over the medial frontal region of the scalp in a number of different paradigms (Friedman 2012; Cavanagh and Frank 2014). These include the error-related negativity (ERN) that distinguishes errors from correct responses in

a variety of tasks, the N2 and medial frontal negativity (MFN) that distinguish incongruent trials from congruent trials in the flanker and Stroop tasks, and the feedback negativity (FN) or feedback-related negativity (FRN) that distinguishes gains from losses in gambling and reinforcement learning tasks. Each of these components has been linked to neural generators in the anterior cingulate cortex (ACC) in studies using both dipole source modeling and distributed source analysis. Consistent with these findings, converging evidence from studies using fMRI in humans and single-unit recording in primates has revealed neural activity related to choice errors, response conflict, and negative feedback in the ACC (Cavanagh and Frank 2014; Gehring et al. 2012).

The ERN represents a transient negativity over the medial frontal region of the scalp that in healthy younger adults is greater in amplitude for errors than correct responses (Gehring et al. 2012). The ERN typically peaks between 50 and 100 ms after an error is committed and reflects the activity of an endogenous error monitoring system, as feedback indicating the presence of the error is not required to elicit the component. The ERN is typically followed by the error positivity (i.e., Pe) that can extend from the frontal to the parietal region of the scalp and last for 300–500 ms after the response. The psychological processes represented by the ERN and Pe have been extensively debated, and current consensus appears to be that the ERN is related to the detection and possibly correction of the error or the restoration of goal-directed processing, while the Pe is related to conscious awareness that an error has occurred.

The effect of aging on the ERN has been studied in a variety of paradigms including choice response tasks, response compatibility tasks (e.g., flanker or Stroop task), and reinforcement learning tasks (Friedman 2012). In almost all cases, the amplitude of the ERN is reduced in older adults relative to younger adults when measured as the difference between errors and correct responses. The effect of aging on the ERN most commonly appears to result from a decrease in the

amplitude of the ERPs elicited by errors in older adults, although some evidence indicates that aging can also be associated with an increase in the amplitude correct-related negativity (CRN) in older adults that thereby reduces the difference in amplitude between errors and correct responses. Potential moderators of the effect of aging on the ERN have not been extensively explored, with some limited work demonstrating that the effect of aging is not sensitive to individual differences in physical fitness. Together, the results of the extant literature lead to the suggestion that aging is associated with a decrease in the efficiency of the endogenous error monitoring system that involves the ACC and is reflected by the ERN.

The MFN is elicited in a variety of stimulus–response compatibility tasks and reflects greater negativity for incongruent (incompatible) than congruent (compatible) trials that can be observed when the ERPs are locked to either stimulus or response onset (Friedman 2012). In the flanker and Simon tasks, the MFN or N2 tends to be greatest in amplitude between 200 and 300 ms after stimulus onset, while in the Stroop and Stroop-like tasks, the component is greatest in amplitude between 300 and 500 ms after stimulus onset. The difference in the timing of component across tasks is likely related to variation in the time course of information processing, as the flanker or Simon tasks tend to produce substantially shorter response times than the Stroop task.

The effect of aging on the MFN is less consistent than the effect of aging on the ERN, but there have also been fewer studies (Friedman 2012). In studies using a Simon-like task wherein the ERPs were locked to the response, the amplitude of the MFN was similar in younger and older adults (Friedman 2012). In contrast, in studies using the color-word or counting Stroop tasks wherein the ERPs were locked to stimulus onset, the amplitude of the MFN was attenuated in older adults relative to younger adults (West and Schwarz 2006). Given the existing literature, it is difficult to know whether variation in the effect of aging observed across studies results from differences in the cognitive processes measured by the tasks that were utilized in the various studies or the method

of data processing. There is some evidence that individual differences in executive function may moderate the effect of aging on the MFN observed in the Stroop task and that the presence of age-related differences in the MFN is sensitive to the amount of interference that is encountered in the task (Friedman 2012; West and Schwarb 2006). Gaining a greater understanding of how individual differences and task-related factors influence the effect of aging on the MFN is clearly one avenue for future research.

The FN represents a transient negativity over the frontal central region of the scalp that is greater in amplitude following negative outcomes (i.e., losses or negative feedback) than positive outcomes (i.e., gains or positive feedback) in gambling and reinforcement learning paradigms between 250 and 350 ms after feedback is presented (Cavanagh and Frank 2014). Studies examining the effect of aging on the FN have consistently revealed that the amplitude of this component is smaller in older adults than in younger adults and that this results from a reduction in the amplitude of the ERPs elicited by negative outcomes (Hämmerer et al. 2011). In various studies, the reduction in the amplitude of the FN in older adults has been associated with a mild decrement in associative learning, a tendency to switch following gains and losses, and a tendency to be more conservative than younger adults. These findings may indicate that an age-related reduction in the efficiency of feedback processing could have widespread effects on efficient information processing.

In summary, aging is associated with a reduction in the amplitude of medial frontal ERP activity related to error monitoring and feedback and conflict observed in a variety of paradigms. At the neurobiological level, these data may indicate that aging is associated with a decrease in the functional integrity of the ACC and related neural structures; at the psychological level, the effect of aging on the MFNs and the ACC may contribute to an age-related reduction in degree to which negative or undesirable outcomes guide future information processing or decision making.

## Episodic Memory

ERPs have been used extensively to examine the neural correlates for encoding and retrieval processes related to episodic memory in studies of item recognition and source memory (Wilding and Ranganath 2012). Successful encoding is commonly associated with slow-wave activity over the frontal and parietal regions of the scalp that can be greater in amplitude over the left than right frontal regions. The left frontal slow-wave activity has been associated with semantic retrieval and integrative processing that facilitates episodic encoding. The ERP correlates of successful retrieval are somewhat dependent upon the task that is used to probe episodic memory. In recognition memory paradigms, there are three components that consistently distinguish remembered items (hits) from forgotten (misses) or new (correct rejections) items; these include the FN400, the left parietal old–new effect, and the right frontal slow wave. The NF400 is greatest in amplitude over the medial frontal region of the scalp and has been associated with item familiarity, being similar in amplitude for recognized old items regardless of whether or not the memory includes source information or recollection. The left parietal old–new effect represents greater positivity for old items than for new items between 400 and 600 ms after stimulus onset that is typically greater in amplitude when recognition is associated with source information or recollection. The right frontal slow wave is observed less consistently than the other two components and has been associated with monitoring or meta-memory processes. In paradigms requiring source judgments or cued recall, successful retrieval is commonly associated with slow-wave activity that can be broadly distributed over the scalp from the frontal to the parietal regions. As will become clear in the paragraphs that follow, the effect of aging on ERPs related to successful encoding and retrieval in episodic memory has been quite mixed with some studies revealing minimal age-related differences in ERP activity related to episodic memory, while others reveal dramatic reductions in amplitude in older adults or ERP components that are seemingly

unique to older adults (Friedman 2012; Friedman et al. 2007).

ERPs measured at encoding reveal slow-wave activity that distinguishes between stimuli that are later remembered relative to those that are later forgotten (Hämmerer et al. 2011). The amplitude of slow-wave activity associated with encoding verbal stimuli can be attenuated in older adults relative to younger adults, and this appears to be one source of age-related declines in episodic memory (Friedman 2012). Age-related differences in ERPs related to successful encoding may reflect the failure of older adults to spontaneously utilize processing that promotes recollection or to engage in sustained integrative semantic processing that facilitates later memory. Consistent with this idea, the amplitude of the subsequent memory effect in the ERPs is similar in amplitude when individuals encode natural scenes that are thought to foster relational processing during encoding.

There is considerable variability in the effect of aging on the ERP correlates of episodic memory in studies examining recognition (Hämmerer et al. 2011). A number of studies have reported that the amplitude of the FN400 is similar in younger and old adults, a finding that converges with the behavioral literature in demonstrating that familiarity is preserved in later adulthood (Friedman 2012). However, in other studies, the amplitude of the FN400 was reduced in older adults relative to younger adults, or there was no difference in the amplitude of the ERPs elicited by hits and correct rejections in the time window where the component was observed in younger adults (Wang et al. 2012). A similar pattern has been observed for the left parietal old–new effect. In some studies, the amplitude of the component is similar in younger and older adults when source information or recollection is associated with memory retrieval; however, in other studies the amplitude of the left parietal old–new effect is attenuated in older adults, or there is no difference between hits and correct rejections. One possible explanation for variation across studies is related to the demands of the memory test, as age-related differences appear to be reduced or absent when recollection or source information is required for a

successful memory judgment relative to when individuals could rely on familiarity to support successful recognition (Friedman 2012). Another possibility is that the mixed results result from variation in the characteristics of the older adults included in the samples across studies. Supporting this idea, limited work has demonstrated that individual differences in memory performance, education, and executive function may moderate the effect of aging on parietal ERPs related to episodic memory.

In addition to examining the effect of aging on the FN400 and left parietal old–new effect that are related to recognition memory in younger adults, some studies have also reported ERP components over the frontal region of the scalp associated with successful recognition that may be limited to older adults (Friedman 2012). There are not a sufficient number of studies that have examined ERPs unique to older adults to draw firm conclusion regarding the functional significance of this neural activity. The frontal ERP activity may be greater in amplitude for low-performing individuals relative to high-performing individuals, leading to the suggestion that it likely does not reflect compensatory recruitment that underpins preserved episodic memory in later adulthood.

Studies using ERPs consistently reveal two effects of aging on the neural correlates of source memory (Li et al. 2004). In younger adults, the retrieval of source information is associated with left parietal activity that resembles the old–new effect and slow-wave activity over the right frontal region. The amplitude of both of these components is attenuated in older adults, and in some studies the amplitude of the ERPs does not differ between old and new items in older adults. These findings are consistent with the age-related decline in source memory that is commonly observed in behavioral studies. In older adults, there is slow-wave activity extending from the frontal to parietal regions that reflects greater negativity when source information is retrieved relative to new items. This slow-wave activity is generally absent in younger adults. Some investigators have suggested that age-related differences in the ERP correlates of source memory may reflect variation in the type of information that

younger and older adults rely upon when making source judgments. Consistent with this idea, the left hemisphere ERP activity was reduced or eliminated in older adults when participants were instructed to use self-referential processing during encoding that presumably focused individuals to rely on a source of information known to promote episodic memory (Dulas et al. 2011).

## Language

Since the discovery of the N400 in 1980, this and other ERP components (e.g., P600 and late frontal positivity) have been widely used to study various aspects of information processing related to language comprehension (Friedman 2012; Kutas and Federmeier 2011). ERPs provide an excellent tool for investigating relatively natural language process without the imposition of artificial response demands that are required when using some behavioral measures. The N400 represents a negativity in the ERPs over the central to parietal midline that varies in amplitude with the degree of fit between the meaning of a stimulus (i.e., word, picture) and the prior semantic context. Like the N400, the late frontal positivity is also sensitive to semantic aspects of information processing. This component may be related to ambiguity resolution as it is most pronounced when a word is inconsistent with a highly constrained semantic context. In contrast to the N400, the P600 represents a later positivity over the parietal region that is more sensitive to variation in syntactic variables rather than semantic features of the stimulus or linguistic context. The effect of aging on the P600 has only been investigated in a few studies, which appear to demonstrate that aging has little effect upon syntactic processing related to this component (Friedman 2012).

The effects of aging on the N400 and the linguistic variables that contribute to the generation of this component have been intensely investigated (Friedman 2012; Wlotko et al. 2010). With visual or auditory + visual stimuli, the latency of the N400 increases by about 1.5 ms per year, and its amplitude decreases by .05-.09 microvolts per year

between 20 and 80 years of age (Kutas and Iragui 1998). The effect of aging on the latency of the N400 may be reduced or eliminated with auditory presentation of connected speech. Importantly, this method of presentation does not eliminate the effect of aging on the amplitude of the N400. Understanding the nature of the effects of aging on the N400 may provide insight into the development of age-associated neuropathology, as variation in the amplitude of the N400 and P600 has been shown to predict conversion from mild cognitive impairment to dementia over a 3-year period (Olichney et al. 2008).

The reason for the age-related decrease in the amplitude of the N400 has been examined in a number of studies (Wlotko et al. 2010). There is general agreement that the effect of aging on the N400 does not result from an age-related decline in semantic memory (Friedman 2012). In contrast, the results of a number of studies lead to the suggestion that an age-related decline in the use of contextual information to form expectations or make predictions during online comprehension may account for the effect of aging on the N400 (Wlotko et al. 2010). Also, other research demonstrates that the effect of aging on the N400 may result from the coordinated recruitment of the left and right hemispheres to support processing of multiple meanings of words (i.e., dominant versus nondominant) or to integrate different features (i.e., concreteness versus imagery) of words (Wlotko et al. 2010). Consistent with this idea, the amplitude of the late frontal positivity related to ambiguity resolution is attenuated, or this component is absent, in older adults. This effect of aging on the late frontal positivity would be consistent with the idea that older adults generally do not activate multiple meanings of ambiguous words during online comprehension, thereby reducing the need for ambiguity resolution.

The effect of aging on language comprehension and particularly ambiguity resolution may be sensitive to individual differences in verbal fluency, an important executive function (Wlotko et al. 2010). Two studies have demonstrated that individual differences in verbal fluency are correlated with ERP amplitude over the frontal region of the scalp when individuals are required to

resolve ambiguity related to homographs or semantic incongruity, with high-fluency older adults being more similar to younger adults than low-fluency older adults. This effect appears to be relatively limited to frontal processes as it does not extend to the N400.

## Conclusions

The literature reviewed in this entry clearly demonstrates the utility of using ERPs to examine the effects of aging on neural activity related to various aspects of cognition. In some instances, the ERP data converges nicely with the cognitive aging literature (e.g., the linear effect of aging on the latency of the P3 and N400 components) (Polich 1996; Kutas and Iragui 1998). In other instances, the ERP data reveal qualitative differences in neural recruitment between younger and older adults that may not be expected within the context of a cognitive behavioral perspective (e.g., age-related variation in left and right frontal slow-wave activity related to source memory) (Li et al. 2004). Also, there is growing evidence that various individual differences may moderate the effect of aging on neural recruitment reflected by ERPs (West and Schwarb 2006; Wlotko et al. 2010) and that understanding these differences may provide insight into the development of age-associated neurodegenerative disease (Olichney et al. 2008).

## Cross-References

- ▶ [Cognitive Control and Self-Regulation](#)
- ▶ [Executive Functions](#)
- ▶ [Language, Comprehension](#)
- ▶ [Memory, Episodic](#)

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## Everyday Cognition

Jason C. Allaire<sup>1</sup> and Alyssa A. Gamlado<sup>2</sup>

<sup>1</sup>Department of Psychology, North Carolina State University, Raleigh-Durham, NC, USA

<sup>2</sup>School of Aging Studies, University of South Florida, Tampa, FL, USA

### Synonyms

Everyday problem-solving

### Definition

Everyday cognition refers to the ability of individuals to solve cognitively complex real-world or “everyday” problems. Specifically, studies of everyday cognition focus on assessing the real-world manifestation of basic cognitive abilities such as memory, reasoning, knowledge, and processing speed by testing older adults’ ability to solve problems using ecologically valid stimuli such as a medication label or food nutrition label.

### Everyday Cognition and Everyday Problem-Solving

Terms such as “practical problem-solving” or “everyday/real-world problem-solving” are used interchangeably, and both are often applied to studies of everyday cognition. However, practical or everyday/real-world problem-solving refers to the larger domain of research focused on examining the ability of older adults to solve any kind of real-world problem. Everyday cognition refers to a subdomain of practical or everyday/real-world

problem-solving, which is characterized by cognitively complex real-world problems typically drawn from domains of instrumental daily functioning such as medication use, financial management, or food preparation. These types of problems typically have one “correct” answer, and therefore, the focus is on objective performance.

Another subdomain of practical or everyday/real-world problem-solving focuses on socio-emotional or affective problems that older adults might face in their daily lives (Blanchard-Fields 2009). Studies examining these socially and/or emotionally laden real-world problems typically focus on identifying the coping strategies employed in response to these problems. While socioemotional problem-solving is an important area of research, only everyday cognition is discussed here.

### Theoretical Underpinnings

The study of everyday problem-solving in general and everyday cognition specifically began, in part, by questioning whether psychometric tests of cognition were appropriate assessments of older adults’ cognitive functioning (Denney 1989; Willis and Schaie 1986). Some argued that despite significant and normative age-related declines in many cognitive abilities, the majority of older adults retained their ability to effectively function in their daily lives. In addition, psychometric tests were designed for and validated in samples of children and young adults in an academic setting. Thus, for older adults, who are many years removed from school environments, psychometric tests may not be sensitive measures of cognitive competence. In addition, context-free psychometric tests might underestimate older adults’ ability because they do not allow them to call upon a lifetime of accumulated knowledge to solve the problem. That is, in their everyday lives, older adults can draw upon domain-relevant experiences to support and/or enhance their cognitive performance, and so relatively “a-contextual” laboratory-based assessments of cognition may produce an underestimation of true performance

competencies. These concerns with psychometric tests led some researchers to propose that measures comprised of real-world problems and stimuli that older adults might face in their daily lives might be a more accurate way to assess cognitive competency (Denney 1989; Willis and Schaie 1986).

The early everyday problem-solving research focused on identifying the kinds of problems older adults experienced in their everyday lives. These studies found that the everyday problems older adults often experienced fell into one of two overarching categories: socioemotional or instrumental. Early studies assessing individual differences in performance included both problem types, such as the seminal work by Denney (1989). However, as the field matured studies tended to focus on examining problem-solving either within instrumental domains of functioning (Willis and Schaie 1986) or socioemotional domains (Blanchard-Fields 2009).

### Measuring Everyday Cognition

There are a number of different measures used to assess everyday cognition. An excellent overview of the various measures is provided by Law and colleagues (2012). Assessments of everyday cognition tend to have at least four things in common. First, as previously mentioned they generally focus on instrumental tasks of daily living which older adults must be able to solve effectively in order to remain independent. Items describe a real-world problem such as “You woke up this morning and your refrigerator is not working” and/or present real-world stimuli, such as a bank statement, and ask participants to solve problems based on those stimuli. Second, the real-world problem is clearly defined, so older participants know exactly what they are supposed to solve. For instance, there is little ambiguity as to what is the real-world problem in the following statement: “You woke up this morning and your refrigerator is not working.” Third, the desired goal or end state is also apparent from the problems (e.g., you want your refrigerator to work). Fourth, most measures are performance based rather than

self-report. Though some interesting findings have come from subjective measures of everyday cognition (Farias et al. 2013; Marshall et al. 2014), such assessments are often unrelated to objective performance (Tucker-Drob 2011).

### Sources of Individual Differences in Everyday Cognition

Over the past 25 years, research on everyday cognition has primarily focused on identifying sources of individual differences in older adults’ performance. Not surprisingly, given the early rationale for studying everyday cognition, much of the research has centered on the mapping of age differences as well as understanding the underlying role basic cognitive abilities play in everyday cognitive performance.

**Age-related Differences and Changes.** As previously mentioned, the study of everyday cognition was, in part, predicated on the idea that psychometric measures of cognition might underestimate older adults’ true cognitive competency. Furthermore, performance on real-world measures of cognition might be preserved because elders can call upon domain-specific knowledge when solving real-world problems. Unfortunately, there has been very little evidence to support this assumption, with many cross-sectional studies reporting a negative relationship between age and everyday cognition (Allaire and Marsiske 1999; Burton et al. 2006; Diehl et al. 2005). In fact, results from a meta-analysis of over 33 age-comparative studies indicated that older adults performed significantly worse than middle-age and younger adults on measures of everyday problem-solving, particularly on items drawn from the instrumental domains of daily living (e.g., financial and medication management) (Thornton and Dumke 2005).

In addition to negative age differences, a number of longitudinal studies have found evidence of long-term decline in everyday cognitive functioning (Tucker-Drob 2011; Yam et al. 2014; Gross et al. 2011). Tucker-Drob reported that three different measures of everyday cognition exhibited significant and negative decline over a

5-year period (Tucker-Drob 2011). In a follow-up to that study, Yam and colleagues reported that everyday cognition exhibited a quadratic over a 10-year period (Yam et al. 2014). Specifically, an early increase in everyday cognitive performance due to practice effects was overshadowed by significant declines in performance over time.

Taken together, these findings suggest that older adults' ability to solve cognitively complex everyday problems is, in general, compromised with age. However, it is possible that in some situations, perhaps where tacit knowledge for the problem or context is strongly age-related, differences may be minimized. For instance, Artistic and colleagues reported that older adults performed better than younger age groups on everyday problems set within an "older adult context" (Artistic et al. 2010). Presumably, older adults benefited from their familiarity with the context of the problem and their domain-specific knowledge of the problem. Unfortunately, the authors did not adequately assess domain-specific knowledge. It is important to note that age is not an explanatory variable but merely an index of chronological time. That is, an individual's age does not cause declines in everyday cognition, but instead a more proximal predictor(s) associated with age is driving the declines. Additional research is still needed to understand what factors can explain the age-related differences and age-related declines in everyday cognitive functioning. One such explanatory construct is basic cognitive functioning.

## Basic Abilities

Given that everyday cognition is characterized by the ability to solve *cognitively* complex real-world problems, it should come as no surprise that basic cognitive abilities provide the foundation for everyday cognitive performance. That is, everyday cognition can be considered the application of basic cognitive abilities to real-world problems such that an amalgam of basic abilities is responsible for cognitive performance within everyday contexts. Evidence from cross-sectional studies suggests that lower performance on basic ability tests

(e.g., inductive reasoning, memory, processing speed) is associated with lower everyday cognitive functioning (Allaire and Marsiske 1999; Burton et al. 2006; Diehl et al. 2005). In fact, Allaire and Marsiske reported that as much as 80% of the individual differences in everyday cognition were accounted for by basic cognitive abilities, particularly memory and inductive reasoning ability (Allaire and Marsiske 1999). Yen and colleagues reported that inductive reasoning and a factor representing learning and memory were both significantly related to everyday cognitive functioning, while processing speed was not related to everyday cognition (Yen et al. 2011). Informant-based subjective everyday cognition functioning is also significantly negatively related to neuropsychological clinical assessments of memory and executive functioning (Farias et al. 2013).

Evidence of the association between basic cognitive abilities and everyday cognition also comes from more recent longitudinal studies (Tucker-Drob 2011; Gross et al. 2011; Yam et al. 2014). Yam and colleagues found that 10-year decline in everyday cognition was not as dramatic as the decline observed for memory and speed (Yam et al. 2014). However, the negative trajectory for everyday cognition was greater than what was observed for verbal ability and was significantly similar to that of reasoning ability. In fact, reasoning accounted for 85% of the intercept and 96% of the slope variance in everyday cognition. Tucker-Drob reported that decline over 5 years in three different measures of everyday cognition was significantly related to decline in basic ability measures assessing reasoning, processing speed, and memory (Tucker-Drob 2011). In fact, a single latent change factor could significantly account for change in each of the basic ability and everyday cognition tests, suggesting that these declines are the "manifestation of a common underlying process." Further evidence of this common underlying process comes from Farias and colleagues (2013), who reported that lower total brain and hippocampus volume were related to worse everyday cognition (Farias et al. 2013).

**Other Sources of Individual Differences.** While the lion's share of research has focused on everyday cognition as it relates to age

and/or intellectual ability, some researchers have explored other sources of individual differences. For instance, markers of health such as blood pressure and number of chronic conditions have been associated with everyday cognition. For instance, Whitfield and colleagues found that the number of chronic conditions and perceived change in health status were significantly related to lower everyday cognitive performance even after controlling for demographic characteristics (Whitfield et al. 2004). In addition, lower blood pressure is associated with worse everyday cognition ability even after controlling for age and performance on tests of basic cognitive abilities. In addition to indices of physical health, higher levels of depression have been shown to be directly and indirectly (through basic cognitive abilities) associated with lower everyday cognitive performance (Yen et al. 2011). There is also evidence that depression is related to everyday cognition (Paterson et al. 2015). Higher scores on a standard measure of depression were significantly related to worse everyday cognitive functioning in older adults. The predictive salience of depression remained even after controlling for age, gender, and education.

### **Predictive Outcomes of Everyday Cognition**

As previously discussed, early research on everyday cognition focused on cataloguing the problems older adults faced in their day-to-day lives. As the field developed, studies turned to exploring age differences and the association between basic cognitive abilities and everyday cognition. More recently, a growing group of researchers have turned to examining the extent to which everyday cognition predicts meaningful outcomes. If everyday cognition is thought to assess cognition in the real-world, then it should be strongly related to real-world outcomes. Moreover, everyday cognition was, in part, originally designed as an “alternative” to traditional measures of intelligence or cognitive functioning. Therefore, if it does not provide added value beyond basic cognitive abilities, then there may be no need to include

assessments of everyday cognition in addition to basic cognitive ability tests. It is important to note that when everyday cognition is used as a predictor, there should not be an assumption of causality. That is, everyday cognition does not necessarily cause the outcome, but it is related to explaining individual differences in the outcome.

One such outcome is mortality, where lower performance on measures of everyday cognition is uniquely related to a greater likelihood of death (Allaire and Willis 2006; Weatherbee and Allaire 2008). For instance, Weatherbee and Allaire reported that performance on a measure of everyday knowledge was a significant and unique predictor of death even after controlling for a number of basic cognitive abilities (Weatherbee and Allaire 2008). In another study, everyday cognition was a significant and unique predictor of nearness to death (Allaire and Willis 2006). Perhaps related to morality, older adults who performed better on measures of everyday cognition were more likely to remember to take their medications even after controlling for performance on basic cognitive ability tests (Neupert et al. 2011). Thus, performance on everyday cognition may be an indirect indicator of mortality risk, in that it can identify older adults who are likely to adhere to their health provider’s prescribed medication and/or treatment plan, which can sustain their health and quality of life and reduce their mortality risk. Not surprisingly, everyday cognition also serves as a unique predictor of older adults’ self-reported instrumental functioning (Allaire and Marsiske 2002; Allaire et al. 2009), accounting for all individual differences in subjective instrumental functioning associated with basic abilities and also adding unique explanatory power (Allaire and Marsiske 2002).

**Cognitive Impairment.** Everyday cognition is also used as a predictor of mild cognitive impairment (MCI) which is considered the transitional period between normal cognition and dementia. Cross-sectional studies of community-dwelling elders report that performance on various measures of everyday cognition significantly predicts impairment or MCI status even after controlling for performance on cognitive screening or basic cognitive ability measures (Allaire et al. 2009;

Burton et al. 2009; Allaire and Willis 2006). Allaire and colleagues reported that older adults with MCI performed significantly worse on the three instrumental subdomains of an everyday memory test and that performance on the subdomain assessing of financial management was a significant and unique predictor of MCI status even after controlling for a battery of basic cognitive ability tests (Allaire et al. 2009). Thomas and Marsiske reported that everyday cognitive performance was worse in older adults with amnesic MCI, then nonamnesic, and then unimpaired (Thomas and Marsiske 2014).

Studies from the clinical literature have also found that everyday cognition plays a central role in differentiating between impaired and nonimpaired older adults. For instance, a study using an informant and proxy subjective assessment of everyday cognition, while not ideal, found that items such as “remembering a few shopping items” or “balancing a checkbook” significantly discriminated MCI from non-MCI older adults (Marshall et al. 2014). In addition, this same study also found that older adults with poorer everyday cognition were more likely and more quickly to progress from normal to impaired status. However, this study did not control for basic cognitive abilities. Other studies have also reported that differences between MCI and non-MCI older adults are particularly salient when the everyday task is memory laden (Farias et al. 2013).

## Interventions

Since the late 1970s, a considerable amount of research has focused on the extent to which older adults’ basic cognitive functioning is amenable to intervention. As part of this research, measures of everyday cognition have been used as outcome variables. Their use in outcome batteries is to determine if the cognitive training intervention impacts domains related to but still unique from the basic abilities which are the focus of the intervention. However, there is little evidence that interventions focused on improving basic cognitive abilities have a robust or reliable impact on older adults’

everyday cognition functioning. For instance, results from the ACTIVE study have suggested that while improvements in trained abilities are evident, these gains do not consistently transfer to measures of everyday cognition (e.g., Rebok et al. 2014).

Given this lack of transfer, some studies have examined whether everyday cognition is amenable to direct intervention. For example, Thomas and Marsiske (2014) examined the outcome of providing simple verbal instructions or prompts such as “look harder” or “try again” when a participant was unable to correctly answer a question on an everyday cognition test. The results suggested that prompts significantly improved performance. Promoted performance did not exhibit significant age-related decline like unprompted performance. Moreover, participants with MCI benefitted the most from prompts with prompted performance similar to that of the unprompted performance of non-MCI participants. Another study adapted the strategies used to train inductive reasoning ability and applied them to real-world or everyday problems (Williams et al. 2014). Participants from assisted living facilities that received this training experienced significant gains in everyday cognitive performance relative to participants that did not. In addition, these gains were maintained 3 months later.

## Conclusion

With the burgeoning older adult population, there will be an increasing concern among older adults about experiencing cognitive impairment and, subsequent, loss of functional independence. Understanding the antecedent of and outcomes associated with an older adult’s ability to perform cognitively demanding real-world tasks is at the core of everyday cognition. Even though everyday cognition is correlated with basic abilities, it remains sufficiently distinct enough to warrant additional research. While studies have begun to point out that everyday cognition is a salient and unique predictor of important real-world outcomes, additional research is warranted to identify

modifiable determinants of impaired everyday cognition. Such research can be useful in designing successful interventional protocols to improve cognitive functioning and well-being.

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## Executive Functioning

Stephen Rhodes<sup>1</sup> and Mario A. Parra<sup>1,2,3,4</sup>

<sup>1</sup>Department of Psychology, Centre for Cognitive Ageing and Cognitive Epidemiology, and Human Cognitive Neuroscience, The University of Edinburgh, Edinburgh, UK

<sup>2</sup>Department of Psychology, Heriot–Watt University, Edinburgh, UK

<sup>3</sup>Alzheimer Scotland Dementia Research Centre, The University of Edinburgh, Edinburgh, UK

<sup>4</sup>UDP–INECO Foundation Core on Neuroscience (UIFCoN), Diego Portales University, Santiago, Chile

### Synonyms

Central executive; Controlled processing; Response inhibition; Set-shifting; Working memory updating

### Definition

Executive functioning is an important concept in neuropsychology and broadly refers to our ability to plan and coordinate complex behavior. The term is used widely in describing performance on cognitive tasks that require planning, strategy use, self-regulation, focused attention, inhibition, and other supervisory functions.

## Executive Functioning

Our executive functions allow us to organize the actions of lower-level cognitive processes in order to behave flexibly in the face of an ever-changing environment. A multitude of complex cognitive tasks have been developed to assess executive functioning, and healthy aging appears to impair performance on many of these measures. While it has often been proposed that executive functioning reflects the operation of a number of subprocesses, such as planning, strategy use, self-regulation, focused attention, and so on, the complex nature of the measures used to assess executive functioning has made this difficult to clearly establish. However, over the past two decades, a great deal of progress, using psychometric methods, has been made toward identifying core processes underlying executive functioning. The emerging view is that there are separable but interdependent components underlying performance of complex executive tasks. This approach has also been used to assess the effect of healthy aging on specific processes in order to better characterize the decline of executive functioning with age. Given the pervasive effect of age on cognition, much of this work has also attempted to establish whether the effect of age on specific functions is greater than would be expected given age-related decline in speed of processing. This entry does not aim at providing a comprehensive review of the topic; for such reviews see MacPherson et al. (2015), Jurado and Rosselli (2007) and Phillips and Henry (2008). Its aim is to briefly touch upon state-of-the-art issues in this field with emphasis on current theories of cognitive aging.

### Fractionating Executive Functioning

In their highly influential paper, Baddeley and Hitch (1974) made the distinction between low-level storage buffers for verbal and visuospatial information and a higher-level controlling mechanism they termed the “central executive.” This executive component was said to coordinate the action of the “slave” storage systems and

allow flexible behavior in the face of constantly changing goals. Whether executive functioning reflects the action of a single general-purpose control system or multiple separable processes, working in concert, has since proven controversial. Neuropsychologists have developed a wide array of measures to assess executive functioning, and Table 1 provides a selective list of commonly used tasks. These measures are inherently complex, and, given this problem of task impurity, there is widespread disagreement as to what underlying abilities these tasks actually assess (MacPherson et al. 2015; Jurado and Rosselli 2007). Consequently, psychometric methods have proven useful in identifying potential core processes that support executive functioning. These methods assess patterns of shared variance between conceptually similar tasks and attempt to explain performance on an array of measures in terms of underlying, latent variables. The emerging view from this line of research is that the central executive can be fractionated into separable but highly interdependent executive processes (Jurado and Rosselli 2007; Miyake et al. 2000; Miyake and Friedman 2012).

In their review of the literature, Miyake and colleagues (2000) identified three executive functions, or processes, that are commonly referred to when explaining performance on measures of executive functioning. These three executive functions are as follows:

1. *Updating*: When information currently stored in working memory – the small amount of material that can be actively maintained in the face of concurrent processing – is no longer relevant to current goals, the space must be freed up via the removal of irrelevant items. This ability to clear and update working memory is crucial for the efficient use of this limited capacity workspace. Updating is typically assessed with tasks that require simultaneous storage and processing of information (see Table 1).
2. *Shifting*: In day-to-day life, it is rarely the case that one task can be completed without attention being diverted to another. This ability to switch between different mental sets necessitates that the appropriate rules for a given task are maintained and engaged/disengaged as required. Measures of shifting typically compare performance between conditions in which participants characterize stimuli according to a single rule, to conditions in which there are two or more rules to shift between (see Table 1). These measures of task switching are considered important indices of cognitive control.
3. *Inhibition*: Much of our behavior is automatic and based on well-learned responses to stimuli. However, it is often desirable to inhibit these prepotent responses if the automatic reaction is inappropriate. Typical assessments of this construct require speeded responses that run counter to well-learned stimulus–response mappings, for example, naming the color font in which the word BLUE is presented (see Table 1). Inhibition may also refer to the ability to ignore irrelevant information or the ability to resist the distracting effects of no-longer-relevant information, also known as proactive interference (Miyake and Friedman 2012).

Having identified these core executive functions in the literature, Miyake et al. (2000) administered a range of simplified executive functioning measures to a group of young, college-aged adults. Using latent variable modeling, they then assessed patterns of association between the different measures to examine whether their three proposed executive functions could be separated. A model separating the contributions of updating, shifting, and inhibition to performance on measures of executive functioning gave a better account of their data than a model with a single component. However, in the favored model, the correlations between the three components were moderate to large (0.42–0.63) suggesting that, while the three functions are separable, they are interconnected. What underlies this unity is very much up for debate, although it has been noted that the requirement to actively maintain task goals is a basic feature of all executive processes (Miyake and Friedman 2012).

The idea of separating updating, shifting, and inhibition has gained support from subsequent

**Executive Functioning, Table 1** Commonly used measures of executive functioning

Measure	Description	Outcome measure(s)	Putative domains tapped
<i>Wisconsin card sorting test (WCST)</i>	Participants arrange cards, one at a time, into four piles. Cards can be sorted on the basis of multiple features (color, shape, number) but only one is the correct rule at any one time. Feedback is given after each card and the sorting rule changes without warning	The number of incorrectly sorted cards following a rule change. Referred to as the number of perseverative errors	Shifting (Miyake et al. (2000) found their shifting factor predicted performance on the WCST), inhibition, sustained attention
<i>Go/no-go</i>	Participants make a response (e.g., press a button) as quickly as possible if a certain condition is met (go trial; e.g., when an X is presented) but not otherwise (no-go trial; e.g., any other letter is presented). No-go trials are infrequent	Reaction time The number of hits (responses on go trials) and false alarms (responses on no-go trials)	Inhibition, goal maintenance (no-go rule)
<i>Verbal fluency</i>	Generate as many different words possible in a given time period. In the most common variants, participants generate words beginning with the same letter (phonemic fluency) or words belonging to the same category (semantic fluency)	The number of words produced. The number of repeated words (perseverative errors)	Inhibition, working memory updating, access to long-term memory (see Miyake and Friedman 2012)
<i>Working memory span</i>	This refers to a selection of tasks requiring simultaneous processing and storage of information. In operation span participants verify an equation (e.g., $(3 * 4) - 7 = 3?$ ) and then are given a word to store for later recall. Reading span is similar except that participant verifies a sentence then remembers the last word	The total number of items (e.g., words) recalled, or if an adaptive method is used the last level at which the participant met a criterion (e.g., two out of three trials correct)	Working memory updating, shifting
<i>The Stroop task</i>	In the most common variant of this task, participants must name the color font that a color label (e.g., BLUE) is presented in. This is compared to a baseline condition in which the participant either names the color of meaningless units (e.g., #####) or names color labels presented in black font	Reaction time difference between incongruent trials (the font matches the color label) and incongruent (mismatch) trials Difference between incongruent trials and baseline trials	Inhibition, cognitive control
<i>Trail-making task (TMT)</i>	These tasks are typically paper-and-pencil and require participants to connect randomly arranged dots. In a baseline version (Part A), the dots are connected in order of numeric label. In the comparison task (Part B), dots are connected by alternating between numeric and alphabetic labels (e.g., $1 \rightarrow A \rightarrow 2 \rightarrow B \dots$ )	Difference between baseline and switching tests in terms of time taken to complete or number of errors made	Shifting, speed of processing

See Jurado and Rosselli (2007), Baddeley and Hitch (1974), and Lezak et al. (2012) (and the references therein) for more detail on each task and for additional tasks commonly used to assess executive functioning

studies using a similar individual differences approach (see Jurado and Rosselli 2007; Miyake and Friedman 2012 for reviews). Of course this list is an oversimplification, and there are other important processes that likely contribute to measures of executive functioning (see, e.g., Fisk and Sharp 2004; Lezak et al. 2012). In fact, a three-factor model would be insufficient to account for the large number of behavioral responses we can observe and measure either in healthy individuals or in those affected by brain diseases, which are thought to result from the function of an executive system (e.g., planning, selective attention, monitoring, decision-making, and others) (Lezak et al. 2012). Thus while conceptualizing executive functioning in terms of these separable but inter-related components is clearly a simplification, it provides a useful focus for discussing studies of the neural correlates and age-related decline of executive functions.

### Neural Correlates of Executive Functioning

Damage to the frontal lobes has long been associated with profound behavioral changes. Patients with frontal lobe lesions can exhibit a range of deficits including an impaired ability to initiate goal-directed action and socially inappropriate, impulsive behavior (MacPherson et al. 2015; Lezak et al. 2012). Historically this has led to the suggestion that the frontal lobes, particularly prefrontal cortex, are the seat of executive control (see MacPherson et al. 2015 for a historical overview). However, further evidence from neuropsychology and neuroimaging studies has shown that this mapping of executive functions purely onto the frontal lobes is highly misleading. While measures of executive functioning are *sensitive* to frontal lobe lesions, they are certainly not *specific* as lesions to other areas have also been associated with impaired performance (MacPherson et al. 2015; Jurado and Rosselli 2007; Lezak et al. 2012). Studies assessing executive tasks along with neuroimaging measures, such as functional magnetic resonance imaging (fMRI) or positron-emission tomography (PET), have shed

further light on the neural correlates of executive functioning (Collette et al. 2006).

Early neuroimaging studies of executive functioning compared tasks presumed to pose some executive demand to baseline tasks without such demand and, in general, found activation of a wide-ranging network including both anterior and posterior areas (Collette et al. 2006). However, as multiple processes contribute to performance of executive tasks (Miyake et al. 2000), it is difficult to identify activation involved in, say, shifting with a single-task measure. Consequently, one notable study in the field used PET to measure regional cerebral blood flow (rCBF), while participants performed a range of tasks selected to place primary demand on updating, shifting, or inhibition (Collette et al. 2005). Consistent with earlier findings, Collette and colleagues (2005) found activation of a large frontoparietal network common to all tasks that they assessed. This network included the left superior parietal gyrus and right intraparietal sulcus along with regions of the dorsolateral prefrontal cortex.

As well as assessing common activation, the use of multiple measures allowed them to perform interaction analyses to identify areas disproportionately associated with one function relative to the others. This method of analysis suggested that the hypothetical processes of shifting, updating, and inhibition do exhibit separable patterns of activity. Performance of tasks involving the updating of working memory representations was associated with the activity in inferior frontal and frontopolar cortices as well as the intraparietal sulcus. Activity associated with inhibiting prepotent responses was found in the orbitofrontal cortex along with middle and superior frontal gyri. Finally, shifting was associated with greater rCBF to the left intraparietal sulcus.

While it is difficult to make strong conclusions on the basis of neuroimaging data, these findings complement the behavioral data nicely. There appear to be separable patterns of activity associated with the performance of tasks primarily assessing updating, shifting, and inhibition, as well as a large frontoparietal network engaged regardless of task demand.

## Aging and Executive Functioning

Healthy adult aging is associated with reduced performance across a range of cognitive variables, and measures of executive functioning are no exception. For example, on the Wisconsin Card Sorting Test (WCST; see Table 1), older adults show an increased number of perseverative errors relative to younger adults (MacPherson et al. 2015; Phillips and Henry 2008). That is, following a change to the sorting rule, older adults are more likely to erroneously use the old rule to sort the cards and take longer to discover the new rule. Similarly, studies using the go/no-go task tend to find that older adults produce a greater number of errors (e.g., responses on no-go trials) and slower response times relative to younger groups (MacPherson et al. 2015; Phillips and Henry 2008). Further, structural neuroimaging studies have found evidence of pronounced deterioration of the frontoparietal network implicated in performance of many executive tasks. The frontal lobes in particular appear to be greatly affected by the aging process. Gray matter volume in the prefrontal cortex exhibits pronounced decline relative to other areas, and white matter hyperintensities are observed with greater frequency in the frontal lobes (Raz and Rodrigue 2006).

However, as highlighted above, multiple processes underlie performance on complex measures of executive functioning, and older adults may take longer or make more errors for many different reasons (Phillips and Henry 2008). Thus, in attempting to understand the effect of healthy aging on executive functioning, it is important to take a broad range of measures to separate out age-related decline in executive processes. Further, it is important to disentangle change to specific executive processes, such as a reduced ability to update the contents of working memory, from more general changes associated with age, such as reduced information processing speed (Albinet et al. 2012).

### Fractioning Executive Functioning in Old Age

An important starting question, before discussing the decline of specific executive functions with

age, is whether the performance of older adults on complex measures of executive functioning reflects the operation of the same underlying abilities as in younger adults. That is, is it still possible to separate out the contributions of shifting, updating, and inhibition components or do abilities become dedifferentiated (i.e., less distinct) with age? Several studies have adopted an individual differences approach to assess the latent factor structure of executive functioning measures in older groups. In contrast to the idea of dedifferentiation, many of these studies have found that the three-factor solution gives a good account of performance in groups of healthy older adults (Fisk and Sharp 2004; de Fraix et al. 2009; Vaughan and Giovanello 2010).

It should also be noted, however, that other investigators have found two-factor solutions. For example, Hull and colleagues (2008) found that a two-factor model, with no distinction between updating and inhibition but with a separate shifting component, fitted their data just as well as the more complex three-component model. On the other hand, Hedden and Yoon (2006) found a separable inhibition factor in their group of older adults but were unable to separate shifting and updating factors (see also Androver-Roig et al. 2012). While these studies may suggest some degree of dedifferentiation with age, it is the case that even in college-aged adults, the existence of a distinct inhibition factor, that can be separated from the shared variance between the other executive processes, is a matter for debate (Miyake and Friedman 2012). The choice of measures used to construct the factors is likely to be an important reason for this discrepancy.

Interestingly, findings from the large-scale Victoria Longitudinal Study suggest that, in fact, the separability of different executive components may be a good indicator of general cognitive functioning in old age (de Fraix et al. 2009). That study assessed the structure of executive functioning in over 500 participants aged between 53 and 90. On the basis of a broad cognitive battery – assessing speed, reasoning abilities, as well as episodic and semantic memory – the group was split into high performers (termed “cognitive elites”), those performing at a normal level and

those who showed a mild level of cognitive impairment. At the baseline assessment, the three-factor model, with separable updating, inhibition, and shifting components, fit the data from the high and normally performing older adults. However, the three-factor model did not fit the data from the cognitively impaired group; their pattern of performance was explained by a single component, consistent with dedifferentiation of executive functions. Further, the cognitively healthy groups (high and normal performers) showed stability in their underlying abilities over a 3-year follow-up period.

Thus, much of the extant literature suggests that in groups of healthy older adults, it appears to be possible to separate the contribution of different underlying executive processes to complex measures of executive functioning, just as can be done for younger adults.

### Does Age Differentially Affect Executive Functions?

Given that the contributions of shifting, updating, and inhibition appear to remain largely separable with age, the question becomes: does healthy aging affect all executive processes equally or do some processes exhibit a disproportionate age-related effect? The nature of executive functioning measures makes this an inherently difficult question to answer. As noted above, performance on a measure like the WCST may be impaired for a number of reasons, such as reduced speed of processing, failure to inhibit overlearned responses, an impaired set-shifting ability, or a mixture of these factors. However, some have adopted the multivariate approach of Miyake and colleagues (Miyake et al. 2000) to assess the effects of age on the separable but interconnected executive processes. These studies have also attempted to disentangle specific change from the more general age-related change to speed of processing.

One study assessing healthy adults' (aged 20–81) performance on a range of executive functioning tasks found a significant relationship between age and the factors reflecting updating, inhibition, and shifting ability (Fisk and Sharp 2004). However, when measures of processing

speed were accounted for in the statistical model, the amount of variance in executive functioning accounted for by age was greatly reduced. This reduction of age-related variance in executive functioning when accounting for measures of speed has been found many times (Albinet et al. 2012; Androver-Roig et al. 2012; Sylvain-Roy et al. 2014). However, despite the overall reduction in age-related variance, this study found that a significant relationship remained between age and the component representing the ability to shift between mental sets, suggesting that age may impair shifting ability *over and above* the reductions seen in information processing speed.

Similar conclusions have also been reached in a recent series of meta-analyses of the executive functioning and cognitive aging literature (Verhaeghen 2011). The estimated age effects on many measures of inhibition were no greater than that predicted by age differences in matched baseline measures (i.e., tasks with similar structure but without the requirement of executive control). This analysis did, however, reveal a disproportionate effect of age on task switching and was able to probe further into the possible origin of this deficit. The cost of having to switch between two sets of task rules can be expressed as the difference in performance (in this case RT) between blocks of trials in which a single-task rule must be applied as opposed to blocks in which participants must switch between rules. The resulting contrast gives the *global task-switching cost*. Alternatively task-switching costs can be calculated as the difference in performance between trials on which a switch was required (i.e., the previous trial used a different rule) versus trials where no switch was required (i.e., the previous trial used the same rule). Here the resulting score is referred to as the *local task-switching cost*. The meta-analyses revealed that older adults exhibited a disproportionate global task-switching cost, whereas the local cost was no greater than expected from matched baseline measures. This global task-switching deficit was interpreted as a reduced ability to simultaneously maintain two sets of task rules, whereas the lack of a disproportionate effect of age on local switching suggests

that the ability to engage the relevant task rules when a switch is required is well preserved (see also Phillips and Henry 2008). Thus the increased number of perseverative errors exhibited by older adults on tasks such as the WCST (MacPherson et al. 2015; Phillips and Henry 2008) would be interpreted as a failure to maintain and retrieve the new appropriate rule, rather than a failure to initiate rule following.

There is additional evidence that performance on measures of set shifting may be an important determinant of day-to-day functioning in old age (Vaughan and Giovanello 2010). This study extracted shifting, inhibition, and updating factors from the performance of 100 older adults (aged 60–90) on a range of measures. They also included self-report and performance-based measures of instrumental activities of daily living, which give an indication of a person's ability to live independently. While none of the executive processes predicted self-report measures of daily functioning, the shifting component significantly predicted performance-based measures. The authors conclude, given that self-report measures are prone to overestimation, the ability to shift between different mental sets appropriate to current goals may be an important determinant of an older adults' ability to manage daily life.

In summary, studies adopting a psychometric approach to assessing executive functioning across the life span and meta-analyses of the literature suggest that the ability to shift between mental sets, and more specifically concurrently maintain two sets of task rules, may exhibit disproportionate decline with age. However, it is important to note that findings are mixed as other groups have found evidence for a disproportionate effect of healthy aging on the ability to inhibit prepotent responses (Sylvain-Roy et al. 2014) or a more general effect of age across the subprocesses, even after accounting for age-related slowing (Albinet et al. 2012). Much of this ambiguity may be attributable to different studies using different measures of the underlying constructs and of processing speed. Further it appears that when these studies control for measures of processing speed, the variance in executive functioning attributable to age is greatly reduced

(Fisk and Sharp 2004; Albinet et al. 2012; Androver-Roig et al. 2012; Sylvain-Roy et al. 2014). While this may suggest that much of the decline in executive functioning is accounted for by senescent decline at a lower level in the processing hierarchy, this should be interpreted with caution. It is often assumed that measures of processing speed capture a more "primitive" aspect of cognition; however, many commonly used measures of speed appear to require controlled processing (Phillips and Henry 2008; Albinet et al. 2012). It is reasonable to suspect that slower speed of processing leads to poorer performance on executive functioning measures, but nevertheless it is also conceivable that speed of processing could be slowed by poor executive control; for example, older adults could take longer to process information *because* they are less able to inhibit prepotent responses. Thus a more thorough theoretical analysis of the mutual relationship between speed of processing and different executive functions is required to gauge their relative contributions to age-related decline on complex behavioral measures (Albinet et al. 2012).

### Further Fractionation of Executive Functioning

While focusing on three core executive processes is useful for guiding discussion, further fractionation of executive functioning seems inevitable. For example, the concept of inhibition as discussed above was specifically framed around avoiding inappropriate but automatic responses, but this term may also apply to reducing the interfering effects of previously encountered material (proactive interference) or to preventing task-irrelevant information from distracting task performance (Miyake and Friedman 2012). The suggestion that older adults have a specific deficit in inhibiting distracting information is highly influential in the cognitive aging literature (Hasher and Zacks 1988). Indeed research does suggest that older adults are less able to ignore task-irrelevant distractors, and neuroimaging work has begun to shed light on the mechanisms underlying this. One fMRI study presented younger and older

adults with a series of images of faces and scenes to remember over a brief interval (Gazzaley et al. 2005). Their task involved selectively attending to one of these categories; for example, participants would have to attend to faces while ignoring the scenes presented. Looking at a specific scene-selective region of interest in the left parahippocampal gyrus, the authors found the expected suppression of activity when younger adults were ignoring scenes relative to trying to encode them. Their older adults, on the other hand, did not exhibit the same suppression effect. In fact this seemed to be driven by the very lowest performers in the older group, as high performing older adults exhibited the suppression seen in the younger adults. Thus *inhibition* appears to be multifaceted itself (Miyake and Friedman 2012), and it may be that age has a differential effect on its subcomponents.

Further, there is evidence that the ability to coordinate two tasks at once may be a distinct executive function. The latent variable study of Miyake et al. (2000) found that a measure of dual tasking did not load highly onto any of their three core executive processes, suggesting the possibility that dual tasking reflects a somewhat distinct function (see also Fisk and Sharp 2004). While performance on many measures of executive functioning changes with age, it appears that, under certain circumstances, the ability to coordinate two tasks at once is relatively unimpaired. For example, Logie and colleagues (2004) required participants to retain a sequence of digits while they tracked a moving stimulus with a stylus on a computer screen. Crucially, however, they measured participants' performance when completing these tasks in isolation, in order to titrate the demand of each task (i.e., the number of digits given and the speed of the tracking stimulus) in the dual-task condition. The small cost associated with performing the tasks concurrently was no greater in their older group compared to their younger group. However, a group of patients with Alzheimer's disease (AD) showed a large reliable performance cost. Given that each task was performed within proficient single-task levels, this suggests

that AD patients have a specific deficit in dual tasking.

In fact, recent work with a familial form of AD has suggested that a deficit in dual tasking may signify early changes associated with the disease (MacPherson et al. 2012). Carriers of a genetic mutation exhibited a pronounced deficit when performing the digit recall and tracking tasks concurrently, whereas noncarrier family members did not. Crucially, these carriers did not meet diagnostic criteria for AD and, given the typical age of onset in this cohort, would not be expected to for approximately 12 years. This raises the intriguing clinical possibility that measures of dual tasking, properly titrated, may differentiate between healthy and pathological aging at an early stage.

### Neuroimaging of Executive Functioning in Older Adults

There have been many neuroimaging studies that have assessed age differences in activation patterns during the performance of executive functioning tasks. However, these studies are subject to the caveat mentioned many times above; namely that single tasks do not give sufficient insight into the processes underlying executive functioning. Future imaging studies assessing age-related activation differences across a wide range of tasks (as was done in the study of Collette et al. (2005) described above) would be highly informative establishing whether age has a general effect on the neural substrates of executive functioning or whether specific differences occur.

However, one clear finding from many neuroimaging studies across a broad range of tasks is that older adults exhibit patterns of *overactivation* relative to younger adults. This overactivation appears to be more extensive for tasks requiring executive control relative to tasks assessing memory or perceptual function and is primarily found in the dorsolateral prefrontal cortex (Spreng et al. 2010). The finding that this hyperactivity is usually exhibited by better performing older adults has contributed to the suggestion that it is

in some way compensatory and acts as a scaffold supporting less efficient brain areas (Park and Reuter-Lorenz 2009). However, this over-recruitment could represent a non-specific degradation of brain function or dedifferentiation of cognitive processes with age (see Spreng et al. 2010 for a review).

Interestingly, a meta-analysis of 24 functional imaging studies covering a range of executive functioning tasks and 22 studies assessing age-related change to gray matter volume has recently shown considerable overlap between areas overactivated by older adults and regions exhibiting disproportionate gray matter loss with age (Di et al. 2014). The clusters were found in the bilateral dorsolateral prefrontal cortex, and overactivation of this region was not associated with poorer task performance relative to younger controls. These findings could be leveraged in support of either the compensatory or general inefficiency/dedifferentiation views. That areas showing the greatest volumetric decline were also those exhibiting overactivation is certainly reconcilable with the argument that the additional recruitment is a product of degradation and neural inefficiency. However, that this activation was not associated with any gain or loss in performance could also suggest that hyperactivation serves to compensate for structural decline (Park and Reuter-Lorenz 2009). The compensation account is clearly very flexible, and it will take large longitudinal studies to establish the functional significance of hyperactivation during executive functioning and other tasks (Spreng et al. 2010; Di et al. 2014).

While more work needs to be done to link neuroimaging measures to behavioral measures of executive functioning in old age, it is interesting to note that there may be behavioral evidence for the compensation hypothesis from complex executive functioning tasks. In younger adults, Miyake et al. (2000) found performance on the WCST was best predicted by the shifting factor from their latent variable model. On the other hand, Hull et al. (2008) found that their working memory updating factor predicted WCST

performance best in their group of older adults. If we accept that age disproportionately affects shifting ability – although as discussed above the evidence is mixed – it may be the case that more intact executive processes can be called upon to support less well-preserved functions in the performance of multifaceted executive functioning tasks.

## Conclusion

In summary, a great deal of progress has been made in recent years toward understanding the core processes underlying executive functioning. Studies adopting a multivariate approach have identified separable but highly interconnected factors representing the ability to inhibit prepotent responses, shift between mental sets, and update the contents of working memory. Contrary to the predictions of dedifferentiation, these diverse functions appear to remain largely separable in healthy old age although this may break down in mild-cognitive impairment.

However, whether or not executive processes exhibit differential decline is unclear. The studies discussed above suggest some reason to suspect that older adults have specific difficulty in shifting between tasks or maintaining multiple task rules. Nevertheless, findings are mixed, and this likely depends on the precise measures used to establish the underlying constructs. Further, it appears that much of the impairment exhibited by older adults on complex measures of executive functioning may attributable to more general decline, such as reduced speed of processing. Although it is important to note that commonly used measures of processing speed may include an element of executive control, therefore the effect of controlling for processing speed measures in analyses should be interpreted with caution. It seems likely that the substrates of executive functioning will be fractionated even further through the use of theory-driven tasks that aim to better isolate executive processes. Finally, the assessment of tasks which rely on executive functions which are age

insensitive, such as dual tasking, can open new diagnostic opportunities for the early detection of abnormal variants of aging, such as Alzheimer's disease.

## Cross-References

- ▶ [Age-Related Slowing in Response Times, Causes and Consequences](#)
- ▶ [Aging and Inhibition](#)
- ▶ [Executive Functions](#)
- ▶ [History of Cognitive Slowing Theory and Research](#)
- ▶ [Working Memory in Older Age](#)

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## Executive Functions

Kerstin Unger<sup>1</sup> and Julia Karbach<sup>2</sup>

<sup>1</sup>Department of Neuroscience, Brown University, Providence, RI, USA

<sup>2</sup>Goethe-University Frankfurt, Frankfurt, Germany

### Synonyms

Cognitive control; Executive control

### Definition

Executive functions are higher-level cognitive control functions supporting the flexible adaptation to changing environmental demands. They include abilities such as updating, shifting, and inhibition, which are subject to significant age-related changes. These age differences are associated with age-related changes in the neural substrate supporting executive processes. However, the brain is plastic up to very old age, and executive functions can be improved by intensive cognitive and physical training in adulthood.

### The Concept of Executive Functions

Executive control is an umbrella term for a broad set of higher-order cognitive processes supporting the flexible regulation of thoughts and actions in

the service of adaptive, goal-directed behavior. Executive control is especially required in novel, ambiguous, or complex situations, when there are no well-learned routines for action selection (Baddeley 2000; Jurado and Rosselli 2007). Executive abilities allow us to think divergently and creatively, for instance, when we are stuck with a problem and need to develop new solutions to overcome it. They help us to maintain a goal and focus our attention in the face of distraction, while staying flexible enough to adjust our behavior quickly to unpredicted changes in the environment. We need executive skills to resist temptation and to suppress inappropriate habitual behaviors. Executive functions enable us to plan ahead, to juggle multiple pieces of information in our mind and make new connections between them. It is thus not surprising that executive control is a strong predictor for various life outcomes, such as academic achievement, socioeconomic status, and physical health.

There is a fundamental debate as to whether executive functions can be best described as a unitary or multidimensional construct. While the former view holds that a single ability or common cognitive mechanism underlies all aspects of executive functioning (unity), the latter view assumes that executive functions involve related, but separable, components (diversity). The unity framework includes influential concepts such as the supervisory attentional system in the model of attention for action by Norman and Shallice (1986) or the central executive in Baddeley's working memory model (Baddeley 2000). Further, it has been suggested that perceptual speed and/or basic reasoning skills may form a common basis for executive control operations (Salthouse 2005).

In line with the idea of a unitary control system, studies using confirmatory factor analysis and structural equation modeling have typically revealed substantial correlations between the latent constructs underlying performance in executive control tasks (e.g., Friedman et al. 2011; Miyake et al. 2000). These studies, however, also showed that the latent factors explained unique variance and thus may represent separable abilities. Miyake and colleagues (2000), for

instance, demonstrated that interindividual differences in executive functions in young adults are better accounted for by a three-factor model with the latent variables *shifting*, *working memory (updating)*, and *inhibition* than by single- or two-factor models. Generally considered as core components of executive control, these factors describe the ability to (i) flexibly switch between different tasks, goals, or mental sets (*shifting*); (ii) update or monitor task-relevant information to be maintained in working memory (*working memory/updating*); and (iii) withhold prepotent responses and suppress attention to irrelevant stimuli as well as interfering thoughts and emotions (*inhibition*). The three main latent factors have been found to contribute differentially to more complex executive functions, such as planning or concept formation.

Notably, more recent work has shown that only the shifting and updating factors captured unique variance that was separable from a higher-order unity factor (“common executive function”; Friedman et al. 2011). Further support for a “hybrid” unity/diversity framework comes from neuroscientific studies showing that different executive control processes rely on overlapping but separable networks of neural activity (Jurado and Rosselli 2007; Collette et al. 2006). A fundamental cognitive mechanism that might underlie the common factor of executive control is the ability to stably maintain task goals in working memory (Braver and West 2008; Miyake and Friedman 2012), whereas updating and shifting have been linked to the ability to efficiently “gate” goal-relevant information into working memory (updating) and to quickly remove contents from working memory when they are no longer needed (shifting; Miyake and Friedman 2012; Herd et al. 2014).

Convergent evidence indicates that the basic organization of executive functions is similar in younger and older adults. While some studies replicated Miyake et al.’s three-factor structure in healthy elderly populations, others revealed two-structure solutions with the subcomponents (a) shifting and updating or (b) shifting/updating and resistance against proactive interference (for

review, Adrover-Roig et al. 2012). Importantly, single-factor models did not seem to provide an appropriate description of executive functioning in either of the abovementioned studies. Overall, it has been concluded that aging is associated with changes in the relative contribution of the different subcomponent processes to performance on executive control tasks rather than with a fundamental reorganization of executive functions.

### Age-Related Changes in Executive Functions

Compared to other cognitive domains, such as procedural and semantic memory, language, or emotion regulation, executive control seems to be particularly affected by aging, with a sharp drop occurring after the age of 60 (Jurado and Rosselli 2007). Consistent with the unity/diversity view, both global and component-specific mechanisms have been shown to account for declines in executive functions with advancing age. Prominent examples for global mechanisms that are thought to impact all components of executive control are reduced information processing speed (Salthouse 2005) and impaired goal maintenance (e.g., Braver and West 2008; Miyake and Friedman 2012). Specifically, Salthouse and colleagues suggested that the apparent diversity of age-related cognitive deficits can be explained by a generalized slowing of cognitive processing. This argument is based on their observation that (i) measures of executive functions, reasoning, and processing speed were highly correlated and (ii) controlling for processing speed eliminated or strongly diminished age differences in executive functioning (Salthouse 2005). However, other studies found age-related deficits in executive control when differences in speed of processing were taken into account (e.g., Albinet et al. 2012). Moreover, commonly used measures of processing speed, such as the Digit-Symbol Substitution Test, are “impure” in that they also tap inhibition, shifting, and working memory, which may explain their shared variance with executive control tasks. Using hierarchical regression

analyses, Albinet and colleagues (2012) demonstrated that despite sharing common variance, processing speed and the three main control components are independently affected by chronological age. This finding argues against the view that age-related decrements in executive functions are exclusively mediated by generalized slowing.

Several theoretical frameworks contend that the ability to actively maintain behavioral goals or task sets in order to bias task-appropriate response selection plays a pivotal role in executive functioning (e.g., Braver and West 2008; Miyake and Friedman 2012). An elegant paradigm to examine age differences in the integrity and robust maintenance of goal representation is the AX-Continuous Performance Test (AX-CPT; Braver and Barch 2002). In this paradigm, participants are presented with different cues (“A” vs. “non-A”) that specify the appropriate rule for responding to a subsequent probe stimulus (“X” vs. “non-X”). When an “A” cue is followed by an “X” probe (AX trials), a target response must be given, while “X” probes preceded by “non-A” cues (BX trials) as well as all “non-X” probes (AY and BY trials) require a non-target response. Since AX-trials are presented more frequently than other trial types, “X” probes elicit a strong tendency to make a target response. Thus, failures to maintain a stable representation of the rule context (“A” vs. “non-A”) should lead to *higher* error rates when “X” probes are preceded by “non-A” cues (BX trials) but *lower* error rates when “A” cues are followed by “non-X” probes (AY trials). Consistent with the goal maintenance account, Braver and colleagues observed exactly this error pattern when comparing younger and older adults’ performance on the AX-CPT. Older adults produced more BX than AY errors, while the opposite was true for younger adults. Notably, these age differences were even more pronounced when distractors were presented during the cue-probe delay. This latter finding indicates that older adults are more susceptible to distraction, most likely due to their weaker maintenance abilities. Interestingly, increasing maintenance demands by manipulation the length of the cue-probe delay (1 vs. 5 s) resulted in differential

effects in younger and older seniors. While younger seniors’ performance did not differ between the two delay conditions, older seniors showed worse BX but better AY performance with longer delays.

Based on these findings, Braver and Barch (2002) concluded that the younger seniors’ deficits in BX trials result from their difficulties with updating – rather than maintenance – of the rule context. Thus, updating mechanisms might be more vulnerable to advancing age than maintenance, which shows impairments only at older age or under more challenging conditions (e.g., distraction). In line with this assumption, complex working memory tasks that require updating and monitoring, such as reading or operation span, usually reveal more substantial age differences than simple span tasks. In further support of a particularly high susceptibility of updating skills to cognitive aging, previous work identified updating as the most important predictor of older adults’ performance on tasks tapping complex executive functions, such as Tower of Hanoi (TOH) and Wisconsin Card Sort Test (WCST) (cf. Adrover-Roig et al. 2012). In younger adults, by contrast, the Miyake et al. study (Miyake et al. 2000) found inhibition and shifting to be the best predictors for TOH and WCST performance, respectively.

While the ability to update and maintain information in working memory is characterized by a constant age-related decrease, the ability to flexibly shift between tasks seems to be less affected by age. One frequently used experimental task to measure this skill is the task-switching paradigm including conditions in which participants are required to shift back and forth between two or more tasks (*mixed-task blocks*) and conditions that do not require task switches (*single-task blocks*). Shifting skills are measured as the difference in performance between task-switch and task-repeat trials within mixed-task blocks (*specific switch costs*). Further, by contrasting mixed-task blocks with single-task blocks, this paradigm allows to determine performance costs due to the greater maintenance demands in the dual-task situation (*general switch costs*). When the general age-related slowing of processing

speed is controlled for, age differences are usually only found for general switch costs but not for specific switch costs (e.g., Verhaeghen and Cerella 2002).

It is interesting to note, however, that the common component of executive control and the shifting-specific subcomponent often tend to be negatively correlated (e.g., Friedman et al. 2011). In a recent study, Herd and colleagues (2014) used neural network modeling to show that this might reflect opposite effects of stable maintenance on the two factors. Specifically, the authors demonstrated that stronger goal representations led to an overall decrease in reaction times for both task-switch and task-repeat trials in mixed-task blocks relative to single-task blocks, resulting in a reduction of general switch costs. This effect was smaller for task-switch trials, where participants needed to overcome the stronger goal representations, resulting in an *increase* of specific switch costs. Thus, spared shifting abilities in old age might actually be a byproduct of impaired maintenance skills. Further research is needed to determine how the putative shifting-specific processes – removal of no-longer-relevant information from working memory and automatic persistence of those contents – change with advancing age.

Robust goal maintenance is particularly important in the face of strong interference from competing response tendencies or goal-irrelevant information and usually considered to be a key determinant of inhibition (Miyake and Friedman 2012). Indeed, the abovementioned neural network simulations by Herd et al. (2014) revealed that in the Stroop color-word interference task, strong goal representations particularly benefitted incongruent trials and hence were associated with reduced interference effects. Interestingly, age-related impairments do not reliably occur for all types of inhibitory control. In particular, a number of findings have suggested that older adults' deficits in inhibitory processing as measured by the Stroop task or negative priming reflect global changes in processing speed or impaired sensory processing (e.g., Verhaeghen and Cerella 2002). However, in support of the goal maintenance account, West and colleagues

(Braver and West 2008) found that older participants showed disproportionately higher rates of intrusion errors (i.e., naming the word instead of the ink color) when color and word naming alternated in a trial-by-trial rather than block-wise fashion. Notably, this effect was separable from the switching demand itself and has been argued to reflect a weaker representation of the currently relevant task goal. Similarly, Mayr and colleagues (2014) suggested that older adults' higher susceptibility to irrelevant memory traces in interference tasks results from their difficulties to reestablish a stable maintenance mode after any kind of interruptions (e.g., conflict, task switch). More consistent age-related impairments have been observed in tasks that require participants to withhold their responses upon intermittently presented stopping signals (i.e., stop-signal tasks, go-nogo tasks) or tasks that require the inhibition of the automatic orienting response to salient visual distractors (anti-saccade tasks; cf. Buitenweg et al. 2012).

It is important to note that not all individuals are equally affected by cognitive aging. Indeed, in some older adults, executive functions are remarkably spared. Correlational data indicate that greater engagement in intellectual, social, and physical activities is associated with stronger resilience to cognitive decline in later life (for review, Reuter-Lorenz and Park 2014). Most theories of cognitive aging share the assumption that at least two mechanisms contribute to the protective effect of those environmental variables. First, an enriched lifestyle could directly counteract age-related changes in brain anatomy and physiology, thereby promoting brain health and increasing the threshold for cognitive deficits. Second, environmental enrichment is thought to enhance the ability to adapt to age-related brain pathology and to preserve cognitive function, for instance by compensatory recruitment of additional brain regions and alternative neural circuits. Conversely, depleting genetic and environmental variables, such as vascular risk factors, head trauma, or low socioeconomic status, have detrimental effects on brain health and aggravate the effects of aging on executive and other cognitive functions.

## Neurobiological Underpinnings of Executive Control and Cognitive Aging

Executive control is inextricably linked to the functioning of the frontal lobes, especially prefrontal cortex (PFC). Evidence from neuroimaging and lesion studies revealed, though, that executive functions are supported by a distributed neural network, involving prefrontal and parietal areas as well as subcortical structures, such as basal ganglia, thalamus, or cerebellum (Duncan and Owen 2000). The results of these studies are largely in accordance with the view that both shared and unique mechanisms underlie executive functioning. Specifically, it has been shown that shifting, updating, and inhibition tasks elicit an overlapping pattern of activation in frontal (e.g., dorsolateral PFC, anterior cingulate cortex) and parietal regions (e.g., superior and inferior parietal lobe, precuneus). Component-specific activations have been found in distinct prefrontal, occipital, and temporal areas as well as subcortical regions (e.g., Collette et al. 2006). Consistent with the neuroimaging findings, data from lesion studies revealed that patients with brain damage to different frontal regions show both common and unique performance deficits on executive control tasks.

There are similarities between certain aspects of aging-related neurocognitive changes and the neuropsychological deficits displayed by frontal-lobe patients, especially those with lateral frontal damage. The idea that cognitive impairments in older adults are strongly linked to frontal dysfunction (“frontal lobe hypothesis”) has received substantial support from neurophysiological studies demonstrating that aging is associated with various changes in prefrontal structure and physiology, such as white matter integrity, grey matter volume, metabolic markers of neural integrity, and neurovascular factors (Raz and Rodrigue 2006). Although disruption of white matter integrity has been primarily associated with the generalized age-related decrease in processing speed, a number of studies demonstrated more specific correlations between separable white matter systems and age-related impairments in task-switching, working memory, and inhibition.

Reductions in grey matter volume in PFC have been found to predict performance on age-sensitive executive control tasks such as the WCST or TOH. Further, there is evidence indicating that changes in synaptic connectivity (e.g., reduced synaptic and dendritic density) might play a more important role in explaining cognitive decline in old age than white and grey matter disruption as such.

It is important to note that age-related changes in brain structure are not restricted to frontal cortex but occur throughout the brain. In fact, brain aging has been shown to progress along an anterior-to-posterior gradient rather than being specific to PFC. Moreover, it is well established that deficits in dopamine (DA) function contribute to many of the cognitive impairments observed in old age (Bäckman et al. 2000). DA levels decline monotonically with increasing age (at a rate of about 10% per decade), and markers of advanced DA depletion predict age-related deficits in executive functions, processing speed, episodic memory, reward-based learning, and decision making.

Braver and colleagues (Braver and Barch 2002) provided an integrated theoretical framework for the role of frontal and dopaminergic dysfunction in cognitive aging. According to this account, dorsolateral PFC (dlPFC) contributes to executive control by maintaining goal representations and other task-relevant context information and to use this information to bias (or contextualize) lower-level information processing in posterior cortical regions. The neurotransmitter DA is thought to play a key modulatory role over dlPFC function by regulating maintenance and updating (“gating”) of goal representations. Age-related deterioration in PFC and DA function, thus, are assumed to result in a specific impairment in the ability to actively update goal/context information into working memory and to maintain this information robust against interference. Consistent with the idea of a frontostriatal functional dissociation between maintenance (PFC) and updating (striatum), accumulating evidence points to complementary roles for DA in PFC and basal ganglia, with higher prefrontal DA levels promoting stabilization of goal representations and higher striatal DA levels

flexible updating (Cools and D'Esposito 2011). Thus, the loss of dopaminergic function with normal aging may contribute to both increased distractibility (i.e., impaired maintenance) and updating deficits that have been observed in older adults. In support of this notion, Raz and colleagues (Raz and Rodrigue 2006) found a pronounced age-related decline in frontostriatal DA activity and striatal volume.

Functional neuroimaging studies have provided ample evidence that brain aging is not only reflected structural changes but also differences in brain activity. Common aging-specific patterns of brain activity include over- and underactivation, a loss of functional selectivity of neural responses in different regions and networks (dedifferentiation), and altered functional connectivity among different brain areas. Most of these effects are thought to reflect compensatory mechanism that accompany neurocognitive decline. Compensatory strategy changes, in turn, might initiate changes in brain structure, resulting in a complex interplay between structural and functional effects. A typical example of compensatory neural “scaffolding” is the “posterior to anterior shift” in functional brain activity with advancing age, which has been interpreted as an overrecruitment of frontally mediated control processes in response to the reduced distinctiveness of neural representations in posterior regions. Moreover, older adults often show greater and more bilateral PFC activity at lower levels of task demand than younger adults – a domain-general pattern known as hemispheric asymmetry reduction. Interestingly, both patterns also seem to be reflected in age-related changes in functional connectivity.

Despite the well-documented generality of compensatory neural mechanisms, a recent meta-analysis provided evidence for dissociable patterns of age differences in brain activity during working memory and inhibitory control tasks (Turner and Spreng 2012). Specifically, the authors found that working memory tasks were associated with more bilateral activation of dlPFC as well as greater activation of left supplementary motor area and inferior parietal lobule in older compared to younger adults. During inhibitory

control tasks, older adults showed a separable pattern of effects, involving stronger recruitment of right (but not left) inferior frontal gyrus and left presupplementary motor area. Nonetheless, the overall spatial distribution of working-memory versus inhibition-specific brain activation profiles was largely comparable in younger and older adults.

### **Plasticity of Executive Functions in Older Age**

Given that executive functions decline with increasing age, there has been growing scientific interest in interventions designed to improve them. Recent studies have applied a wide range of cognitive and physical training interventions, revealing that cognitive plasticity (i.e., the potential modifiability of a person's cognitive abilities and brain activity) is considerable up to very old age (for reviews, Karbach and Verhaeghen 2014; Ballesteros et al. 2015).

Cognitive interventions can be divided into three major categories: (i) strategy-based trainings, (ii) process-based trainings, and (iii) multimodal interventions. Strategy-based trainings aim to improve specific cognitive operations – typically those that are most impaired in older age – by teaching participants an explicit strategy on how to solve the given task or problem. For example, the so-called method of loci helps individuals to improve their memory performance by associating the to-be-remembered items with a sequence of specific physical locations along a “mental route” in a familiar place such as their apartment. Although strategy trainings have been shown to result in considerably large and sustained performance gains, improvements are often limited to the trained task, with little evidence of transfer to untrained functions. Training regimes that involve a combination of multiple strategies or focus on more complex functions, such as reasoning, problem solving, or goal management, seem to yield a more generalized beneficial effect on untrained measures of executive function as well as indicators of daily life functioning.

Process-based cognitive intervention programs aim to improve specific cognitive processes, such as speed of processing or working memory, by training participants on tasks that are thought to heavily tax these functions. Only a relatively small number of studies have examined the effects of set-shifting in older adults (Buitenweg et al. 2012). Available evidence indicates that relatively short shifting practice (less than 10 training sessions) can yield significant performance improvements, particularly in terms of general switch costs. Most importantly, training-induced gains have been shown to transfer to untrained tasks and abilities, such as inhibition, attention, and reasoning. Specifically, several studies demonstrated that shifting practice results in reduced Stroop interference effects, better performance on verbal and spatial working memory tasks, and increased fluid intelligence scores in both younger and older adults. Transfer effects have been attributed to the fact that task-switching paradigms put high demands not only on shifting but also on maintenance and interference control and hence tap into multiple subcomponents of executive control. Additionally, transfer to more complex functions (e.g., reasoning skills) might derive from the requirement to efficiently coordinate multiple tasks. Despite promising initial findings, some studies have failed to obtain practice-induced transfer effects to untrained tasks after set-shifting training in older adults. Thus, more research is needed to determine the conditions under which shifting practice may compensate for age-related decline in executive control and associated impairments in daily functioning.

Working memory updating trainings in healthy older populations revealed substantial performance improvements on the trained as well as structurally similar tasks (Karbach and Verhaeghen 2014). In terms of transfer to other dimensions of executive control, intelligence, or reasoning, however, the findings are less consistent. Studies that have systematically assessed the potential of working memory updating training to improve executive control functions in the elderly are scarce. In younger adults, generalization of performance gains to other measures of executive

functions and intelligence are most commonly reported for adaptive trainings, i.e., when task difficulty is individually adjusted over the course of training to match participants' performance levels. Even though transfer effects of updating practice have often been found to be absent or considerably smaller in older participants, a number of recent meta-analyses found small, but reliable, transfer effects of working memory and executive function training to untrained cognitive skills, particularly fluid intelligence. Interestingly, these studies revealed that overall the magnitude of training-induced performance gains is comparable in younger and older adults. It should be noted, however, that not all meta-analytic studies found evidence for benefits of training on executive functions. These inconsistencies might be attributable to methodological factors such as the total number of included studies, criteria for study exclusion, heterogeneity of trained tasks and populations, as well as the specific coding of transfer measures.

Only a very small number of training studies that have been conducted with older adults focus directly on inhibition. As reviewed in Buitenweg et al. (2012), practice on tasks tapping inhibition, such as Stroop or Simon task, improved inhibitory control in elderly but the training-induced gains did not generalize to untrained tasks. A notable exception is a recent study by Mishra and colleagues (2014) that used an adaptive distractor-suppression training to enhance interference control in healthy aging. The training did not only affect behavioral and neural indicators of interference effects in the trained task but also had beneficial effects on unrelated measures of working memory and sustained attention.

Given that a general decrease in information processing speed is thought to play an important role in the age-related decline of executive functions, several interventions have targeted speed of processing in older adults. Speed of processing trainings have been shown to induce large and sustained improvements in speed scores. While some studies reported transfer to untrained functions such as visual-spatial abilities, attention, and everyday speed measures, training gains did not

generalize to executive control measures. Another relatively recent approach to improve executive control and other aspects of cognition in older populations are video game trainings. Results, thus far, show that video game playing can enhance several age-sensitive cognitive functions, including visuospatial attention, memory, and speed of processing, but training gains do not seem to transfer to executive functions.

In recent years, some progress has been made in identifying neural substrates of training-induced plasticity in older age (Brehmer et al. 2014). Training-related changes in brain structure (e.g., grey and white matter volume) have been observed in task-relevant areas rather than globally throughout the brain. Performance gains on executive control tasks were associated with activation increases, decreases, or a combination thereof, in frontoparietal control regions as well as subcortical areas. While activation increases are thought to reflect compensatory strategies, activation decreases are usually interpreted as an indicator of increased neural processing efficiency. In general, neural activation changes can be classified as functional redistribution or functional reorganization, with the former denoting quantitative changes in activation levels within the same or similar brain regions and the latter denoting qualitative changes in the spatial pattern of brain activation. Cognitive interventions often induce a reduction of age-related activation differences, such that after training, brain activation in the elderly approximated that in younger adults.

Interestingly, a number of working memory training studies revealed a pattern of activation decrease in frontoparietal regions in association with activation increase in the striatum. This pattern might reflect faster and less effortful updating of working memory representations due to more efficient information processing in corticostriatal circuits, e.g., as a consequence of more salient striatal updating (gating) signals. In younger but not in older adults, the training-related increase in striatal activation predicted transfer effects to a structurally similar untrained task that also activated the striatum. The latter finding is consistent with the idea that transfer is increased if the

training task and the transfer task engage overlapping cognitive processing components and brain regions.

Aside from cognitive training interventions, physical training, especially from the domain of cardiovascular training, can improve cognitive functions. These positive effects of physical exercise were particularly pronounced in the domain of executive control (Ballesteros et al. 2015). They have been reported for healthy older adults as well as for individuals with cognitive and physical impairments and have been accompanied by changes in cerebral blood flow and the modulation of activity in task-relevant brain areas. Hence, both cognitive and physical activity in older age may be effective ways to support executive functioning in the aging brain. Indeed, multimodal training approaches that combine various types of interventions, including social engagement, cognitive trainings, and physical stimulation, have yielded promising results in terms of improving executive functions and daily life functioning. The complexity of multimodal interventions, however, entails methodological challenges that have not been fully resolved yet. For instance, it is often difficult to determine to what degree single components and/or interactions between different components contributed to training gains.

## Summary and Conclusion

Executive control functions include a number of processes such as updating, shifting, and inhibition, all of which are subject to significant age-related changes across the adult life span. These age differences have been linked to structural and functional alterations in the neural substrate supporting executive processes. Consistent with the “frontal lobe hypothesis” of cognitive aging, the greatest change in brain anatomy and physiology is evident in anterior brain regions. However, research on cognitive aging has also shown that the brain is plastic up to very old age and that executive control can be modulated by lifestyle factors as well as intensive cognitive and physical training in adulthood. Environmental

enrichment, including intellectual, social, and physical activities, is associated with stronger resilience to cognitive impairments in later life by (i) directly counteracting neurophysiological deterioration and (ii) compensatory recruitment of additional brain regions and alternative neural circuits to adapt to depleted neural resources and to preserve cognitive function. Given the contribution of executive functions to various life outcomes and daily life functioning, many studies have investigated the effectiveness of cognitive training interventions designed to improve executive control in older adults. Particularly, switching and updating training have yielded promising effects such that they appear to offer a great potential to improve not only trained but also untrained functions and skills, including inhibition, attention, and reasoning, across the adult life span. Nonetheless, a number of studies have raised questions about the robustness and consistency of transfer effects, especially in older adults. In particular, previous training studies have been criticized on methodological grounds. Key issues include expectation effects, test-retest effects, cognitive depletion effects due to extensive cognitive assessment, appropriate selection of the control group(s), nonrandom assignment of participants to experimental vs. control group(s), and comparability of results from studies using different training regimes. Thus, there is a clear need for carefully designed studies that integrate behavioral measures of cognitive plasticity with structural and functional neuroimaging data – within the broader framework of longitudinal and interindividual differences approaches – to systematically determine the factors that moderate the effects of training interventions on executive control functions in later life.

## Cross-References

- ▶ [Age-Related Changes in Abilities](#)
- ▶ [Berlin Aging Studies \(BASE and BASE-II\)](#)
- ▶ [Cognitive Control and Self-Regulation](#)
- ▶ [Cognitive and Brain Plasticity In Old Age](#)
- ▶ [Executive Functioning](#)
- ▶ [Life Span Developmental Psychology](#)

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## Expertise and Ageing

Ralf T. Krampe  
Brain and Cognition, University of Leuven,  
Leuven, Belgium

### Synonyms

Skill maintenance; Exceptional performance

### Definition

The concept of expertise refers to individuals' superior levels of performance in specific

domains. Domains of expertise and the levels of performance necessary to attain expert status depend on historical and cultural contexts. Skills like writing or driving a car sufficed for expert status in earlier times, but they are minimum requirements for most jobs nowadays. Expert swordsmanship has come out of fashion while excelling in web design was unknown to our ancestors. In aging societies the question if and how expert levels of performance can be maintained into later adulthood has gained central significance. Workforces in most OECD (Organisation for Economic Co-operation and Development) countries are aging rapidly: the age group of 40–45-year-olds formed its largest segment in 2006, and between 1980 and 2006, the median age of the American workforce increased from 35 to 41 years (Ng and Feldman 2008). Fewer young people enter the workforce and those who do have nowadays enjoyed longer periods of training. A main factor is the increasing employment rate of older employees, which is largely the result of reductions in the traditional safety nets of funded (early) retirements even in European welfare states.

Cognitive aging research portrays a rather grim perspective on levels of functioning in older adults. Tests measuring the speed and accuracy of basal processes like visual search or comparison operations are referred to as performance IQ (Intelligence Quotient) or fluid intelligence in the literature, and performances on these tests show considerable age-related declines (Kaufman 2001). Due to the age-referenced definition of IQ, the average 50-year-old has to perform at roughly 85–90% the speed of a 25-year-old to obtain the same IQ score. Adults in their 60s typically take 1.6–2 times as much time compared with 20-year-olds to perform speeded tests or experimental tasks – a phenomenon called *general age-related slowing* (Salthouse 1996). Meta-analytic reviews also point to age-related declines in working memory and reasoning (Verhaeghen and Salthouse 1997), the ability to perform two tasks simultaneously (Verhaeghen et al. 2003), and cognitive control (executive functions) (Rhodes 2004). Cognitive control comprises planning complex actions, the maintenance of

task-relevant information (task sets), inhibition of irrelevant task sets, and switching task sets when performance conditions change. Onsets are later and rates of age-related declines are much shallower for “crystallized intelligence,” that is, abilities based on knowledge, experience, and culturally transmitted skills (Li et al. 2004).

Studies from organizational psychology appear to defy the negative implications from cognitive aging research. In what has been the most comprehensive meta-analysis of studies on the relation of age and job performance to date, Ng and Feldman (Ng and Feldman 2008) found that core task performance on the job and creativity was largely unrelated to age. In additional analyses Ng and Feldman found that the age  $\times$  core performance relation followed an inverted U-shape function: performance in core skills improved with age in younger workers (<40 years), presumably because of growing job-related experience, and it became slightly negative in employees age 40+. Related effects were small however, and the authors concluded that here is little to suggest from the meta-analytic reviews that older workers or employees cannot function in their jobs, lack creativity, or that their other performance aspects deteriorate noticeably relative to young adults. One reason for this apparent contradiction with findings from cognitive aging research may be the definition of “older” traditionally applied in organizational psychology (Ng and Feldman 2008). For pragmatic reasons (early retirement age, low workforce participation rates), the authors considered “older” to be individuals of age 40+. In standard textbooks of life span developmental psychology (Berk 2014), the period 40–65 years corresponds to middle adulthood, and participants in cognitive aging studies typically are in their late 60s or older. A second reason is that cognitive aging studies for the most part use psychometric tests and experimental tasks with unfamiliar materials and they compared young and older individuals’ performances in novel and untrained settings. Arguably, the specific skills, which have been acquired and exercised for considerable amounts of time in professional contexts, show a friendlier age-related development.

Expertise research differs from both cognitive aging and organizational psychology with respect to the type and the levels of performances studied. Expertise research focuses on domain-specific rather than domain-general functions. The broad varieties of job performance studied by organizational psychologists do not correspond to the narrower concept of expert-level performance. While the boundaries between expert and novice performance are far from well defined, authors (Ericsson and Smith 1991; Salthouse 1991) agree on defining expertise as a stable individual attribute. This attribute should not be based on experience (seniority) or social judgment, but on the actual level of performance. Expert performance must be replicable and measurable taking the requirements of a certain domain into account.

Extant models of expertise posit that experts have developed specific mechanisms, which allow them to circumvent the process limitations constraining normal (i.e., novice) performance (Chase and Ericsson 1981; Ericsson et al. 1993). This metaphor implies that experts do things differently and that their brains also differ from novice brains. Examples of cognitive mechanisms are chess players’ memory for game positions, the advance coordination of fingers in rapid typing, and hand-independent timing in pianists. Evidence for expertise-specific adaptations at the neural level comprises enlarged hippocampal regions in expert taxi drivers (Maguire et al. 2000) or enlargements in sensorimotor cortices in musicians (Amunts et al. 1997; Elbert et al. 1995). These examples illustrate that expert mechanisms are not “tricks of the trade” one can pick up in a crash course. Ericsson and colleagues argued that attaining international-level expertise in any domain typically requires 10 years or at least 10,000 h of *deliberate* practice (Ericsson et al. 1993). Deliberate practice is goal-directed learning, which requires careful monitoring of one’s own performance and the continuous search for ways to improve. At least during the initial acquisition phase, this occurs ideally under the auspices of a coach, who is an expert herself/himself. The deliberate practice model depicts expertise development as a long-distance race, during which the individual has to negotiate

*effort, motivational, and resource* constraints. Because its practice is inherently effortful, nature deliberate practice activities can only be sustained for limited amounts of time, and they call for sufficient recuperation. What distinguishes deliberate practice from leisurely exercise is the motivation to improve and to overcome weaknesses in one's own performance. Resource constraints relate to external (teachers, parental support) and internal (physical health, concentration) types of support or limitations. Discussions in the literature abide as to whether deliberate practice is only a necessary or a sufficient prerequisite of attaining expert-level status (Hambrick et al. 2014; Macnamara et al. 2014; Meinz and Hambrick 2010); however, all theoreticians agree that it is a critical factor. Several authors have argued for inherited individual differences or gene-environment correlations, which determine, for example, adult levels of musical accomplishment (Hambrick and Tucker-Drob 2015). A related question is whether individual differences in domain-general cognitive abilities (i.e., intelligence) determine only initial progress in learning (Ackerman 1988; Fox et al. 1996) or if they continue to constrain accomplishments at superior or expert levels of performance (Hambrick and Engle 2002; Wai 2014). Controversies and answers to these questions depend to a large degree on how the type and level of performance necessary to be considered an expert is defined (Ericsson 2014). Whatever the precise perspective on the precursors of expertise, maintaining expertise into later adulthood amounts to a considerable extension of the long-distance race because age changes the nature of effort, motivational, and resource constraints.

### **Accounts for High Levels of Accomplishment in Older Experts**

The primary goal of the experimental study of expert performances is to demonstrate reliable differences between experts and novices in tasks reflecting accomplishment in a specific domain. In the context of aging, the key questions are whether these performance advantages continue

to exist for older experts when compared with age-matched controls. For theoretical reasons such age x expertise studies try to address three other questions: (1) do experts, who excel in their domains also differ from “normal” individuals when it comes to domain-general abilities such as general intelligence (processing speed, working memory) or cognitive control (monitoring and controlling attention, suppressing irrelevant information, updating information in working memory, switching between task sets and plans)? (2) Does domain-specific expertise also convey an advantage in near-transfer domains that are subject to age-related decline in the general population (e.g., are older chess masters also better in reasoning tests)? (3) Does the level of expert performance maintained depend on older experts' investments into certain activities (e.g., practice)? Depending on the answers to these questions, we can distinguish four different accounts of expert or exceptional performance in later adulthood in the literature.

The *preserved differentiation* or a priori *disposition* account maintains that (experts) have always been superior in skill-relevant abilities, such that their advantages at any age could be attributed to interindividual differences with long-term stability that already existed prior to expertise acquisition. For example, a predisposition for visual imagery might nurture interest in and a professional choice for graphic design or architecture. The second position, *expertise-driven general ability account* emphasizes transfer to broader cognitive abilities. The idea is that acquiring expertise involves gradual improvements in some, though not necessarily all, domain-general functions. For example, daily professional challenges to keep complex facts in memory might foster increases in working memory span. *Differential preservation* or *selective maintenance* accounts emphasize the role of specific over broad abilities. Accordingly, expertise at any age rests on specific mechanisms, which age more gracefully than general mechanisms, presumably because experts actively maintain them through continued use or deliberate practice. Finally, the *compensation* account posits that older experts actively acquire specific mechanisms when

experiencing age-related decline of those mechanisms supporting their expertise.

### **Experimental Studies of Expert Performance in Young and Older Adults**

Expert performance has been studied under laboratory conditions with age-comparative samples for such diverse domains as typewriting, games (chess, bridge, GO, mastermind), piloting, and air traffic control, management skills, visual search in medical assistants, fine motor control in mechanics, memory for numerical information in accountants, auditory processing in musicians, and musical performance (for a review, see Krampe and Charness 2006). Across studies experts in their late 50s and 60s typically perform at levels comparable to or slightly below those of experts in their late 20s. Even for experts of more advanced ages, studies have reported at least reduced age-related decline compared with age-matched novices. At the same time, older experts showed the typical reductions in measures of domain-general processing, which were similar to those observed in age-matched controls. This pattern of results strongly suggests that older experts rely on domain-specific mechanisms to circumvent the processing constraints of domain-general functions just like young experts do. In line with this assumption, benefits are the highest in the most complex skill-related tasks, where experts can bring their most adapted specific processes to bear. As an example, professional pianists have a higher single-finger tapping rate compared with novices and amateur musicians; however, their advantages are magnified when complex sequencing of multiple fingers is required. In turn, age effects in the novice group are the largest in the most complex conditions because they related tasks require increased engagement of domain-general functions like working memory or cognitive control. These functions are known to be most affected by age-related decline (West 1996).

It is hardly feasible that such highly specific adaptations reflect a priori (e.g., innate) dispositions. Instead, the pattern agrees best with the selective maintenance account. Studies

investigating experts' activities revealed a clear relation between levels of expert performance and the amount of practice that went into acquisition (Ericsson et al. 1993). Deliberate practice seems to be as important when it comes to maintaining expertise into later adulthood (Charness et al. 1996; Krampe and Ericsson 1996). In particular, the study by Krampe and Ericsson suggests that it is not years of experience, starting age, or practice during young ages, but the amount of practice invested during recent years, which determines the degree of maintenance.

The specificity of the expertise advantage in older experts is in line with the assumptions of limited transfer to other skills or to general dimensions of cognitive abilities (Hambrick et al. 1999; Owen et al. 2010). Individual differences in cognitive abilities (Ackerman 1988) correlate with learning rates in early stages of skill acquisition, but these correlations weaken once learning proceeds to expert levels. These findings are at odds with the expertise-driven general ability account, which posits that the acquisition of a specific skill leads to improvements at the level of general abilities. One specific version of this account continues to enjoy enormous popularity in science and the media, namely, the assumption that music lessons boost intelligence in children. Two intervention studies indeed found small but reliable benefits of music training for broader intellectual abilities in preschool children and 6-year-olds. Surprisingly, these advantages are smaller in adults and absent in professional musicians. Some authors argued for medium transfer of skills such that cognitive control (executive functions) or language processing rather than broad mental abilities benefit from musical training in adults. In the aging context, it is next to impossible to distinguish whether group differences in general abilities reflect expertise-driven mitigation or preserved differences, which existed prior to skill acquisition. For example, two studies found superior performances on tests of broad visuospatial abilities in architects (Salthouse et al. 1990) or graphic designers (Lindenberger et al. 1992). At the same time, age-related differences were similar in experts and novices ruling out experience-related mitigation. The authors argued that the

preserved difference account provided the best explanation for these findings.

Evidence for the compensation account remained suggestive. Charness (1981) proposed that older chess experts compensate for slower search rates by relying on refined, knowledge-based processes of move selection. Other authors (Bosman 1993; Salthouse 1984) have speculated that older expert typists compensate for slower reaction time and reduced dexterity by increasing their eye-hand span (the amount of text they look ahead during transcription typing). An inherent problem of the compensation account is that it is difficult to determine whether older experts indeed acquired specific mechanisms in reaction to (as compensation for) age-related declines they experienced or whether these mechanisms were better preserved than other component functions found in young experts.

### Limitations on Selective Maintenance of Expertise

A key factor determining experience-related mitigation is how closely experimental tasks relate to the expertise under investigation. However, even if tasks are closely related to the expertise under investigation, skill maintenance is typically not perfect if young expert performance is taken as a benchmark. Studies on highly demanding professions like piloting or air traffic control (Nunes and Kramer 2009; Taylor et al. 2007) found that sparing from age-related decline is frequently limited in scope. In particular, these studies showed that some component skills are more easily maintained than others with speed or working memory demands marking those components more sensitive to aging even in experts. Obviously domains of expertise differ with respect to how many of such components they comprise, how sensitive they are to aging, and whether compensatory mechanisms are effective to prolong high levels of performance into late adulthood.

Several studies also suggested that solid reductions of age-related declines in specific skills require a certain level of expertise or accomplishment. For example, amateur musicians (Krampe

et al. 2001; Meinz and Salthouse 1998) or private-licensed pilots (Morrow et al. 1993) were found to show “normal” age-related declines even in tasks related to their hobbies. On the other hand, even top performers in their domain, who are highly motivated to maintain their levels of performance, are not immune to the effects of aging. In his longitudinal analyses, Simonton (Simonton 2012) showed that creative experts in their 60s and 70s were more productive than young experts starting their careers; however, peak productivities were at younger ages (late 30s and early 40s, depending on domains).

### Summary and Implications

Expertise denotes domain-specific skills the development of which can be described as a gradual decoupling of expert mechanisms from domain-general functions. The available evidence gives reasons for cautious optimism that specific skills can be maintained at high levels into late middle adulthood or even old age. Naturally the typical cross-sectional studies in the age  $\times$  expertise domain are subject to cohort and selection effects. Arguably, older experts in these studies could represent the survivors of an age-graded winnowing process by which individuals with pronounced age-related declines in relevant capacities or insufficient motivation to maintain their skills have dropped from the field (or have been promoted to positions where more social skills matter). A second methodological constraint is that all evidence related to capacities assumed to moderate age-related changes in expert performance is correlational, and this is equally true for estimates of practice intensity.

Decoupling of expert from domain-general mechanisms goes a long way, and experts, who continue to strive for their best performances, show remarkably little age-related decline. However, expertise is not immune to aging. When experimental tasks cover a broad range of component skills, maintenance in older experts is rarely perfect, and some component skills are more difficult to maintain than others. This has important implications for certain professions as the studies

of air traffic controllers and pilots illustrate. The degree of decoupling of expert mechanisms from domain-general mechanisms might itself change with age. Theories of life span intellectual development refer to this phenomenon as differentiation-dedifferentiation (Li et al. 2004). Dedifferentiation means that at advanced ages acquired specific skills and their neural underpinnings become vulnerable, and we have to default to domain-general processes again. The implication is that expertise can certainly buffer age-related decline, but this effect does not extend endlessly into very old age.

Expertise does not rest on mere experience lest it fades away in the ruts of routine. An important implication for aging is that the maintenance of expertise does not come for free, but it requires continued efforts in the sense of deliberate practice. This is particularly true as most domains nowadays undergo rapid changes in component skills and standards. Meeting these challenges in terms of time, energy, and motivation becomes increasingly difficult considering physical and mental changes in later adulthood. The type of activities experienced as gratifying and the goals pursued differ between young and older adults (Ebner et al. 2006). There is no reason to assume that this typical adult development should be totally different in experts. From these perspectives the question whether young adult levels of performance could be maintained in principle becomes an academic one.

## Cross-References

- ▶ [Active Aging](#)
- ▶ [Age-Related Changes in Abilities](#)
- ▶ [Cognitive and Brain Plasticity in Old Age](#)
- ▶ [Lifelong Learning and Work](#)
- ▶ [Workplace Creativity, Innovation, and Age](#)

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## Family Therapy

Sara Honn Qualls  
Gerontology Center, University of Colorado,  
Colorado Springs, Colorado Springs, CO, USA

### Synonyms

Family caregiving; Family intervention

### Definition

Therapeutic interventions that change interpersonal processes among family members alter the structure or functioning of families with the goal of improving the family's abilities to meet the developmental needs of all members; aging family therapy focuses specifically on the "needs of families in which the key concerns center around the well-being of elderly members of the family" (Qualls 1995, p. 475).

### Background

Families are a key social context for older adults, with family members making up more of the social network in later life than at any other time in adulthood. The salience of families makes them particularly influential to the well-being of older adults, and vice versa. The instrumental (aid with

tasks) and emotional support flow in multiple directions within the family across the lifespan. As older adults develop illness, disability, or frailty, family support often increases in intensity, frequency, or style in a pattern termed family caregiving. Transitions in family life can disrupt familiar patterns in ways that disrupt the well-being of older adults or other family members as well as in families with long-term deficits. Family therapy focuses on relationships within which older adults live and make their meaning as key opportunities for improving their well-being.

### Conceptual Foundations

Family development and family systems theories posit that families engage a variety of processes to support the development of members (Walsh 2011), and those processes are influenced by structural characteristics of families (McGoldrick et al. 2008). Age-related changes in biological, psychological, or social functioning can alter family structures or processes in ways that lead families to seek assistance.

Basic family structures include marriage, partnership, and parenting that are often depicted in a diagram of a family tree called a genogram (McGoldrick et al. 2008). Intragenerational structures include marriage or partnership, siblings, and cousins. Intergenerational relationships are represented in vertical lines that illustrate parent-child relationships across multiple generations.

The entry and exit of members are defining characteristics of stages of the family life cycle because they represent structural changes that influence functioning. Ambiguity in family structures is particularly stressful on families (Boss 2007). An example of ambiguous structure in later life occurs when a member has dementia that renders him or her incapable of independent participation in family interaction.

Basic family processes include child-rearing, parent care, and partnership for pleasure and economic sustenance among many other functions family members perform for each other. Processes involve communication, verbal and behavioral, that cues family members to act, feel, or think in ways that become highly predictable circular cycles of prompts and responses. The recursive cycles of behavior among members of a family can be articulated as rules of the family system. Anticipation of the familiar sequence shapes the timing and selection of behaviors in particular relationships in ways that appear rule driven. Observers can name the rules that describe the sequences and interrupt the automatic pattern in order to open the opportunity for novel responses that meet members' needs far better.

Life stressors may alter family structures or processes in ways that interrupt support patterns for one or more members. Stressors may result from historical events such as war or economic depression; from normative life events such as employment, the onset or termination, or relationships; or from nonnormative events such as house fire. The individuals' coping responses to stressors are communicated in behaviors that impact other family members, sometimes altering structural or functional characteristics of the family system.

The chronological aging of members in a family may impact family structures or processes, primarily through changes in functional abilities to participate in family activities or self-care. In addition, cultural rules about roles for aging family members also influence family structures and processes if elders are imbued with particular roles or values within the culture. Illnesses or deaths that alter or remove members from the structures often provoke shifts in roles related to instrumental or emotional support. By later life,

older adults are likely to live as singles, with men more likely to live in partnership or marriage than women, especially in advanced age (Davey and Takagi 2013). Historical cohorts vary in number of children, leading to variation in the number and complexity of intragenerational as well as intergenerational relationships. When plotted in a genogram, or family tree, the older adults' families clearly have more intergenerational relationships than within-generation relationships.

The diversity of structures in aging families is great, especially when compared with younger families. In child-rearing families, the parent and child roles have relatively prescribed definitions, with variations across cultures in the timing of transitions, contexts of development, and rules about specific aspects of family roles. Child-rearing families experience role ambiguity primarily during periods of significant transition from one status to another (e.g., child to adult) or when membership status is ambiguous such as occurs when someone is missing in action in war and thus is not dead, but not participating in the family roles (Boss 2007). Aging families, however, are composed of primarily adult members, with no clear role definitions supplied by the culture for the important distinctions between adults as children of independently aging versus very frail or cognitively compromised aging parents. Similarly, there is no clear signal point when a marital or intimate partnership shifts from mutually autonomous to one defined by caregiving and care receiving. Structural ambiguities add stress to the family, especially in times of intensive role demands (Boss 2007).

Age-related chronic illnesses can alter family relationships by shifting roles, with long-term shifts into caregiver and care recipient as being one variation. Families may adapt roles, communication patterns, and decision-making structures from those used in the early adult phases. Later-life family challenges and adaptations occur within the context of many decades of interaction patterns, cultural norms, and expectations and particular intergenerational structures that offer strength, resilience, and challenges (Walsh 2011; Davey and Takagi 2013). Although most families adapt well to aging-induced transitions, some fail

to adapt effectively or experience stress during the period of adaptation; intense or protracted stress can undermine the well-being of one or more members. Perhaps the best-documented example is the impact of the transition to care for a member with dementia on the primary caregiver (see entry on caregiving/carer burden).

Families may enter later life with little preparation for the challenges or the contexts of aging. In recent centuries, each generation must learn the health, housing, social, and legal service structures for their own aging experience, because what was observed in the previous generations offers little guidance due to rapid rates of cultural change. Family therapy often includes education about aging processes or age-related diseases or difficulties, as well as about the formal service systems available to support older family members.

### **Problems Addressed by Family Therapy**

In later life, family therapy can assist families with life stresses, health transitions, or relationship problems in the older or younger generations. The biopsychosocial model that has been embraced by healthcare points to the multiple domains of human well-being that have reverberating effects in others, so interventions with families may be key to supporting health interventions (e.g., changes in diet or activity patterns), psychological interventions (e.g., dementia or depression), or other social interventions (e.g., increasing the rate of social contact or addressing a conflicted relationship with another family member).

Social transitions in later life can disrupt long-term patterns of family life in ways that alter support to members (old and young) and impact other domains of functioning. Retirement generally is experienced as a positive transition, but when the retiree lacks control over the timing or conditions of the retirement, or loses significant resources with the retirement, other members of the family may be impacted. Remarriages and other intimate partnerships in later life can bring great joy and meaning to the couple, even as they may disrupt other aspects of family function (e.g., blending family holiday activities, assets, and

decision-making structures). Disruptions in the life of the mid-life generation can challenge the older members of the family system. Transitions in the lives of mid-life family members that can affect the older generation include divorce, incarceration, geographic relocation, or significant changes in lifestyle. Although these transitions can be navigated with minimal disruption to family patterns, they often require some shifts in communication style and frequency, nurturance, or problem-solving style, ultimately affecting the regular structures or processes of family life.

Chronic disease, sensory impairment, functional disabilities, and/or cognitive impairments in later life intrude upon families, often altering structure, function, and meaning. Families play key roles in delivering health services to older family members, partner with them in management of daily life when illness or disability constrains independence, and negotiate transitions across the healthcare system repeatedly (e.g., from home to hospital to rehabilitation to home with home health to family support to complete independence). Not surprisingly, some transitions are accomplished poorly, with disruptions in needed care (emotional or instrumental). Although current models of health service delivery increasingly recognize the importance of empowering older adults and their families as key participants in the service delivery model, very few health systems can accommodate family members' participation on health teams.

### **Models of Family Therapy Applied to Geropsychology**

Among the earliest adaptations of family intervention approaches for aging families was the application of family systems approaches to later life families by Herr and Weakland in what they described as a "counseling approach" (Herr and Weakland 1979). Grounded in family systems theory, they advocated the use of problem-solving techniques with aging family challenges as conceptualized by systems theory. The contextual approach to family therapy was applied to aging families by Hargrave and Anderson (1992) who

emphasized the importance of addressing obligations and expectations that require forgiveness in order to repair family functioning from the effects of previously painful experiences. Structural family therapy (Minuchin 1974) informs the approach to family therapy for caregiving families who are experiencing significant role shifts by Qualls (1995) and Qualls and Williams (2013).

Medical family therapy has evolved in the past two decades to offer substantial guidance to geropsychologists whose work with later-life families often involves illness-related challenges and transitions (McDaniel et al. 2013). Medical family therapy applies the principles of family development and family systems to families in which one or more members have significant health challenges. This approach addresses the changes in structure and function that illness can impose on families as well as the meaning of illness in the family system (McDaniel et al. 1997) and thus is directly applicable to work with later-life families who are most likely to seek help for health-related challenges.

## Family Therapy Research

The research literature on family therapy with aging families is limited. Reviews of the literature show a stable pattern of approximately 3% of articles in the major marriage and family journals that focus on aging over recent decades (Lambert-Shute and Fruhauf 2011), a rate far lower than expected if research productivity matched the demographic representation. Low rates of curriculum content on aging within marital and family therapy programs offer little opportunity for marriage and family therapy trainees to learn about practice with aging families (Barber and Lyness 2001).

Outcome research on interventions with aging families has focused heavily on families in caregiving situations. Family-level counseling was a key component of successful intervention for dementia caregivers in two programs that have a substantial evidence base: the New York University (NYU) Caregiver Intervention (Mittelman et al. 2004) and the multisite REACH (Schulz et al. 2003) (Resources for Enhancing

Alzheimer's Caregiver Health) study and its extension, REACH II (Belle et al. 2006). Although intervention research with family caregivers has been conducted around the world, family-level interventions have not been the focus outside the USA.

Reviews of the literature on interventions with dementia caregivers found that education and support groups alone produce poorer outcomes than more intensive interventions, including family counseling interventions (Coon et al. 2012). Interventions often include training in specific strategies for communicating with persons with dementia, problem-solving approaches to addressing behavior problems, and strategies for enhancing social support for the primary caregiver(s).

General models for intervention with family caregivers can be applied to a wide range of situations. A strong assessment is key to planning interventions for caregiving families (Zarit and Heid 2015). As with any family faced with significant health problems, aging families require assessment of the care recipient and caregiver and the broader context for care (Zarit and Heid 2015).

Family interventions may also be helpful for problems other than dementia, including elder abuse within families and challenges experienced by grandparents rearing grandchildren. Families of persons within other populations who require family support also benefit from variations on these interventions (e.g., traumatic brain injury, developmental disabilities, or serious mental illness).

Culturally diverse populations require strategies that are aligned with cultural frameworks on the roles of families and the acceptability of nonfamily members understanding the inner workings of the family system (Knight and Sayegh 2010). Furthermore, deliberate outreach approaches are needed in order to reduce disparities in access to services.

## Future Directions

Today, family therapy for aging families is based on the limited conceptual scholarship, with very little empirical data, primarily from the USA. Looking forward, conceptual scholarship needs to

elaborate the foundational constructs for adapting family therapy interventions into strategies and protocols for particular problems faced by diverse family constellations. The elaboration of the conceptual frameworks provides the foundation upon which fidelity of interventions in outcome research can be investigated. Randomized clinical trials are challenging to conduct with aging families due to the heterogeneity in family structures, processes, and problems, yet rigorous empirical investigations need to inform providers about which interventions work for which populations in which settings to achieve which outcomes.

Descriptive research on help seeking by aging families is also needed. Aging families are often geographically dispersed, with highly varied membership and member participation in interventions. When not recruited for research studies, exactly who seeks intervention, in what family constellations, for which problems, and from what sources? Feasibility questions are also key: how are families engaged in intervention, by whom, for what purposes, with what value, to what members of the family, and the service delivery network. How does integrated care offer opportunities for engaging families?

Cultural variation in the processes of engagement (which families seek services in which settings, and accept services from which types of providers) is critical to reduce the disparities in access, services, and outcomes. Careful mapping of the types of problems that families bring to service settings and the interpersonal dynamics within which those problems are embedded would lead the field far toward understanding where interventions can be targeted effectively. Variations in families due to the nature of the stressors being experienced, communication styles and processes, and cultural contexts all need far more investigation. The field knows little about the cost to family members, older adults, or society of the failure to support families with interventions.

Research is needed on training strategies for building skill in geropsychologists to assess and intervene with aging families and with marriage and family therapists to address the distinctive challenges presented by aging families. Training

professionals in family therapy approaches to work with older adults will add to the demand for policy shifts in reimbursement structures for family-level interventions in countries where health and social service reimbursement regulations constrain payments to particular family constellations (e.g., care recipient must be present).

## Cross-References

- ▶ [Caregiving and Carer Stress](#)
- ▶ [Clinical Issues in Working with Older Adults](#)
- ▶ [Intergenerational Relationships](#)

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## Filial Responsibility

Tomoko Wakui<sup>1</sup> and Sheung-Tak Cheng<sup>2,3</sup>

<sup>1</sup>Tokyo Metropolitan Institute of Gerontology, Tokyo, Japan

<sup>2</sup>Department of Health and Physical Education, The Education University of Hong Kong, Hong Kong, China

<sup>3</sup>Department of Clinical Psychology, Norwich Medical School, University of East Anglia, Norwich, UK

## Synonyms

Filial norms; Filial obligation; Filial piety; Filial responsibility expectations

## Definition

Filial obligation is the obligation of children to defer to parental wishes and meet a parent's needs. This role not only includes contact with parents, having shared living arrangements, and providing routine care, but also involves providing physical, informational, and emotional support and financial help, especially when parents reach old age. This responsibility also includes more comprehensive efforts to ensure a parent's safety, health, emotional well-being, sociability, and continued integration in society through contact with the outside world (Schorr 1960; Caro 2014; Whyte 2004).

## What Is Filial Responsibility?

Families provide psychological, social, and physical resources to family members throughout their lives, and family is especially important in an older adult's later life. When physical, cognitive, or mental functions decline, family can provide assistance with ADL (activities of daily living) and IADL (instrumental activities of daily living); medical and long-term care information; emotional, affective, and psychological support; and financial aid.

The terms filial responsibility, filial norm, filial piety, and filial obligations are often used interchangeably. Some studies use the term filial responsibility expectations to reflect what parents expect from their offspring instead of the adult children's perspective or normative obligation beliefs.

Different theoretical approaches, including societal, familial, attitudinal, and psychological perspectives, shed light on the development and maintenance of filial responsibility (Donorfio and Sheehan 2001). From the societal perspective, cultural expectations and values influence the nature and expectations of parental care, and filial obligations are culturally regulated duties based on kinship. Familial perspectives refer to the family norms that ensure that certain functions are performed to maintain and protect the health and safety of older family members. These norms and expectations vary across families, races, ethnicities, socioeconomic statuses, and geographic locations. Attitudinal perspectives refer to the

attitudes assumed by adult children toward intergenerational support, interaction with parents, visiting, and caregiving. Psychological perspectives posit filial responsibility as a developmental stage or task confronting middle-aged children. Filial responsibility is also viewed as a process in which children face a developmental crisis called “filial maturity” (Marcoen 1995). Filial maturity requires adult children to accept that their aging parents are becoming weaker and more vulnerable and are no longer reliable support resources. Adult children must renegotiate their relationship with their parents during this crisis before coming to accept their responsibilities for parents.

Previous studies have universally sought to establish the rationale and motive for filial obligation (Ganong and Coleman 1999). For instance, filial responsibility has been explained as a form of altruism based on kinship ties, involving a genetic predisposition to care for those to whom one is genetically related. A norm of intergenerational transmission of reverence has also been used to explain filial responsibility; when children support their parents, they will likewise receive support when they reach old age. A feeling of gratitude also explains why children reciprocate their parents’ help; parents raised their children or helped their children establish their own families, and so children help their parents in return when needs arise. Filial attitudes may also be influenced by moral duty if one believes that good people show filial responsibility. Children may also be motivated by emotional attachments to their aging parents. Intergenerational solidarity is another model that explains filial responsibility, and this model proposes that children support their aging parents because of “familistic norms, affection for parents, an opportunity structure that facilitates interactions, and perceptions that exchanges between generations have been reciprocal” (Ganong and Coleman 1999).

### **Personal Feelings of Obligation and Normative Obligations**

Filial responsibility includes an individual’s sense of obligation to assist parents and

normative obligations or societal beliefs (Ganong and Coleman 1999). Norms of filial responsibility refer to the recognized duties and obligations that define the social role of adult children with respect to their aging parents. These norms have been described as “more than an expectation of one’s own behavior” (Gans and Silverstein 2006). They are socially defined norms with regard to family obligations and are also described as “rights and duties that specify the ways in which any pair of kin-related persons is expected to behave toward each other” (Rossi and Rossi 1990). From this perspective, filial obligations or filial responsibility expectations are used to label normative beliefs on adult children’s obligations to their aging parents. Personal feelings or attitudes of obligation, however, are defined as the individual’s self-perceived responsibilities. In this perspective, personal obligations are changeable beliefs, and they may change as the relationship and the contexts shift. Hence, a sense of filial responsibility may represent internalized norms of the society or may arise from personal affection for the parent and hence a genuine concern for the parent’s welfare. In most cases, children’s filial responsibility has both elements.

A close examination of the general literature on filial responsibility, including filial obligation, filial piety, filial norms, and filial responsibility expectations, may reveal that authors face difficulty conceptualizing filial responsibility and even simply understanding the expansive idea of that responsibility. The value has been defined in various ways depending on the authors’ interests and the purposes of the studies, resulting in a variety of measurements of filial responsibility (Sung 1995). The measurements include individual feelings, attitudes toward specific behaviors such as coresidence, and the frequency of supportive behaviors toward aging parents. Some are limited to care-related behaviors toward parents with disability, and others include more comprehensive support for protecting aging parents and deferring to them. Consequently, systematic development of measurement for the different components of filial obligation is needed.

## Life Course, Age, Gender, Race, and Cohort Variations in Filial Responsibility

Research has shown that filial obligations may be subject to change throughout the course of a lifetime. In general, younger generations show relatively stronger sense of filial obligation than older generations (Gans and Silverstein 2006), suggesting a weakening of normative beliefs with increasing age. One explanation is that the younger generation, because of inexperience, tend to hold idealistic views about caregiving without considering its practical implications and consequences. In contrast, older generations may have already been exposed to these situations, either as caregivers to their parents or because they have needed help, and may also have observed these situations among their family or friends. Exposure to these experiences may change individuals' perceptions of filial piety (Gans and Silverstein 2006).

A lower expectation reduces the likelihood of "filial discrepancy" (i.e., seeing children's filial behaviors as less than desirable), thus enhancing satisfaction with children's support and avoiding strain in the relationship (Cheng and Chan 2006). As excessive demands may discourage children from offering support when future needs arise, lowering filial expectation is adaptive in the long run.

From a sociological perspective, modernization and aging theory has attempted to explain the decline of status and family support for older parents in developing as well as industrialized countries. Modernization and aging theory explains the decline as a result of extended families giving way to the modern nuclear family, which is related to urbanization and industrialization. The emphasis on the bonds between young parents (i.e., adult children) and their dependent children within the reduced family structure, ultimately, causes a decreased willingness on the part of adult children to provide for their aging parents (Aboderin 2004). The role of material constraints, however, provides an alternative explanation, which emphasizes the incapacity of adult children, rather than unwillingness, to provide

support to their aging parents due to the rising cost of living, especially in urban areas. The growing financial pressure in many economies worldwide put families in a difficult situation if they have to provide support to older family members and younger children at the same time (Aboderin 2004).

On the other hand, an opposite cohort effect has been found in previous studies in that those born in the 1950s and 1960s showed stronger filial beliefs at midlife than their parents' generation (i.e., the later-born generation reported stronger filial obligation than the earlier-born generation). This seemingly confusing may be explained by the fact that the pro-familism trend, which existed simultaneously with a historical trend of weakening filial responsibility, peaked in 1970s and 1980s but diminished subsequently (Gans and Silverstein 2006).

Previous research has identified several personal and family characteristics that explain variations in filial responsibility (Burr and Mutchler 1999). Gender differences have been found, with women consistently showing stronger beliefs of filial obligation than men across cultures. Gender also affects how responsibilities to aging parents are realized. Women tend to provide more housework and personal care for family members than men do. However, in Asian countries, it has been observed that older parents tend to prefer children of the same sex to perform care activities that involve personal privacy such as bathing (Cheng et al. 2015). Moreover, financial assistance to older parents is generally believed to be the responsibility of adult sons.

Economic class is another factor that determines how filial piety is manifested. Middle-class families prefer the transfer of money and goods rather than the provision of actual support, whereas the latter is preferred by the working class. Consequently, working- and lower-class families show stronger beliefs of filial obligation.

Geographical area is another factor. Family ties are stronger among those living in rural areas, who report a greater sense of filial responsibility than those in more urbanized areas (Lee et al. 1994a). This may be a reflection of geographical location; family members usually need to

cooperate with each other in economic production, such as on farm, in rural areas. When actual in-kind help is needed, geographical proximity becomes an important consideration, with distance between parents and children found to be associated with the amount and type of help children provide (Rossi and Rossi 1990). Coresidence or geographical proximity increases help exchange. However, no type of help increases compensatory as the result of fewer in-kind help due to the greater distance.

Filial responsibility also varies by cultural background. In the United States, attachment to the norm of filial responsibility is generally stronger among minority families, including African-Americans, Hispanics, and Asian-Americans than among non-Hispanic whites. African-Americans, for example, who have long struggled for economic and social equality, may have developed extensive generational support networks among family and friends (Burr and Mutchler 1999). Hispanics and Asian-Americans may experience similar circumstances as the African-Americans, and their traditional filial attitudes may be maintained by strong family ties, even though impacts of immigration and acculturation, which likely undermine traditional values, cannot be overlooked. Yet, results were not always consistent. A lower sense of filial obligation among African-Americans, compared with Caucasians, has also been reported (Hanson et al. 1983). Future research should recruit larger and more representative samples of different ethnic groups and examine the longer- and short-term impacts of immigration and acculturation on filial responsibility, in order to reach more definitive conclusions about cultural influences and variations in filial attitudes.

### **Filial Responsibility for Caregiving Behavior**

As parents age, filial responsibility increasingly emphasizes physical assistance, emotional support, and financial support to address parents' needs. In particular, once parents are perceived to have dependency needs, adult children

mobilize their resources to meet the needs. How adult children fulfill their roles as caregivers in the family is contingent on the family situation.

Studying the whole family that includes all the adult children, their interrelationships, and their relationships with aging parents (instead of just one parent-child dyad removed from the family context) is needed to understand the behaviors that help parents. For example, when a family has multiple children, each sibling expects support to parents from the others. While siblings may not provide care in exactly the same ways, the distribution of filial responsibility is partly determined by family structure, family history, and affective ties (Matthews and Rosner 1988). Gender also determines the type of care adult children provide to their parents. Female siblings are more likely to be involved in providing care than male siblings when there are both male and female siblings in a family, although sons do help when asked. Sons may feel obliged to provide care, as daughters do; however, some types of caregiving tasks are more traditionally provided by females. As a result, female children are more likely to engage in routine care (e.g., housework and personal care) than male children. When male children are the caretakers, their wives are also usually involved, either in an assisting or a principal capacity, although fewer and fewer daughters-in-law are willing to assume the primary caregiving role (Zhang et al. 2014; Cheng et al. 2013). In families with multiple children, siblings share caregiving roles; some siblings coordinate routine care, whereas others are involved sporadically or help financially. The birth order of siblings is an important factor in care provision decisions in Asia and sometimes in Western countries; for example, the oldest sibling may be expected to be involved in routine care (Cheng and Chan 2006).

The effects of filial responsibility on family caregiving have been examined in several studies. On the one hand, filial responsibility may reduce the negative impacts of caregiving. Several studies have reported that filial piety is related to a lower level of the caregiving burden (Khalaila and Litwin 2011). On the other hand, a strong sense of filial obligation may place undue pressure on the

caregiver, leading to feelings of guilt when one seems to perform below self-expectations (Cheng et al. 2014). The benefits of filial responsibility may also differ according to culture (Funk et al. 2013), and more studies are required to elucidate how cultural values moderate the relationship between filial piety and caregiving burden. It also has to be mentioned that the relationship between the attitude of filial responsibility and actual caregiving behavior is not clear. Attitudes of filial responsibility are not necessarily translated into enacted social support (e.g., personal care) (Chappell and Funk 2012). Unfortunately, research on the impact of filial responsibility on caregiving is limited by inconsistent definitions and measurements of filial responsibility. Thus, future research should clarify the relationships between feelings of filial responsibility, adult children's helping behaviors, the selection and usage of public long-term care service, and caregivers' mental health outcomes.

### Filial Responsibility Expectations

Although the foregoing discussion has focused on children's filial attitude and its relationships with caregiving behaviors, the role of older parents' filial responsibility expectations should not be ignored. The concept of intergenerational solidarity suggests that caregiving behaviors are more likely to be executed in an appropriate manner when the two generations share similar filial responsibility norms and make decisions collectively (Bengtson and Roberts 1991). Otherwise, there may be negative impacts on older adults' personal well-being when their expectations are unrealistic or are not met by their children (Cheng and Chan 2006; Seelbach and Sauer 1977).

Some studies have focused on the perspective of the older parents on filial responsibility expectations. These studies measure filial responsibility expectations as the extent of support to which aging parents feel entitled to receive from children. Women, unmarried, those in poorer health, and those of lower economic class and education are more likely to hold stronger filial responsibility expectations (Lee et al. 1994a). This may

simply reflect that those who need help expect more from adult children. Although parental expectations of filial responsibility appear to vary by race, the findings are far from being conclusive. For example, whereas a study has reported stronger filial responsibility expectations among African-Americans than among Caucasians, even when sociodemographic, health, and support factors were statistically controlled for (Lee et al. 1998), others have found the reverse or a lack of difference between the two ethnic groups (Lee et al. 1994b). Moreover, parents' expectations of filial obligation do not determine the actual amount of support received from adult children, although parents' aid to children does positively affect the amount of aid adult children provide to their parents (Lee et al. 1994b).

### Filial Responsibility in the West and the East

In the United States and some other Western countries, filial responsibility has become a growing issue in view of the number of older adults with different degrees of dependency. Actual help from offspring is typically provided only after the parents have ceased struggling to maintain their independence and self-sufficiency, as individuals taking responsibility for themselves are culturally valued in these countries (Cheng and Chan 2006; Silverstein et al. 1996). An ideology that people are responsible for themselves and their dependents is the result of a long history of autonomy orientation or individual rights in the United States and elsewhere. Yet, ideas about individualism have existed alongside the assumption that women will be available, able, and willing to assist and support family dependents in the household. However, this assumption is increasingly challenged due to changing family structure, including the downsizing of the family, women working outside the home, or the reconstruction of families through divorce or remarriage, uniformly closed relationships, or the unavailability of family members to provide services for aging parents. How such changes in the family affect the provision of care to aging parents in the context of

the traditional emphasis on personal autonomy remains to be seen.

In Asian societies, the concept of filial responsibility is commonly believed to derive from Confucianism. Filial piety is a dominant idea in Confucian teachings and guides the relationship between children and parents. This belief system prescribes such behaviors as showing respect, being obedient, and honoring or promoting the public prestige of one's parents and ancestors. Filial piety, in the traditional sense, also emphasizes the value of producing an heir, carrying on the family line, and caring for the parent, whether healthy or sick (Cheng and Chan 2006). Children in Asian countries are taught from an early age to show courtesy and respect to older adults (Bengtson et al. 2000). Having filial children is a source of pride and major support resource, so much so that childlessness poses a risk for ill-being in Asian older adults (Cheng 2014). However, it has been argued that the value of filial piety has been changing in Asian countries such as China, Korea, and Japan because of industrialization and urbanization. Nevertheless, filial piety has remained a core value, and rapidly aging societies have continued to rely on family support with fewer children to provide it. In this context, formal social services and long-term care programs are expanding to meet the needs that families cannot provide. Thus, the unavailability of family support has led to modifications of the methods used to support older adults.

### **Filial Responsibility and Aging Policy**

One major issue in societies with aging populations and declining fertility is how to provide care for the elderly. The reduction in the number of potential caregivers vis-à-vis the increasing number of frail older adults places strain on the state's health care and support resources. The combined effects of increased longevity, fewer kin ties, and women's social advancement in rapidly aging societies lend greater importance to the balance between family and state responsibility in care provision for the aged (Cheng et al. 2015). However, weakened

marital relations or reconstructed family networks erode familial responsibility and make family members unavailable as a future resource for supporting aging parents.

The traditionally important role of the family in supporting aging parents has been well documented, and even societies that have introduced long-term care programs retain this fundamental assumption. It is generally recognized that the role of the state in care provision will become increasingly indispensable, along with the rapid increase of the older adult population, but whether that will diminish family responsibility in providing for the needs of older family members is debatable. Nevertheless, the state can never replace the family's support functions entirely, as certain support functions, such as confiding and affectionate exchanges, cannot be reliably replicated by formal care services, though some of the traditional family caregiving tasks could be replaced by the expansion of public services.

However, current aging policies in most countries face the limitation of the competing roles between family and states. Most studies support the idea of complementarity rather than substituting family with the state (Bengtson and Lowenstein 2003). Complementarity is based on the idea that the family would provide care by using services when the service reduces the family's burden. In this way, public services could contribute toward practical and material support so that the family can focus more on emotional support. Additionally, the generous pension system in some countries allow older adults to reciprocate via financial support to the younger generation, thus sustaining adult children's in-kind support to parents (Bengtson and Lowenstein 2003). How state involvement changes concepts of filial piety and adult children's responsibility to parents remains to be seen.

### **Conclusion**

Filial piety is a multidimensional concept. It includes normative expectations, actual expectations at the personal level, and enacted behaviors. When it comes to expectations and normative

beliefs, there could be intergenerational differences and conflicts that produce tension between adult children and their aging parents. Understanding filial responsibility and behaviors within the family context becomes more and more important in aging societies. As we embrace the challenges of our rapidly aging societies, both family support and formal care provided by the state are necessary to meet the needs of an aging population. However, with the reduction in the number of children per family, the possibility of relying on the family is reduced. Balancing reliance on formal services and reliance on informal support networks becomes a crucial issue. Although it is often said that state involvement will erode traditional family values and responsibilities, we opine that the proper provision of formal services and social welfare may be necessary to preserve the values of filial piety and family responsibility because these values will only break down more quickly if families cannot cope.

Some studies conclude that filial piety is still strong even in the face of changes to traditional family structures and have introduced public long-term care programs in modern society. However, ambiguities with regard to the way the concept is defined and measured across different studies have sometimes clouded conclusions. Different researchers may talk about filial piety at the same time; yet one may be referring to normative expectations, another to self-expectations, and still another to filial behaviors. However, these constructs are not identical. For instance, a strong belief in filial responsibility does not necessarily imply enacted supportive behaviors to aging parents in times of need. Thus, researchers need to define the concept more clearly in the future and preferably assess the different aspects of filial piety simultaneously so that we can have a more thorough understanding of this important topic as we embrace rapidly aging societies.

## Cross-References

- ▶ [Caregiving and Carer Stress](#)
- ▶ [Home-Based Primary Care](#)
- ▶ [Stress and Coping in Caregivers, Theories of](#)

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## Financial Planning for Retirement

Noreen Heraty and Jean McCarthy  
Kemmy Business School, University of Limerick,  
Limerick, Ireland

### Synonyms

Financial planning; Financial security; Life savings; Pensions; Retirement planning; Retirement savings

### Definition

Financial planning for retirement refers to the process that an individual undertakes to safeguard his/her financial security post retirement, most often in the form of voluntary financial contributions to pension plans and personal savings accounts while still in employment.

### Introduction

Aging has been identified as one of the four key “megatrends” that will shape the world in over the next 15 years. People are living longer and it is estimated that the typical worker today is likely to have approximately 15–20 years of retirement (Adams and Rau 2011). Acknowledging distinct variations in national social security and pension provisions across countries, the OECD in 2012 highlighted that recent reforms in many developed countries will lead to lower public pensions for future generations of retirees, to the extent that future retirees will have to rely less on social security schemes and more on voluntary pension plans to finance their own retirement. When one considers that most people tend to wait until the age of about 48 years before they start planning for their retirement (Hershey and Mowen 2000), the suggestion is that many workers will leave employment with insufficient resources to maintain their financial independence during

retirement. The absence of adequate retirement preparation poses a real concern (at the individual as well as at the policy level) about individuals' ability to adequately finance their retirement, with the concomitant risk of falling into poverty in later life. Calls for concerted national efforts to foster long-term investments in income and old-age pension systems are being made amid concerns that retirees across the globe run the risk of becoming poorer relative to the rest of society.

### **Importance of Financial Planning for Retirement**

Our understanding of retirement has been informed by a well-developed body of research evidence that has described retirement as an identifiable stage during an individual's life cycle. Much of the early research on retirement focused on the experience of transitioning out of the workforce and in particular on the loss of job role. This literature evolved to consider factors associated with the physical and psychological effects of no longer being "employed" and the attendant loss of structure, focus, purpose, and social connection that many retirees wrestle with. More recent research has focused attention on unearthing a range of antecedent factors that may help predict positive adjustment to retirement, and here, financial planning is recognized as one critical activity which may facilitate both a successful transition into retirement and satisfaction with one's retirement lifestyle, and consequently, an activity that facilitates successful aging in retirement.

While research has shown that higher income promotes better retirement adjustment, and that inadequate income and financial stress are associated with dissatisfaction and more negative retirement experiences (Heraty and McCarthy 2015), it is almost a certainty that many retirees could have set aside savings while they were working but failed to do so. Given the centrality of financial planning for adjustment and well-being in retirement, there is a growing debate that the stumbling block for many people is a widespread uncertainty about how to go about financial planning for the future.

### **Theoretical Frameworks**

Research on retirement has adopted varying approaches to understanding the dynamics of when and why people retire, how they approach preparing for their retirement, and how they adjust to life in retirement. A recent review (Wang and Shi 2014) depicts three particular psychological models for understanding retirement: the temporal process model encapsulating retirement planning, retirement decision-making, and retirement transition and adjustment; the multilevel model of retirement which institutionally embeds retirement and individual decisions and plans into a social, cultural, and organizational milieu; and the resource model which focuses on retirement adjustment as a fluctuating process dependent on a range of individual resources. Resources here are understood to include an individual's total capability required to fulfill a valued need, and therefore comprise a combination of income, health, and social support resources (Kim and Moen 2002; Donaldson et al. 2010). A more recent six-factor resource model (Wang and Shultz 2010) extends beyond the resource categories of physical (health), financial (income), social resources (relationships and activities) to include emotional resources (positive emotions), cognitive resources (including self-esteem, mastery, and optimism), and motivational resources (goal clarity and tenacity). Together, this resource perspective suggests that resources determine retirement well-being in terms of retirement adjustment and retirement satisfaction. It is suggested (Heraty and McCarthy 2015) that this resource perspective could also be used to explain preretirement behavior. Since the accumulation (and depletion) of resources occurs across the life span, it is likely that the valence of particular resource types (at critical points in time) will be associated with certain preretirement behaviors, including financial planning for retirement.

Focusing on financial preparation for retirement here, we can trace the use of a range of perspectives to understand the dynamics of individual financial planning behavior. Early work (Ando and Modigliani 1963) used life cycle economic theory to explain individuals as rational

economic maximizers who make decisions that will afford them the highest net benefit, and so will make investment decisions that will yield higher returns over the longer run. The theory of planned behavior (Ajzen 1991), based on earlier work on reasoned action, has emerged as one of the most influential frameworks for the study of human action. This theory suggests that human behavior is guided by three particular kinds of considerations: attitudes about the likely consequences or other attributes of the behavior (*behavioral beliefs*), attitudes about the normative expectations of other people (*normative beliefs*), and attitudes about the presence of factors that may further or hinder performance of the behavior (*control beliefs*). In consort, behavioral beliefs produce a favorable or unfavorable attitude toward the behavior; normative beliefs result in perceived social pressure or subjective norm; and control beliefs give rise to perceived behavioral control, which is the perceived ease or difficulty of performing the behavior. In general, the more favorable the attitude and subjective norm is toward a certain behavior and the greater the perceived behavioral control over that behavior, the stronger an individual's intention to perform the behavior under consideration (Ajzen 1991). The relative importance of these three determinants is expected to vary across behaviors and situations. This suggests that financial planning for retirement is a function of the degree to which people feel they need to make adequate provision and have the capability to make such provision now. A number of additional features have been identified in this regard and are explored next.

### **Predictors of Financial Planning for Retirement**

The possibility of being able to predict who will most likely engage in financial planning behaviors is intuitively appealing at several different levels and remains an area of considerable research interest, especially in terms of retirement planning. To date, research has unearthed a combination of demographic, dispositional, and psychological variables that have some

explanatory power in helping to predict financial planning behavior generally and financial planning for retirement specifically. These will be considered in turn.

Turning first to demographic predictor variables, it has been shown that the nature and amount of preparation people engage in changes (i.e., increases) as they draw nearer to the retirement event (Hershey et al. 2007; Phua and McNally 2008). This *life stage* view of planning can be understood through the Life Course Perspective (Elder 1995), which presents our lives as a series of key transition events, during which individuals reflect on their own development and interpret their aging as they move across the life span. The closer one gets to retirement age, the more readily individuals can conceptualize themselves as being retirees, and the more likely they are to plan for that more immediate life stage.

There is also some evidence (Moen et al. 2001) to suggest that those with higher overall levels of *education* are more likely to engage in financial planning behavior. This may be related to better financial literacy or higher incomes linked with better job opportunities overall.

*Gender* appears to have some explanatory power when it comes to predicting financial planning. Specifically, men are more likely than women to engage in financial planning (Moen et al. 2001; Glass and Kilpatrick 1998). Women appear to have lower occupational pension coverage and lower pension income than men, due at least partially to interrupted work histories because of occupational segregation, childbirth, child-rearing, and other caring responsibilities. Given that women have a higher life expectancy than men and so are more likely to have longer life in retirement, they may run a higher risk of income poverty in retirement.

*Financial literacy* has been consistently found to be a strong predictor of financial planning for retirement (Lusardi and Mitchell 2011). Although financial knowledge and financial literacy in general populations is considered to be low (Lusardi and Mitchell 2011; Babiarz and Robb 2013), it becomes a key concern as individuals consider when and how to plan for their retirement. In particular, a working knowledge of the basic

fundamentals of finance and economics, including understanding compound interest, inflation risk, and risk diversification, provides individuals with some objective knowledge of what may be required for pension purposes. Evidence (Lusardi and Mitchell 2011) suggests those who actively plan for their retirement tend to arrive close to retirement with much higher wealth levels and display higher financial literacy than those who fail to plan.

The *temporal perspective* explores how individuals adopt a long or short time perspective when considering finances. The ability to engage in and commit to planning over a longer time perspective has been shown to explain variations in individual savings patterns (Van Dalen et al. 2010), such that those who adopt a longer time horizon are more likely to engage in active planning for their retirement.

*Risk tolerance* has been found to partially explain financial planning behavior. In this context risk tolerance provides an indication of the amount of financial uncertainty someone is willing to accept. Risk propensity is thus an individual's attitude and behavioral tendency toward taking or avoiding risks. Financial risk tolerance has been described as an individual's willingness to engage in financial behaviors in which the outcomes remain uncertain and possibly even negative (Grable et al. 2009); it has been shown that those with a higher propensity to plan for their retirement are more risk tolerant. Those who have a tendency to avoid risk have been found to have more conservative investment patterns in retirement savings and therefore lower income replacement in retirement. There is also some indication of a lower preference for risk taking among women when compared with men.

*Self-efficacy* is a well-established construct in the psychological literature that describes an individual's perception of his or her ability to perform a certain behavior in response to a particular threat or challenge (Bandura 1977). In terms of financial planning, self-efficacy influences the perceived amount of control and ability one feels when considering and dealing with financial plans – the extent to which one feels capable of developing plans and following through with them.

There is some evidence to suggest that individuals with higher levels of self-efficacy when it comes to saving for retirement are more likely to participate in pension plans and for this to be reinforcing (Lusardi and Mitchell 2011; Wiener and Doescher 2008).

A link between individuals' *self-perceptions* or self-concept and financial planning behavior has also been established (Hira and Mugenda 1999) suggesting that financial behaviors are as likely to be influenced by sociopsychological needs as practical and financial ones. A recent study of self-perceptions of aging as psychological predictors of financial planning behavior (Heraty and McCarthy 2015) among older workers (aged 50 year +) found that, after controlling for age, gender, employment contract type, and industry sector, self-perceptions of aging significantly predict the likelihood of financial planning behavior. Specifically, older workers with more positive beliefs about their ability to control aspects of their aging were more likely to financially plan for retirement, while those with a less consistent awareness of their own aging were less likely to plan for their retirement.

## Future Directions

In the last 20 years, people all over the world have, on average, gained 6 years of life expectancy. This increasing longevity means that people can expect to live for longer in retirement, and therefore, the pressure escalates to ensure that individuals can create and maintain the means to ensure their financial independence as they enter into retirement. This is particularly important where the evidence shows that inadequate income predicts dissatisfaction and maladjustment in retirement.

However, while recent work demonstrates the significance of a combination of demographic, dispositional, and psychological predictors of financial planning behavior, there is still much to be learned about the particular mechanisms that underlie financial planning for retirement. Indeed, since aging itself is characterized by large interindividual variability, planning for retirement is likely to vary as a function of many

contextual and psychological predispositions. The recognition that dispositional and psychological factors may be more salient than several demographic variables should facilitate a more nuanced understanding of how retirement itself may be internalized by the individual and allow for different strategies to be employed to cater for individual needs. In particular, they may help to identify those at more risk of failing to adequately prepare for retirement and who consequently run the risk of pensioner or retiree poverty. This suggests a key role for career counselors, organizational psychologists, those who are responsible for managing the transition into retirement, and those involved in designing training and development programs on career planning, pensions, and retirement planning in the workplace. While research continues to explore variations in financial planning behaviors, there is an interest in exploring patterns of behavior over time and on a longitudinal basis. Such a dataset would allow for a more patterned exploration of individual differences in financial planning over time. It is suggested that our understanding of successful aging generally would benefit considerably from the use of multiple data sets from longitudinal research studies (Zacher 2015).

Echoing recent policy-level discourse in both the European Union and in the United States on how to reform and restructure pension systems to facilitate retirement planning, it is suggested that research that makes comparisons across national contexts may be particularly helpful, with the potential to advance theory on financial planning for retirement, especially where different national pension systems are in operation.

## Cross-References

- ▶ [Quality of Life in Older People](#)
- ▶ [Retirement Planning and Adjustment](#)

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## Five-COOP Study

Jean-Marie Robine  
INSERM & EPHE, Paris and Montpellier, France

### Synonyms

100 years old people; People having reached the age of 100 years; Studies of centenarian people

### Definition

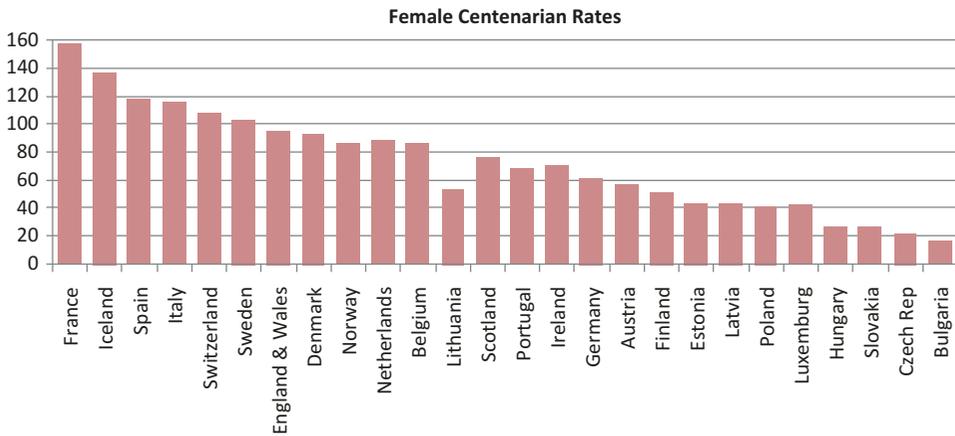
The 5 Country Oldest Old Project (5-COOP) is the first study which analyzes the relationship between the level of mortality selection, the speed of accumulation of oldest old, and their functional health status. The 5-COOP project will provide the prevalence of the main functional limitations and geriatric conditions, at the age of 100 years, in the five geographic settings (Denmark, France, Japan, Sweden, and Switzerland) as well as the level of independence in activities of daily living.

The number of oldest old is increasing dramatically. However, the health status of nonagenarians and centenarians remains controversial: some studies show that they are healthy, while others suggest relatively poor health. Few studies have been able to explore how the mortality selection and the rate of increase of the oldest old are associated with cognitive and physical status

among very old people. The 5 Country Oldest Old Project (5-COOP) aims to study these questions by pooling and comparing representative samples of subjects aged 100 years in Denmark, France, Japan (including Okinawa), Sweden, and Switzerland. A theoretical sample size of 1250 (5\* 250) subjects has been initially set. In the first phase, each sample is analyzed at the country level. In the second phase, comparisons among countries will be performed by merging the five standardized data sets. The 5-COOP project will increase knowledge about the age trajectory of several functional and geriatric conditions (mobility, difficulty in activities of daily living, cognitive disorders) and about the relationships between longevity and health (i.e., risk of dependence as well as medical and social needs). This understanding of mortality selection and health status will help us to plan care resources and make better population forecasts.

### Background

One of the most important changes in modern societies is the (slow at first and then rapid) emergence of a new age group of population, the oldest-old people, beyond the usual elderly people. Actually, very little is known about the nonagenarians and the centenarians. Their numbers and their speed of accumulation greatly vary between developed countries even if life expectancies at birth are quite close. Even less is known about their health status. Data from Denmark suggest that the functional health of the Danish centenarians improved, especially for females, between 1995 and 2005, while data from Japan suggest a significant decline in the functional health status of the Japanese centenarians since 1973. In Denmark life expectancy at age 65 for females increased from 17.8 in 1985 to 19.0 in 2005 (1.3 years increase), while the number of females aged 100 years increased from 66 to 233 (250% relative increase). In Japan, life expectancy at age 65 for females increased from 19.0 in 1985 to 23.2 in 2005 (4.1 years increase), while the number of females aged 100 years increased from 536 in 1985 to 7892 in 2005



**Five-COOP Study, Fig. 1** Centenarian rate in 26 European countries in 2006 (for females)

(1300% relative increase). This discrepancy in longevity increase suggests the existence of a trade-off between the level of mortality selection, the speed of accumulation of oldest old (centenarians or nonagenarians), and their functional health status.

In the mid-1990s, James Vaupel and Bernard Jeune demonstrated that the number of centenarians had doubled on average every 10 years since 1950 in half a dozen Western and Nordic European countries (Vaupel and Jeune 1995), however, starting with very small numbers. Since that time, the increase in the number of centenarians has been meticulously described in Japan (Robine et al. 2003) and in a handful of European countries such as Denmark (Jeune and Skytthe 2001), England and Wales (Thatcher 2001), Belgium (Poulain et al. 2001), France (Vallin and Meslé 2001), and Switzerland (Robine and Paccaud 2005). More recently, Robine and Saito analyzed the emergence of the centenarians in 27 European countries (Robine and Saito 2009), disclosing significant differences in the probability of becoming centenarian: For instance, French females, born in 1906, had an about ten times higher chance to reach 100 years alive than Bulgarian females (see Fig. 1).

On the other hand, little is known on the health status of the oldest old, nonagenarians or centenarians. Most published nonagenarian and centenarian studies consist of small convenient samples

of people being interested and who volunteer to participate in scientific studies exploring their “extreme longevity.” This often leads to the perception that centenarians are healthy people, free of most of the aging-related impairments, especially of cognitive disorders. In reality, the few representative or quasi-representative studies of nonagenarians and centenarians have demonstrated that they are in relatively poor health with a significant proportion being bedridden and/or demented (Andersen-Ranberg et al. 2001). According to Gondo and colleagues, less than 2% of the Japanese centenarians are in perfect health, defined as having no sensory problem, no cognitive deficit, and being fully independent in basic activities. Most of them should be considered as frail or fragile people (Gondo et al. 2006), confirming a previous study showing that only 1% of Italian centenarians were fully independent (Motta et al. 2005).

### Relationships Between the Mortality Selection and the Health Status of Centenarians

However, studies have also suggested that these extremely old people were in relatively good health 5 or 10 years before reaching age 100. For instance, among the 1905 Danish cohort, the great majority of those who became centenarians in

2005 were physically independent when they were 92 years old. As only a modest decline in the proportion of independent individuals has been observed within this cohort between the ages of 92 and 100 (Christensen et al. 2008), differential mortality risk must have eliminated the frailer and more dependent nonagenarians. Indeed, nonagenarians and centenarians are strongly selected people, and the current spectacular increase in their numbers in many countries creates new concerns. For instance, in Japan the number of centenarians increased from 154 people in 1963 to more than 50,000 in 2013. This phenomenal increase is mainly due to a reduction in mortality above the age of 80 years. Are older people more likely to become centenarians because they are in better health or because they are better cared for or, more generally, because it is much easier to survive today than before? In Denmark, where the number of oldest-old people increased relatively slowly compared to most of the Western European countries, over the recent decades, the functional health status of female nonagenarians and centenarians significantly improved (Christensen et al. 2013; Engberg et al. 2008). On the other hand, in Japan, where the number of centenarians has increased more than threefold every decade since the 1970s, occasional centenarian surveys demonstrated significant declines in the functional health status of Japanese centenarians. For instance, the prevalence of female centenarians being bedridden increased from 21.9% in 1973 to 41.1% in 2000 (Gondo 2008). The first objective of the 5-COOP project is to clarify the existence of a possible trade-off between the speed of increase in numbers of oldest-old individuals and their functional health status.

### **The Cognitive Status of the Centenarian People**

Besides specifying the prevalence of the main functional limitations and geriatric conditions in the five geographic settings as well as the level of independence in activities of daily living, the second important objective of the 5-COOP project is

to better characterize the cognitive status of centenarians. Indeed, the literature provides a very large range of prevalence of dementia among centenarians, from 50% to 100% (Calvert et al. 2006). The 5-COOP project has made an important effort in collecting comparable data on the cognitive functional status of the centenarians, and the merging of the five samples should help to better understand the dementia development in the very old. Combining information on health and cognition, the 5-COOP project will not only estimate how many centenarians suffer from dementia or are dependent in the five studied countries but will also estimate how many can be considered as frail or as successful according to various definitions of frailty and successful aging (Nosraty et al. 2012). For all these objectives it is of the utmost importance to get representative, or at least unbiased, samples of centenarians. This methodological issue was central since the beginning of this study, and the 5-COOP project did the maximum of what was possible in each country to maximize the representativeness of the samples. Data collection shows that not only it is more and more difficult for the researchers to contact the oldest-old people and their families because of the newly established privacy and ethical rules, but even when the families are contacted the rate of participation in social surveys tends to decrease. For these reasons, the participation rates in 5-COOP are much lower, except in Sweden, than expected or experienced in previous surveys in Denmark and in France.

### **The 5-COOP Consortium**

The 5-COOP Study is a joint effort of the Institute of Public Health, University of Southern Denmark, in Odense in Denmark (<http://www.sdu.dk>); the research team “Biodemography of Longevity and Vitality” (INSERM U1198) of the French National Institute of Health and Medical Research in Montpellier in France (<http://www.inserm.fr>); several Japanese research groups in Keio University, Nihon University, Osaka University, and Okinawa International University

coordinated by the Advanced Research Institute for the Sciences and Humanities of Nihon University in Tokyo (<http://www.nihon-u.ac.jp/intldiv/en/academics/graduates/arish.html>) and the School of Human Sciences of Osaka University (<http://www.hus.osaka-u.ac.jp>); the Aging Research Center (ARC) of the Karolinska Institute at the Stockholm University (<http://ki-su-arc.se>); and the Department of Internal Medicine, Rehabilitation and Geriatrics, Geneva University Hospital (<http://www.hug-ge.ch>) as well as the Institute of Social and Preventive Medicine of University Hospital of Lausanne (<http://www.iumsp.ch/>) in Switzerland. All together, these five economically advanced countries present three levels of mortality selection among the oldest-old people which will allow the various research questions to be explored (Robine et al. 2010).

### The 5-COOP Timeline

The 5-COOP project has been prepared through three international workshops held in Geneva/Archamps in November 2008, August 2009, and August 2010. At least two researchers per country participated in each workshop. The first workshop examined and discussed (i) the data availability (including ethical and privacy issues) in each country, (ii) the historical background (i.e., health events and transitions, diet, tobacco consumption, etc.), (iii) the more general sociodemographic background, (iv) the functioning and disability data, and (v) the usefulness of the clinical exam and biomarkers. The opportunity of a common study design were also discussed and working groups prepared proposals for the second workshop, as well as an Internet discussion on the general study design. The working groups examined four main issues (i) functioning (mobility, difficulty in activities of daily living – ADL, vision and hearing, physical tests), (ii) geriatrics (symptoms, fatigue, sleep, pain, mood; clinical assessment; cognitive functioning and biomarkers), (iii) health care consumption (health care and social services uses), and (iv) demography and background (sociology, economy, anthropology and

quality of life). The second workshop focused on the general study design and broadly discussed sample characteristics, questionnaires, physical tests, clinical and cognitive assessment, blood samples, data management, statistical analysis, and ethical issues. New working groups related to these issues were set up. Eventually, the study protocol and the various questionnaires were fine tuned during the third workshop in the summer of 2010.

The data collection, funded by AXA Research Fund, started in the different countries as soon as each national team got the legal permission to start the 5-COOP project. This phase took a few months in Denmark which was the first country starting to collect the data in May 2011, but it took more than 2 years in Switzerland which started to collect the data only in August 2013. The three other countries started to collect the data in fall 2010. Getting legal permission involves up to three kinds of committees as in France (privacy committee, ethical committee, scientific committee) and may have to be obtained from several regional or local committees as in Switzerland. In Denmark, the 5-COOP survey benefited from the staff of the Danish oldest-old surveys, and several specially trained interviewers collected the data throughout Denmark in a little bit more than 1 year. In Sweden, the 5-COOP survey was embedded in the SWEOLD survey, and the data was nationally collected by lay interviewers in about 8 months. In Japan, the data was collected in five prefectures evenly distributed from the north to the south of the archipelago: Aomori, Tokyo, Hyogo, Fukuoka, and Okinawa. The data collection lasted about one year and a half in Japan. In France, the data was collected in only one region, namely, the Languedoc-Roussillon, by the same interviewer who visited during two years and a half each new centenarian who accepted to participate in the 5-COOP project. In Switzerland, the data was collected in Western French-speaking cantons by trained nurses between August 2013 and December 2014.

The response rates in the 5-COOP project were lower than expected, except in Sweden where the participation was exceptionally high for a centenarian survey with a participation rate of 85.6%. The response rate reached only 30.4% and 31.6%

**Five-COOP Study, Table 1** The 5-COOP project: Summary of the data collection

	Denmark	France	Japan	Sweden	Switzerland	Together
Starting date	05/05/2011	01/09/2011	20/02/2012	24/10/2011	21/08/2013	05/05/2011
Ending date	05/07/2012	31/03/2014	26/09/2013	27/06/2012	31/12/2014	31/12/2014
Sample size	504	756	1067	360	428	3115
Interviews	251	211	337	274	168	1241
Deceased before interviewed		63		40	13	116
Males	56 (22.3%)	36 (17.0%)	58 (17.2%)	75 (18.2%)	23 (13.7%)	248 (20.0%)
Females	195 (77.7%)	175 (83.0%)	279 (82.8%)	199 (81.8%)	145 (86.3%)	993 (80.0%)
Response rate*	49.8%	30.4%	31.6%	85.6%	40.5%	41.4%

\*The response rate, in percentage, is obtained by dividing the number of conducted interviews by the number of centenarians contacted minus the number of centenarians who deceased before the date of the interview

in France and Japan, respectively, 39.8% in Switzerland, and 49.8% in Denmark. The impact of these low response rates on the representativeness of the samples will be carefully studied (see Table 1).

## National and Common Analyses

The 5-COOP samples are first analyzed at the national level before being merged in the common 5-COOP database at the Geneva University under the responsibility of François Herrmann.

Data cleaning and national analyses started in 2013 for Denmark and Sweden. Various results have been already presented in several national conferences. The 5-COOP project organized a first symposium at the annual scientific meeting of the Gerontological Society of America in Washington in November 2014 (Robine and Saito 2014). Data cleaning is under way in France, Japan, and Switzerland. All data will be merged in 2015 and the first common analyses will follow. A theoretical sample size of 1250 subjects had been initially set for allowing the simultaneous analysis of up to 125 variables in multiple regression models. The final sample size of 1241 subjects will not reduce the statistical potential of the common analyses, which will be weighted according to the survey sampling schemes used in each country. Comparison among countries will be performed with usual statistics (i.e., chi square,

Kruskal-Wallis nonparametric tests, ANOVAs and multiple regression). The first elements to be compared are the participation rates, the reasons why data could not be collected, and the prevalence of geriatric conditions, including dementia and cognitive disorders. The results of the 5-COOP project will be publically available through scientific publications in several disciplines: anthropology, demography, epidemiology, geriatrics/gerontology, sociology, and public health.

## Cross-References

- ▶ [Health in Centenarians](#)
- ▶ [Hong Kong Centenarian Study](#)
- ▶ [Korean Centenarian Study, Comprehensive Approach for Human Longevity](#)
- ▶ [New England Centenarian Study \(NECS\)](#)
- ▶ [Okinawa Centenarian Study, Investigating Healthy Aging among the World's Longest-Lived People](#)
- ▶ [Sydney Centenarian Study](#)
- ▶ [Well-Being in Centenarians](#)

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## Flexible Work Arrangements

Judith Davey  
Institute for Governance and Policy Studies,  
Victoria University of Wellington, Wellington,  
New Zealand

### Synonyms

Employers' attitudes; Employment of older people; Part-time work; Phased retirement; Prolonged workforce participation

### Definition

Paid work arrangements that may be desirable for older workers, including flexible working hours, part-time work, working at home, part-year work, and casual work

### Introduction

Longer lives and better health in later life provide an opportunity for prolonging participation in paid work beyond what has been considered a normal or sometimes compulsory, retirement age (often 65 years). The social, economic, and individual benefits of encouraging older people to

remain longer in paid work are increasingly recognized in academic literature and in policy statements (Carnegie Trust 1993; OECD 2006). There is considerable evidence that meaningful and appropriate work is beneficial to the well-being of older people. Remaining in or reentering the workforce has been shown to have a positive psychological impact for older people; the habits of work routine are beneficial to a sense of well-being and accomplishment and are linked to self-worth as opposed to retirement, which may be viewed as a non-role (Jaworski 2005; Hinterlong et al. 2007). Remaining in paid work provides people with social contact and mental stimulation. "Productive engagement" can lead to improved health and functioning for older people (Humphreys et al. 2003). Participation in paid work will also increase the incomes of older people, improving their material well-being in later life.

There are potential disbenefits to individuals. Retirement is now seen as a legitimate phase of life, a right that has been earned by a lifetime of paid work and something to look forward to (Phillipson 1998). Low levels of job satisfaction and low morale resulting from unsatisfactory working conditions can lead to a deterioration of both physical and psychological well-being, at a time when age-related health problems may be beginning to affect some people. The quality of work in later life is therefore important.

There are also social benefits. Society would be worse off if older people are not given the opportunity to contribute their skills and experience as role models and mentors in workplaces, helping to break down ageism and negative stereotypes. This will also contribute to intergenerational solidarity. A World Economic Forum report expresses this in terms of releasing accrued social capital among the older population and facilitating the process of adaptation to an aging population (Biggs et al. 2012).

Demographic trends suggest that labor and skill shortages will become more pressing in the future as younger people entering the workforce do not balance the numbers retiring. The economy therefore benefits from having an economically active older population, which will contribute to growth and the maintenance of living standards

and also, through taxation, help to meet the costs of an aging population. Older workers represent a valuable and often untapped source of increased productivity. Retaining older workers provides important benefits to employers in meeting skill shortages; retaining the valuable skills, experience, and the accumulated knowledge of older workers; and encouraging them to act as mentors to younger staff. Firms which understand the implications of aging will be better placed to address its challenges. Population aging itself can be a significant source of innovation and business opportunity.

If these benefits are to be realized and potential disbenefits are to be avoided, older people will require appropriate and acceptable working arrangements. Working conditions and experiences can be very influential in decisions about retirement from the paid workforce. These factors include the availability or otherwise of flexible conditions, access to training to keep up and prevent obsolescence of skills, the quality of working conditions, feeling valued by employers and colleagues, and having a sense of control and of purpose in their job (McNair et al. 2004; Smeaton and McKay 2005).

## Elements of Flexible Working Arrangements

Alternative work options for older people are varied. They include permanent or semipermanent part-time work, sometimes linked to phased retirement with reduced work schedules, prorated salary, and benefits; adjustment of responsibilities and time at work (variations to starting and finishing times, number of hours worked per day, and part-week, -month, or -year arrangements); contract work – on a fee for service basis; relieving pools (for temporary full-time or part-time assignments); temporary or seasonal work, telecommuting, or home-based work (working a portion of usual hours regularly at home or working from home or an emergency or casual basis); and extended leave and the flexible use of annual leave and long service leave (Morrison 1986; Government of Western

Australia 2010). Self employment will provide the opportunity for flexible work arrangements as these can be set by the people themselves.

Such measures, which seek to enhance the functional capacity of older workers, have been brought together in a process called “reciprocal adaptation,” in which the individual seeks to establish a “fit” with the job, and the job is modified to suit the needs, values, and interests of the older worker (Yeatts et al. 2000). This aims to produce job modifications acceptable to both workers and employers in a “win-win” situation. Work Ability, a concept developed in Finland, aims to establish a proactive, preventative, and holistic approach to working lives, through better age management at the enterprise level (Maltby 2011). It balances personal factors – health, skills, motivation – with the job and how it is managed and aims to encourage employers to tailor work to individuals as they age.

At the same time, the human resource approach needs to shift from a “depreciation model,” where a worker’s value to the organization peaks early in their career, reaches a plateau mid-career, and then steadily declines (Yeatts et al. 2000). Instead, there is benefit in fostering a “conservation model” in which all employees, regardless of age, are viewed as renewable assets that can continue to yield a high rate of return if they are adequately managed, educated, and trained and given appropriate working conditions. The similar “age management” approach aims to ensure that workforce aging is managed well and that age does not become a barrier to employment (Naegele and Walker 2006; Brooke and Taylor 2005).

### **The Value and Importance of Flexible Work Arrangements**

Flexible work arrangements are the means whereby older people can achieve their preferences and aspirations in the paid labor force and retain levels of participation which provide job satisfaction, income to supplement pensions and superannuation, and time to pursue recreational and family activities, including caring, and voluntary work, which are seen as part of a healthy

retirement and positive aging (Hegewisch 2009; Lissenburgh and Smeaton 2003; Australian Institute of Management 2013). They allow older people to exercise a preference to sacrifice income for more control over their time without giving up paid employment entirely. If older workers are unable to balance their chosen activities, capabilities, and responsibilities with the demands of their paid work, and employers are unwilling to provide flexibility, then many older workers may be forced out of the workforce, removing valuable skills and significantly impacting on their future financial and personal well-being.

Deteriorating physical and mental health among older people may be a barrier to continuing workforce participation. Flexible work arrangements will be helpful to people with declining physical stamina and sensory impediments, especially when accompanied by ergonomic and other forms of job adaptation.

Flexibility in work arrangements may also be required to accommodate caring responsibilities, especially eldercare. As life expectancy increases, many working people in their 50s, 60s, and even 70s have living parents in their 80s and 90s, often in need of care and support. At the same time as governments are intensifying their efforts to delay retirement, many are also pursuing policies to support aging at home with reliance on informal care. Middle-aged women are frequently expected and frequently do take on eldercare responsibilities and also caring for grandchildren and other dependent relatives. Yet this group has increased its level of participation in paid work and this is likely to continue. As a result they may experience difficulties in juggling caring responsibilities with paid work. Lack of flexibility in the workplace may lead to their withdrawal as work becomes incompatible with the service they wish to offer their families (Johnson 2011). Considerable attention has been focused on family-friendly working arrangements with respect to child rearing, but less has been given to workers in midlife with other family responsibilities, ranging from social contact to personal care. Combining paid employment with eldercare is an emerging issue in New Zealand and internationally (Phillips et al. 2002).

Flexible working conditions also provide a means of phasing into retirement. Many older people switch to part-time work for a few years before full withdrawal from the paid labor force. While most people still expect to retire, an abrupt break between working full time and not working at all is becoming much less likely. Rather than seeing retirement as a “one-off” concept, it would be more productive to see people negotiating moves in and out of work, not related to chronological age, but based on their skills, abilities, and life experiences (Allen et al. 2004). This might develop into a transitional decade, during which people select how and when they wish to retire, with the option of gradually winding down by adopting more flexible work practices.

International research suggests that the majority of workers would prefer a gradual transition to retirement and that there are benefits for both workers and employers (Department of Labour 2011). For workers, reduced participation in paid work allows them time to pursue leisure and family activities and adjust and prepare for the financial changes which retirement brings. For employers, retaining older workers allows valued knowledge and experience to remain with the firm and be used to mentor and train less-experienced workers.

### **Policy Initiatives on Flexible Work Arrangements**

Facilitating participation in the labor market by people with caring responsibilities has been a focus of policies relating to flexible work, but other considerations include providing opportunities for employees to pursue education and training, assisting older workers to transition to retirement, and increasing labor force participation through part-time work.

Several countries, including New Zealand, Australia, the UK, and Northern Ireland, have legislation providing the “right to request” flexible work arrangements. This legislation may confine the right to employees with caring responsibilities, although some countries are

extending these provisions to all workers. In New Zealand, the Employment Relations (Flexible Working Arrangements) Amendment Act came into effect in 2008. This provides employees, who have worked for the same employer for at least 6 months and are responsible for the care of any person, with the right to request flexible working arrangements (i.e., a variation to their hours of work, days of work, or place of work). After a review, these provisions are being extended to all employees. Employers can refuse a request on reasonable business grounds, which include inability to reorganize work among existing staff or to recruit additional staff, the burden of additional costs, and/or a detrimental effect on ability to meet customer demand.

Reviews of flexible working arrangements in Australia and New Zealand found that the provisions were working effectively and were being taken seriously by employers and employees, and the vast majority of requests were being granted (Department of Labour 2011). In New Zealand the majority of employee-reported requests were accepted by employers without recourse to the formal legislative process, but only 56% of requests related to caring responsibilities; a significant proportion were for other reasons. The conclusion was that employers and employees have been independently developing formal and informal flexible work arrangements that suit their particular needs. However, even where legislation exists, many workers are not aware of their rights to request flexible work arrangements and employers also are often not well informed. Awareness appears to be higher in larger businesses and among higher-income employees.

### **The Availability of Flexible Work Arrangements**

Flexible work practices are already widespread in many countries and also are very popular with older workers. As already noted, a high proportion of organizations, in New Zealand and elsewhere, provide flexible work arrangements in some form for all employees (Hudson 2004). Such practices are more likely to be offered in large businesses

than smaller firms. In New Zealand, they are most prevalent in government agencies, professional services, and IT firms, and manufacturing, construction, property, engineering, and wholesale distribution firms are the least likely to offer flexibility. It is more common for employees working in highly skilled occupations to have flexible hours than those working in other types of occupations and employees with no qualifications.

Research shows that flexible working arrangements are being taken up by both men and women, and a significant proportion of these employees have no caring responsibilities. Benefits to employees arising from better work-life balance include higher levels of motivation and commitment to their jobs, lower levels of stress and higher productivity, better relationships with their families, and better health outcomes (Heathrose Research 2010).

### Assessment of Flexible Working Arrangements

A gradual reduction in hours over a number of years leading up to retirement is the most preferred flexible work arrangement among older workers, and one of the most common barriers to working beyond the age of eligibility for superannuation/pensions is the inability to access greater flexibility in work arrangements. But despite these demonstrated benefits, there are barriers to their extension. Some groups of workers may have little or no access to flexible work due to limited bargaining power, the culture of the workplace, and operational constraints within some workplaces (EEO Trust 2006; Department of Labour 2006). There may also be attitudinal barriers to accessing flexible working arrangements on the part of workers themselves. These include perceptions that using flexible work will hamper career progression and involve a reduction in income; that flexibility is only available to highly valued employees in particular occupations or industries; and that workplace cultures were not supportive, including the attitudes of managers or employers and the views of colleagues and

coworkers, leading to guilt about reducing working time.

Recent surveys in New Zealand, the UK, and Northern Ireland show that employers widely perceive flexibility as delivering positive business benefits (Heathrose Research 2010). Their experience in this area has been largely unproblematic; few have encountered the costs, increased litigation, or flood of requests anticipated prior to the introduction of flexible working legislation. Benefits include better employee retention, reduced turnover, improved recruitment through widening the talent pool, increased employee motivation and loyalty, and improved productivity and profitability.

Support for flexible work arrangements was also expressed in recent research among New Zealand employers and representatives of public and private sector organizations involved with workforce issues (Davey 2015). The unanimous opinion was that flexibility could be consistent with business efficiency and could pay a dividend in employee engagement and loyalty and being seen as an employer of choice. There was acknowledgment, however, that flexibility might not be appropriate in all jobs, such as assembly line, retail, reception, and hospital work. Part-time work may not be easy to fit in to schedules that require fieldwork and teamwork. In some cases, respondents reported that senior management may resist moves toward flexibility, at least on a formalized basis. If greater flexibility was extended only to senior workers, this could bring accusations of unfairness from other staff who do not have such freedom.

Some managers may fear that flexible working conditions which suit the preferences of older people may not be consistent with business efficiency. For example, part-time workers can increase administration costs and flexible working can be harder to manage. Nevertheless, problems with flexibility can be tackled; increased overheads related to part-time workers can be overcome with creative thought – using “hot” desks or off-site work. Work from home can save the cost of office space. One respondent commented: “Having the best person 80% of time is often better than having another 100%.”

## Conclusions

The social, economic, and individual benefits of extended participation in the paid workforce among older people are now widely accepted, and in many countries policies are being promulgated to encourage this trend. There are a wide range of work arrangements which can be applied to facilitate older people's working arrangements while taking into account the possibility of reduced physical or sensory capacity and allowing them to participate and contribute in other areas of life, including voluntary work, family activities (and informal care), recreation, and leisure. Flexible work arrangements can facilitate the transition to retirement and the adjustments – social and financial – which this entails.

Initiatives to encourage and facilitate flexible working conditions may come from government policies. These include legislation on access to flexible work, employment regulations and agreements, antidiscrimination law, and provisions around retirement income support (e.g., whether a work test is applied for pension entitlement). However, the main decisions about allowing flexible work arrangements are made at the individual business level. Therefore the attitudes of managers and employers and the prevailing business culture are of fundamental importance in whether or not flexible work arrangements for older people are offered and supported.

## Cross-References

- ▶ [Motivation to Continue Work After Retirement](#)
- ▶ [Organizational Strategies for Attracting, Utilizing, and Retaining Older Workers](#)
- ▶ [Timing of Retirement](#)

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## Fordham Centenarian Study

Daniela S. Jopp<sup>1,2</sup> and Stephanie Hicks<sup>3</sup>

<sup>1</sup>Institute of Psychology, University of Lausanne, Lausanne, Switzerland

<sup>2</sup>Swiss Centre of Competence in Research LIVES, Overcoming Vulnerability: Life Course Perspectives, Lausanne, Switzerland

<sup>3</sup>Psychology Department, Fordham University, Bronx, NY, USA

## Synonyms

Centenarians; New York oldest-old; Population-based; Successful aging

## Definition

The Fordham Centenarian Study is a population-based study which aims at describing life circumstances in very advanced age and characteristics of near-centenarians and centenarians. A mixed-methods designed was used to investigate individuals aged 95–107 years old with respect to person characteristics (e.g., health, cognition, well-being, psychological strengths), their immediate social network (e.g., family and friends, informal support, relationship to advanced age children), and societal-cultural features that may play a role for successful aging in these very old individuals. Findings confirm poor health conditions and limited social networks, while maintaining rather high levels of mental health and well-being. Future analysis comparing the Fordham Centenarian Study data with data from the Second Heidelberg Centenarian Study and the Oporto Centenarian Study will help to better understand specific vs. global mechanisms of successful aging.

## Introduction

Living an exceptionally long life is wished for by many individuals, and this wish is likely to become reality for more and more people. The older adult population is growing rapidly in industrialized countries around the world, as life expectancy increases due to advances in medicine and healthier lifestyle, as well as the aging of large cohorts such as the “baby boomers” (Christensen et al. 2009; Ortman et al. 2014; Robine et al. 2010). The group of the population that shows the strongest increase is very old individuals. In the USA, for example, the number of centenarians increased by 66% between 1980 and 2010, resulting in a total of 53,364 individuals aged 100 or older, as documented by the 2010 CENSUS (Meyer 2012). This trend will continue and is likely to accelerate, resulting in population projections of between 600,000 and 1 million centenarians in the USA by 2050. Given that half of all children born after the year 2000 are expected to reach their 100th birthday

(Christensen et al. 2009), this global trend will change the life perspectives in many countries and poses various challenges at the individual, family, and societal levels. To better evaluate the challenges to be expected and to plan for the future, it is important to learn more about what characterizes life at age 100.

Despite currently increasing numbers and future projections, centenarians represent an understudied and underserved group to date. As most centenarian studies have concentrated on demographic, medical, and genetic research questions, with the overarching aim of enhancing the understanding of what may be responsible for increase in life expectancy and what contributes to exceptional longevity, only few studies have addressed what it actually means to live to age 100 (Jopp et al. *in press a, b*). As a consequence, views on very old age described in the media are rarely realistic but polarizing: individuals of very advanced age are either depicted very positively, by showing for example outstanding centenarian and supercentenarian individuals who are aging extremely well, or they are depicted very negatively, for instance by describing a “tsunami” of very old people who, bedridden and plagued by dementia, endanger our social welfare systems. In the absence of a solid empirical knowledge base, life in very old age is still poorly understood in terms of its unique characteristics and challenges. Moreover, as reaching very old age becomes a topic of personal interest for more and more individuals, questions about quality of life at this age urgently need to be addressed. Also, as those demographic changes do not only affect the individual, but their families and societies, additional challenges arise. To handle these successfully, information about care needs is important in order to develop support structures that could enable the very old to maintain their independence for as long as possible.

The Fordham Centenarian Study has three key goals: (a) to create a realistic, more balanced, and more differentiated picture of very old age. Following a population-based recruitment approach, it aimed at gaining representative information about the limitations to be faced in very old age, as well as the strengths possessed by the very long

lived; (b) to determine support needs of the very old and create a knowledge base that will help to develop well-suited care and service structures. As very old age comes with unique challenges and service needs, identifying those is essential for the individual, the family, and society in planning for the future; (c) to determine individual, societal, and cultural characteristics that contribute to successful aging and enhance and foster those in current and future generations.

The Fordham Centenarian Study has a key interest in identifying personal factors that may enable successful aging and a specific focus on psychological characteristics such as psychological strengths (e.g., self-efficacy, optimistic outlook, meaning in life, and will to live). At the same time, expanding on classic approaches of successful aging and in line with lay perspectives on successful aging (e.g., Jopp et al. 2015), the Fordham Centenarian Study considers the immediate social context (e.g., social network and informal support system) as well as the wider societal and cultural context (e.g., laws and regulations as well as attitudes towards aging) as important features that shape life in younger years but particularly in very old age. It is our long-term goal to ascertain the person factors, social network characteristics, and cultural aspects that are of key importance for quality of life in very advanced age and to examine their interplay to better understand mechanisms of successful aging. This will be a major step toward developing prevention and intervention programs that enable more very old individuals and their families to age successfully.

## Methodology

**Participants.** Participants included individuals aged 95 years and older from the three most diverse boroughs of New York City (i.e., Manhattan, Brooklyn, the Bronx). Participants did not need to be fully cognitively intact to be eligible for the study, but they had to be able to reliably respond to questions about themselves, as the study’s goal was to capture the very olds’ experience of their very advanced age, well-being, and

depressive symptoms, as well as other psychological constructs. In order to ensure a population basis of the study, recruitment was primarily accomplished by inviting individuals aged 95 years and older for study participation who were listed in the New York Voter's Registry. The recruitment approach resulted in 103 interviews, of which 95 were included in the study (80% of the total sample). As this main recruitment approach made it slightly more difficult to reach individuals living in nursing homes, we recruited an additional 23 participants via five collaborating health care providers. Finally, one additional centenarian was recruited by word of mouth. The final sample consisted of 119 adults aged 95–107 years ( $M_{\text{age}} = 99.25$  years; 78% females), including 57 near-centenarians (95–99 years old;  $M_{\text{Age}} = 97.11$ ; 71.9% females) and 62 centenarians (100–107 years old;  $M_{\text{Age}} = 101.22$ ; 83.9% females). Of these, 92 (77.3%) were White, 23 (19.3%) were Black, and 4 (3.4%) were Hispanic. Thus, the Fordham Centenarian Study included similar proportions of both gender and ethnic groups as documented within the US CEN-SUS for the city of New York (Meyer 2012).

**Measures.** The assessment included a comprehensive interview, for which a mixed methods approach was used, combining qualitative and quantitative data collection techniques. Specifically, both standard questionnaires with a Likert-type answering format and questions with an open answering format were applied; the former allowing to compare the centenarians with younger age groups and the latter allowing the very old to describe less investigated aspects in their own words. In line with our experience in prior studies and during the study's pilot phase, we adjusted the measures to reduce their cognitive load as much as possible. Due to age-related reduction in sensory capacity and potential restriction in cognitive function, all centenarians were interviewed in person at their home by well-trained interviewers. To facilitate the interview procedures, we reformulated statement items often used in self-report questionnaires ("I feel satisfied with my life") into questions ("Do you feel satisfied with your life?") to ensure that the centenarian understood right away that an item was meant as a

question for him/her when read by the interviewer. We also checked items for double negations and other complicated formulations were replaced. We furthermore reduced the answering options to a maximum of 5, as more options caused difficulty to the centenarians. The open answers were later coded using clustering or open coding techniques usually applied in qualitative research.

In line with our key research questions, the following areas of functioning were investigated: basic demographic aspects (including life achievement such as education and work history, marital status), health (including common diseases, subjective health, sensory impairment, pain, activities of daily living, walking speed, and grip strength), cognitive status (including a shortened version of the Mini-Mental State Examination, Folstein et al. 1975; and the Global Deterioration Scale; Reisberg et al. 1982), social network and living arrangements (including social contact, informal support, loneliness, living in a private household, living with whom), well-being aspects (including life satisfaction, happiness, depressive symptoms), and psychological strengths (including self-efficacy, optimistic outlook, meaning in life, will to live, self-determination, coping, and life management strategies). Key constructs that were assessed with open coding procedures were everyday challenges, relationship between centenarians and their advanced age children, and centenarians' views about what had contributed to their successful aging.

**Procedures.** Participants were interviewed in person at their residence (private home or institution). Specifically, interviews were divided into two sessions of 1.5 h each to minimize fatigue. Study procedures were approved by three institutional review boards. Data collection was conducted between 2010 and 2012.

## Results

### Health and Physical Functioning

Whether centenarians are prime examples of successful aging has been long discussed, given that they have outlived almost all their peers. Yet, life

at age 100 seems nevertheless characterized by illness. In line with findings from prior studies on health in very old age, many Fordham centenarians were affected by multimorbidity, reporting an average of 4.85 (SD = 2.32) medical conditions (Jopp and Hicks 2016). The health issue reported most often, mentioned by over 80% of the sample, was sensory (vision, hearing) conditions. This was also the top one condition mentioned in the Second Heidelberg Centenarian Study (Jopp et al. 2016d), which is notable as sensory issues can be expected to have a high prevalence at this age, but they have received limited attention in prior studies on health in centenarians. Heart/circulation conditions and muscular-skeletal conditions were both mentioned by about two thirds of the sample, representing the second highest prevalence. Mobility issues were on rank 4 with a slightly lower prevalence. In the Second Heidelberg Centenarian Study, we had, however, found mobility issues to be the condition mentioned second most often (Jopp et al. 2016d). Possibly, the slightly younger age of the Fordham Centenarian sample is responsible for this finding. Another notable difference was the nearly doubled prevalence of conditions related to the respiratory system in the Fordham sample compared to the Second Heidelberg Centenarian sample, which was particularly due to reports of pneumonia (Jopp and Hicks 2016).

Despite high multimorbidity, self-rated health was fairly high, with 67% reporting their health as good or excellent. Centenarians also showed good functional health, as indicated by low levels of restriction in personal activities of daily living. Functional health was assessed with reported difficulty in seven personal activities of daily living (PADL) and seven instrumental activities of daily living (IADL) as measured within the Older Americans Resources and Services Multidimensional Functional Assessment Questionnaire (Fillenbaum 1988). Specifically, findings indicate that functional capacity was high for PADLs, with an average of 10.41 (SD = 3.67) out of 14 from the PADL scale. Twenty-eight percent of the sample had the highest score of 14, 21% had difficulty with only 1 activity, and 19% had difficulty with only two activities.

Nevertheless, regarding specific PADL activities, about half of the sample mentioned having difficulty in taking a bath (55%), getting dressed (52%), and moving in and out of bed (48%). Centenarians had increased levels of impairment in instrumental activities of daily living, which were slightly more impaired, with an average score of 8.89 (SD = 4.05) from the IADL scale; however, 17% of the sample reported no difficulty. The instrumental activities causing difficulty most often were light housework (77%), shopping (76%), preparing meals (65%), and getting around/traveling (64%; Jopp et al. 2016c). Compared to prior studies, levels of PADL and IADL in our sample were higher than previously reported.

Sensory impairments were assessed via self-rated vision and hearing capacity. Participants rated each on a 5-point scale ranging from 1 (Poor) to 5 (Excellent). Many centenarians reported impairments in vision and hearing: specifically, 17% indicated to have only poor or fair ability for vision and 18% had poor or fair ability for hearing, while 38% had poor or fair function in both vision and hearing concurrently (Cimarolli and Jopp 2014). Thus, while vision and hearing impairment only were reported at similar rates as in younger samples, prevalence of dual sensory impairment was particularly high in this age group and substantially higher than in younger ages (compared to, for example, 20% of a sample with average age of 78 years, Brennan et al. 2005). At the same time, it is notable that more than a quarter of the sample reported no sensory impairments, which was an unexpected finding that deserves future attention. Confirming the importance of vision and hearing for everyday functioning, vision impairment only and dual sensory impairment were found to be strong predictors of functional disability and these effects remained significant when controlling for depressive symptomatology, health limiting desired activities, and living in a nursing home. Explaining independent amounts of variance in functional ability, namely, 6.6% (vision impairment only) and 4.8% (dual sensory impairment), indicates that these impairments have a substantial role in determining the extent to which a person is able to live independently. Notably, these

impairments had about the same size effects as other factors (e.g., living in an institution or depressive symptoms), yet, the importance of sensory impairment is often overlooked. Findings further suggest that individuals with dual sensory impairment had the highest level of depressive symptoms, compared to the other impairment groups.

An additional set of analyses revealed which specific basic or instrumental activities of daily living were influenced by vision or hearing impairment. Specifically, vision impairment had a significant influence on taking care of one's appearance, eating, taking medications, writing checks, and using a telephone, while hearing impairment had a significant influence on traveling only (controlling for age, gender, minority status, cognitive function, depression, and the other [vision or auditory] impairment; Cimarolli et al. 2016). Thus, vision impairment seems to have an effect on more specific activities compared to hearing, which is likely to be related to the nature of these activities and the extent to which visual and auditory senses are involved in accomplishing them successfully.

### Education and Cognitive Functioning

Participants of the Fordham Centenarian Study were relatively well educated, with one third ( $n = 40$ , 34%) having a bachelor's or higher degree and another third having a high school diploma or some college ( $n = 38$ , 32%). Another third had middle school education or completed some high school ( $n = 36$ , 30%). Very few ( $n = 3$ , 3%) had received only primary school education. Participants also exhibited relatively high levels of cognitive functioning. To assess cognitive functioning, we used the following subscales from the Mini-Mental State Examination (MMSE; Folstein et al. 1975): Orientation (range: 0–10 points), Registration (range: 0–3 points), Attention (0–5 points), and Recall (0–3 points), resulting in a maximum total of 21 points. Doing so, we followed the recommendations by Holtsberg et al. (1995), who proposed using items that were unlikely to be biased by the poor sensory functioning highly prevalent in centenarians. Our findings indicate an average shortened MMSE score of

16.45 ( $SD = 4.04$ ) out of 21, indicating high levels of functioning. Although study participation had not been possible with a shortened MMSE score of 4 or less, in order to ensure that centenarians were able to reliably talk about their lives and inform about subjective well-being and psychological strengths, there was still substantial variability as indicated by a range of 5–21. Based on the observer rating of the Global Deterioration Scale (1 = no memory deficit evident from interview, to 7 = very severe cognitive decline; Reisberg et al. 1982), participants had a mean score of 1.44 ( $SD = .9$ , range: 3–7), denoting only little memory impairment. Ninety-three individuals (93%) had no or little cognitive limitations (scores of 1 to 3), and seven individuals (7%) had moderate limitations (scores of 4 and 5), which indicates that the sample was somewhat more positively selected, but in line with our study goal of assessing reliable self-reports among this age group.

### Living Arrangements, Marital Status, and Social Network and Support

Despite the substantial health issues mentioned above, a large majority of the Fordham centenarian study participants lived in the community (74%), while only 26% lived in an institution (i.e., 6% assisted living, 19% nursing home, and 1% other). Of those living in the community, 66% lived alone, 3% lived with their spouse, 19% with children, and 3% with other family. The proportion of near-centenarians and centenarians living alone was substantially larger than in other studies, and comparing both age groups, centenarians were even more likely to live alone than near-centenarians (Jopp et al. 2016b). One could speculate that this is due to the fact that living in a city like New York comes with more services, ranging from a doorman, food delivery services to various levels of professional care supports, which could allow for residing in the community longer. Furthermore, considering marital status, we found that most of the sample (75%) was widowed, but 7% were still married. Eight percent were divorced/separated and 9% had never married.

In comparison to studies with younger individuals, social functioning of the near-centenarians

and centenarians was poor: Participants reported having an average of three relatives to talk to at least once a month, two relatives as confidants, and two relatives as emergency contacts. In comparison to family contacts, the number of friends available to talk to at least once a month was smaller, namely, about two, and the number of friends being confidants and emergency contacts were between one and two on average. A combination of these indicators of social contact and support (as measured by the six-item Social Network Scale (Lubben 1988)) underscored the impression that the very old had substantially smaller social resources than individuals of younger old age. Although most participants had at least one person for communication/social support, their overall support score of 12 was substantially lower than that of young-olds (70–80 years old), who scored between 16 and 18 (Lubben 1988; Lubben et al. 2006). Using 11 or less as a cutoff for the total score and 5 or less for the family and friends score (Lubben 1988; Lubben et al. 2006), we found that, when considering their total network, half of the sample (51%) was at risk for social isolation. Considering family support, the percentage at risk was smaller (34%), but for friendship support, the risk was double (58%), indicating that a large proportion of near-centenarians and centenarians were at risk for social isolation (Jopp et al. 2016).

Given our particular interest in social factors enabling very old individuals to age successfully, one focus of the Fordham Centenarian Study was to examine more closely the nature and quality of the relationship between the centenarians and their children, who themselves have reached advanced age. Study participants had a mean number of living children of 1.36 ( $SD = 1.31$ ). It is notable that about 39% had lost one or more children, which represents one of the most difficult life experiences of centenarians. The average age of the living children was 66 years. The range of the children's ages was 42–83, and about one fourth of the children were older than 70 years old and 10% were older than 75 years old, highlighting a new phenomenon associated with the current

demographic development, namely, that for the first time, two generations within one family reach old and very old age together. Of those who had children, 76% reported having a child living close.

In-depth assessment of the quality of the relationship was delivered by a subgroup of very old and their children ( $n = 29$ ). Qualitative coding of the relationship description indicated that most centenarians and their children experienced their relationship as positive (90% of the very old and 70% of the children). It was, however, notable that the very old gave much more positive reports and rarely mentioned issues, while the children were somewhat less positive and were more open to talk about difficult aspects of their relationship. Positive features mentioned were feeling a close bond, sharing activities, and having important conversations. Negative features included having day-to-day frictions and having different views. Only few mentioned serious frictions. Children, however, also mentioned old wounds that made the relationship difficult (Jopp et al. 2016a).

Considering the amount of informal support that near-centenarians and centenarians receive in everyday life (e.g., help with care, household, but also socializing), the children had a particularly important role. In most cases, the child was the main go-to person: they were the primary contact involved in providing day-to-day help mentioned by 31% of the sample (Jopp et al. 2016b). We were furthermore surprised to find that individuals other than immediate family played a much smaller a role: friends were mentioned as providing help by 15% and other relatives by 9% of the participants. Furthermore, those with a living child had substantially more help than those without children, indicating that having a child does apparently not only come with help from the child him/herself but also seems to facilitate help from other individuals. Nevertheless, it is of note that only 51% of the near-centenarians and 40% of the centenarians indicated receiving any help at all. Although study participants residing in the community received more help (52%), only one fourth of

those living in an elder facility indicated receiving any informal help.

### Well-Being and Mental Health

Participants of the Fordham Centenarian Study had relatively high levels of mental health (Jopp et al. 2016c). Using the Geriatric Depression Scale (GDS; Sheikh and Yesavage 1986), with higher scores indicating more depressive symptomology (theoretical range = 0–15), mean depression score was 4.10 (SD = 3.41), and 72% of participants had few or no depressive symptoms (i.e., GDS scores 0–4). Over 80% of the sample did not meet the criteria for clinical depression (GDS scores 8 and higher). Life satisfaction, measured by the Satisfaction with Life Scale (Pavot and Diener 1993), was moderate considering the mean level (M = 2.07, SD = 1.14). About 66% reported moderate to very high life satisfaction. About 25% were “a little” satisfied and only 9% were not satisfied with their lives. Regression analysis indicated that individual differences in depression were related to subjective health and IADL functioning, as well as support from the family. For life satisfaction, subjective health as well as PADL functioning and number of children were significant predictors (Jopp et al. 2016c). In a second set of analyses, in which we considered not only basic personal resources but also psychological strengths, we found that optimistic outlook and will to live were the strongest predictors of life satisfaction, besides ADL functioning and number of living children (Jopp 2016), suggesting that psychological aspects play an important role in the well-being of the very old.

### Common Challenges and Beliefs about Successful Aging

Centenarians’ reported everyday challenges were assessed with two open-ended questions. The first was, “Please think now for a moment about the things that you find challenging. Are there things that you find challenging or difficult?” Participants were then asked how the difficult instance

was challenging for them. Responses were coded using open coding and clustering methods in order to identify common challenges among these centenarians.

Allowing the very old to indicate in their own words what they found challenging in their everyday life revealed a multidimensional concept of challenges at this very advanced age. Although near-centenarians and centenarians most commonly reported functional challenges (76%), such as restrictions in activities of daily living, disability, health, and sensory impairment, they also indicated other types of challenges, including psychological and social. Psychological challenges (40%) were commonly mentioned, including loss of independence and loss of enjoyable activities. Social challenges (20%) were also commonly reported, involving, for example, social loss and leaving loved ones behind. It should also be noted that a small proportion of centenarians mentioned having no challenges at all. Regression analysis further revealed that differences in aging satisfaction were predicted by functional and psychological challenges, with functional challenges being negatively associated and psychological challenges being positively associated. The latter, somewhat unexpected, effect could indicate that those very old reporting psychological challenges are more sensitive to age-associated challenges and see the potential of these to grow and develop. A regression predicting loneliness furthermore revealed that functional challenges were related to higher levels of loneliness. In addition, more social challenges were marginally related to higher levels of loneliness. Interestingly, none of the specific challenge types was associated with depressive symptoms. In sum, findings suggest that perceptions of challenges are not only specific and varied but that they are also differentially associated with mental health outcomes.

To assess centenarians’ views on successful aging, participants were asked two open-ended questions. The first was, “A lot of people are very fascinated that one can reach a very old age and wonder how this comes about. Since you are

one of the few people who have reached their 100th birthday, or are close to it, what do you think are the reasons for it?" The second question was, "And if you think about your life, did you have a certain theme, a guideline, after which you lived and maybe still live?" Responses were coded using open coding or content-based clustering to identify recurrent themes. Findings indicate that most centenarians believed that psychological aspects (e.g., taking good care of yourself, letting others help you) had helped them reach age 100. The two most commonly mentioned themes after psychological aspects were social aspects (e.g., family background, children, friends) and lifestyle (e.g., living life in moderation, healthy diet). Other themes mentioned include faith, health, luck, work, leisure (having hobbies), and aging experience (e.g., forget about aging). Thus, results suggest that, in line with more recent findings on laypeople's views on successful aging, near-centenarians and centenarians have a multidimensional view of aging and that psychological aspects are quite important, maybe even more important than in other age groups.

## Conclusion

In line with the main goals of the Fordham Centenarian Study, its findings to date give important insights about what characterizes life in very old age and help to increase our understanding of the common challenges at this age, as well as levels of functioning and strengths of near-centenarians and centenarians. Findings indicate that all study participants had health challenges, yet they perceived their health as good. The cognitive status of the sample was high, which was in line with the goal of the study to talk directly to individuals of that age, rather than gaining information by proxy informants. Findings also demonstrate that the social resources of the sample were low and many of them were at risk for isolation. Despite reduced levels of physical functioning and social resources, very old participants were in good mental health suggesting high resilience and the

ability to adapt to age-associated challenges. Findings further indicated that perceived challenges were related to mental health outcomes, which indicates that centenarians are not ignoring their issues but apparently have ways of dealing with these in a positive way. Future analysis will further highlight the role of psychological factors that seem to be responsible for this successful adaptation.

Findings further highlight the importance of social partners. The Fordham Centenarian Study is the first to provide information about the relationship of centenarian parents and their advanced age children, a dyad that is the result of recent demographic changes. How old children and very old parents experience their relationship will be further investigated, also taking into account how the nature of the relationship may influence physical and mental health outcomes in both dyad partners. So far, it is already clear that the children become the most important go-to people and that the relationship is mostly experienced positively, but that difficult interactions with substantial burden do occur. More research is necessary to identify the unique care needs and to provide guidance for the development of well-suited services for this very old population.

That a large proportion of the sample lived in the community, and that this proportion was much higher than in other studies, seems to be in line with the very old's desire for leading an autonomous life, which may have been facilitated by New York service culture. The impact of the wider societal and cultural environment will be further investigated by considering data from the Second Heidelberg Centenarian Study (Jopp et al. 2013) and the Oporto Centenarian Study (Ribeiro et al. *in press*), which were designed in large parts as parallel studies to the Fordham Centenarian Study (Jopp et al. *in press b*). The comparison of person, social, and societal-cultural factors among the parallel studies will help to identify which factors are responsible for successful aging in specific cultures and which are responsible across countries, in order to shoulder the global challenge of very old age at individual, family, and societal levels.

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## Frailty and Cognition

Mônica Sanches Yassuda<sup>1</sup> and  
Ivan Aprahamian<sup>1,2</sup>

<sup>1</sup>University of São Paulo, São Paulo, SP, Brazil

<sup>2</sup>Jundiaí Faculty of Medicine, Jundiaí, Brazil

### Synonyms for Frailty

Fragility; Vulnerability to stressors

### Definition of Frailty

An age-associated syndrome linked to diminished physiological reserves and lower resistance to stressors. This syndrome is associated with increased risk for negative health outcomes, such as immobility, hospitalization, and death.

### Introduction

#### Definitions and Models of Frailty

In recent decades, the frailty syndrome has received different definitions. Earlier studies equaled frailty to multiple comorbidities, dependency, mobility limitations, institutionalization, failure to thrive, and predeath (Hogan et al. 2003). In the past 15 years, the concept has gained more precise definitions. Frailty can be considered a biologic age-associated syndrome linked to diminished physiological reserves and lower resistance to stressors (Fried et al. 2001). It results from cumulative declines across multiple physiologic systems due to age and diseases. Frailty increases the risk for negative health outcomes, such as immobility, falls, hospitalization, and death.

An international consensus has defined physical frailty as “a medical syndrome with multiple causes and contributors that is characterized by diminished strength, endurance, and reduced physiologic function that increases an individual’s vulnerability for developing increased dependency and/or death” (Morley et al. 2013).

This consensus has also stated that the syndrome can be prevented and treated by interventions which include exercise, protein-calorie supplementation, vitamin D supplementation, and reduction of polypharmacy; it can be identified with rapid screening instruments, and that individuals 70 and older or with significant weight loss due to disease should be screened for frailty.

An influential model (Walston et al. 2006) has proposed that frailty is related to oxidative stress, mitochondrial dysfunction, DNA damage, genetic factors, and inflammation. These processes may lead to decrease in key hormone levels, such as estrogen, testosterone, and dehydroepiandrosterone (DHEA) and increase in cortisol levels, increase in inflammatory markers (TNF-alpha, IL-6), and loss of lean muscle mass.

According to Rodriguez-Mañas and Fried (2015), the prevalence of frailty in people older than 65 years is high, ranging from 7% to 16.3% in most studies. The prevalence increases with age and it is greater in women than in men. In older samples, 85 years and older, it may reach 28% (Collard et al. 2012). Prevalence estimates depend on sample origin and may be higher in clinical samples.

There is a productive debate about the best approach and criteria to identify frailty in clinical and research settings. Three recent strategies have been most frequently used for that purpose.

Fried et al. (2001) have proposed a frailty phenotype which emerged from the Cardiovascular Health Study (CHS) including data from 5,317 men and women 65 years and older. The phenotype associated with negative health outcomes in this study comprised three or more of the following characteristics: unintentional weight loss (10 pounds in the past year), self-reported exhaustion, weakness (assessed by grip strength), slow walking speed, and low physical activity. Reaching frailty criteria at baseline was associated 3 or more years later with incident falls, worsening mobility or ADL disability, hospitalization, and death. Presenting one or two of such characteristics was regarded as pre-frailty, and it was associated with intermediate risk for the conditions described above.

The frailty phenotype has generated a very significant body of research, spanning several aspects of the syndrome from epidemiology and early diagnosis to treatment and prevention strategies (Rodríguez-Mañas and Fried 2015). The phenotype has been helpful to identify a high-risk subgroup of seniors for negative outcomes with higher predictive value than chronic disease.

Researchers from the Study of Osteoporotic Fractures (SOF) have proposed the use of a simplified strategy to identify the frailty syndrome – the SOF index. This index includes weight loss, inability to rise from a chair five times without using arms, and reduced energy level assessed with one question from the Geriatric Depression Scale. One criterion should indicate pre-frailty status and/or two frailty status. Studies from this group (Ensrud et al. 2009) have shown that the SOF index predicts risk of falls, disability, fracture, and mortality as well as the CHS criteria.

Alternatively, the Canadian Study of Health and Aging has defined frailty as a risk index. According to this group, frailty can be evaluated by the number of health deficits that individuals accumulate. Therefore, the frailty index is calculated as the ratio of the deficits present in a person to the total number of potential deficits evaluated. In many epidemiological and clinical studies, the FI has successfully graded the degree of risk of adverse outcomes, such as mortality, health service use, hospital-acquired complications, worsening health, and loss of independence (Mitnitski et al. 2015).

In addition to the phenotype and the risk index perspectives, several different instruments and questionnaires have been proposed to detect frailty. Such instruments might capture some of the core aspects of frailty maintaining predictive validity for adverse outcomes (Pialoux et al. 2012). However, this approach has been questioned, as the use of frailty screening instruments may only identify the presence or absence of frailty. Such instruments most likely cannot identify the level of risk or gradients of frailty in order to predict specific outcomes accurately, and they may be limited in their contribution to the device of individualized care plans (Rockwood et al. 2015).

Several issues remain open to debate regarding frailty. It has been challenging to reach consensus regarding the essential characteristics of the syndrome and ways to operationalize its assessment. In addition, there has been prolonged debate whether cognitive impairment should be included in frailty criteria. Some research groups (Fried et al. 2001) have excluded older adults with cognitive impairment from study samples justifying the need to study frailty in general and not frailty associated to dementia. In the risk index perspective, the inclusion of cognitive problems has been recommended as it may represent an important deficit that accumulates with others to determine frailty thresholds (Mitnitski et al. 2015). In the next sections, the evidence linking frailty and cognition will be revisited with the aim to support the view that frailty and cognitive impairment are associated phenomena and may be subsided by similar biological processes.

### **Frailty and Cognition: Evidence from Cross-Sectional and Longitudinal Studies**

Cross-sectional studies from different regions of the world have reported that frail and pre-frail older individuals tend to have lower scores in global and domain-specific cognitive tests compared to non-frail seniors (Chen et al. 2015). In addition, cross-sectional studies have reported that individual markers of frailty are associated to cognition. As an example, one previous study tested the association of the five CHS frailty criteria individually with cognitive scores and found that grip strength and gait speed were significantly correlated to cognitive performance (Yassuda et al. 2012).

Longitudinal investigations have reported that frailty is a significant predictor of future cognitive decline. Samper-Ternent et al. (2008) followed up 1,370 older Mexican Americans for 10 years, without cognitive impairment at baseline. They reported that frailty was an independent predictor of cognitive decline assessed by the Mini-Mental Status Examination (MSSE). In another longitudinal study, Ávila-Funes et al. (2008) classified a community-based sample into seniors who were

frail, pre-frail, and robust according to the phenotype model and further classified all participants into those who were cognitively impaired and those who were intact. They reported that cognitively impaired frail elderly had higher risk for functional impairment, mobility limitations, and hospitalization than those frail individuals who were cognitively intact. These findings suggest that the presence of cognitive impairment among frail elderly may increase the predictive value of frailty to determine negative outcomes.

Other studies have suggested that changes in individual frailty criterion may predict cognitive decline. Alfaro-Acha et al. (2006) reported that older Mexican Americans with reduced grip strength at baseline, after 7 years, demonstrated significant decline in the MMSE, whereas seniors with high grip strength tended to maintain cognitive performance. Mild physical impairment has also been associated with greater risk for cognitive decline and dementia (Wilkins et al. 2013).

### **Frailty Increases the Risk for MCI and AD**

Most importantly, previous studies have revealed that physical frailty is associated with higher risk for mild cognitive impairment (MCI) and Alzheimer's disease (AD). Buchman et al. (2007), in a 3-year follow-up study of 823 seniors, found that baseline frailty scores and annual rate of change in frailty were associated with an increased risk of incident Alzheimer's disease (AD). In a recent study of this group, Buchman et al. (2014) reported that in 6 years, frailty and cognition declined in similar proportions. Most individuals showed worsening frailty and cognition (82.8%). In addition, rates of change in frailty and cognitive scores were strongly correlated. Brain tissue analyses revealed that AD pathology, macroinfarcts, and nigral neuronal loss showed independent associations with the rate of change in both frailty and cognition. These results strongly support the hypothesis that frailty and cognition may be caused by the same biological mechanisms.

Using data from 7,239 cognitively healthy, community-dwelling older adults from the Canadian Study of Health and Aging, who had 5- and 10-year follow-up data, Song et al. (2011)

calculated a frailty index based on 19 deficits not known to predict dementia. Their results indicated that dementia and AD incidence increased exponentially with the increase in this frailty index. These results suggest that frailty and general health are associated with the risk for dementia.

In a longitudinal study, including 750 seniors without cognitive impairment, with follow-up assessments of up to 12 years, Boyle et al. (2010) showed that frailty was associated with a higher MCI incidence risk and a faster rate of cognitive decline.

A previous study in Japan (Shimada et al. 2013), which included 5,104 community-dwelling seniors, investigated the prevalence of frailty, MCI, and both conditions concomitantly. Results indicated that 11.3% of participants were frail, 18.8% were diagnosed as having MCI, and 2.7% had both conditions. More importantly, there was a significant relationship between frailty and MCI.

Few studies have investigated the frailty syndrome among patients with MCI. McGough et al. (2013) assessed a sample of 201 sedentary seniors previously identified as having amnesic MCI for three frailty criteria (gait speed, grip strength, and physical activity level) and cognitive performance in the ADAS-Cog, Trail Making A and B, and WMS-R Logical Memory I. Among participants, the majority reached criteria for frailty, 57.3 for low gait speed, 64.2 for low grip strength, and 58.2 for low physical activity. In a linear regression model, gait speed was significantly associated with all cognitive measures, whereas activity level was associated with Trail Making B and ADAS-Cog Word Recall, and grip strength was associated with scores for the Trail Making A. These results lend support to the notion that there is a significant relationship between frailty dimensions and cognitive performance in a sample of older adults with cognitive deficits. Most importantly, MCI patients who reach certain frailty criteria, particularly gait speed, may be at a higher risk for conversion to dementia and may require more assistance.

In a longitudinal study of 12 months, Alencar et al. (2013) followed up 207 cognitively intact seniors. After 1 year, there was an incidence of

4.9% of cognitive impairment among the physically robust participants, 8.9% among the pre-frail, and 13.3% among the frail seniors. The latter group had lower scores in the MMSE in both evaluation points. This study suggests that even in a short-time period, an association between frailty and cognitive decline can be observed.

Frailty among the oldest old has been less frequently studied. Using data from 840 community-dwelling seniors 85 years and older from the Jerusalem Longitudinal Cohort Study, with 5-year follow-up assessment, Jacobs et al. (2011) reported that frailty and cognitive impairment were significantly associated. Mortality rates were higher for frail and pre-frail than for robust participants. However, mortality among frail subjects with or without cognitive impairment was equivalent. Also, frailty alone was more predictive of mortality than cognitive impairment alone.

Taken together, cross-sectional and longitudinal studies have provided support for the hypothesis that frailty is a clinical condition associated with worse cognitive performance, faster cognitive decline, and higher risk for MCI and dementia. The initial implication for these findings is that frail seniors should be screened for cognitive impairment in order to improve early dementia detection. In addition, individualized care plans for frail elders may need to include cognitive stimulation and/or cognitive training programs. Considering that frailty and cognitive deficits may be subsided by similar biological processes, seniors with MCI or dementia might also benefit from frailty screening and interventions aiming to minor or delay frailty. It is plausible that frail seniors with MCI might be at a greater risk for conversion to dementia and may benefit from multimodal interventions targeting both physical and cognitive impairments.

### The Concept of Cognitive Frailty

The evidence linking frailty and cognitive impairment has compelled a panel of specialists to propose a condition called cognitive frailty (Kelaïditi et al. 2013). This condition should describe the deleterious effects of frailty on cognition in the absence of dementia. The tentative criteria proposed by this panel for cognitive frailty are the

presence of frailty, presence of MCI (CDR = 0.5), and absence of AD or other dementias. In other words, the condition should describe cognitive decline not associated with neurodegeneration.

The cognitive frailty concept has faced some challenges, such as ruling out the presence of neurodegenerative processes. It is known that healthy seniors may also present a significant degree of atrophy and AD markers, in the presence of intact cognition. Therefore, the criteria for cognitive frailty might need to include a temporal aspect; that is, the presence of frailty may need to precede the onset of cognitive deficits (Canevelli and Cesari 2015). According to these authors, the concept of cognitive frailty needs to be further investigated in epidemiological and clinical studies so that its operational definition may be improved as well as the understanding of its biological mechanisms.

### Interventions Geared Toward Improving Frailty

Currently, there is considerable interest in identifying interventions that might prevent or delay frailty; yet there is a lack of well-designed frailty trials. Cesari et al. (2015) reported findings from the Lifestyle Interventions and Independence for Elders Pilot (LIFE-P) study. In all, 424 community-dwelling persons (mean age = 76.8 years) with sedentary lifestyle and at risk of mobility disability were randomized into the 12-month physical activity or successful aging interventions. The CHS frailty syndrome criteria were assessed at baseline, 6 and 12 months. At 12 months, there was a reduction in frailty prevalence in the physical activity group compared to the active control group. However, when individual frailty criteria were analyzed, the authors observed that low physical activity was the criterion most affected by the key intervention. The other criteria, such as gait speed and grip strength, were not altered by the physical activity intervention. The authors hypothesized that to alter other frailty dimensions, multimodal interventions may be needed. In other words, physical activity may need to be offered along with nutritional supplementation, for instance.

A recent review with a focus on studies which offered physical activities to frail elders has

documented the large methodological variability among the studies (de Labra et al. 2015). Among other findings, the authors documented that five out of seven studies reported significant increases in muscle strength in frail seniors.

The literature on interventions to improve or delay frailty is diverse, and several studies have investigated specific outcomes, such as falls, or instead included in their sample seniors with certain clinical characteristics, such as cardiologic diseases. So far, most clinical trials have not used well-established models to assess frailty at baseline and follow-up, and they have failed to show convincing evidence of effectiveness (Rodríguez-Mañas and Fried 2015). Well-designed intervention studies addressing frailty and cognition simultaneously have not been identified in recent searches.

## Future Directions

Frailty is now widely regarded as a relevant medical condition associated with adverse health outcomes. There is debate regarding the ideal criteria to define this condition and the best strategy to operationalize its assessment. There is agreement that frailty and cognitive deficits may co-occur, and that the presence of frailty increases the risk of MCI and dementia. Larger and well-designed intervention studies are needed to offer insights regarding the best strategies to delay or prevent frailty. Such interventions may play an important role in dementia prevention as well.

## Cross-References

- ▶ [Cognition](#)
- ▶ [Dementia and Neurocognitive Disorders](#)
- ▶ [Mild Cognitive Impairment](#)

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## Frailty in Later Life

Nico De Witte<sup>1,2</sup>, Lieve Hoeyberghs<sup>2</sup>, Liesbeth De Donder<sup>1</sup>, Dominique Verté<sup>1</sup> and Jos Schols<sup>3</sup>  
<sup>1</sup>Vrije Universiteit Brussel/University College Ghent, Brussels, Belgium  
<sup>2</sup>University College, Ghent, Belgium  
<sup>3</sup>Maastricht University, Maastricht, The Netherlands

## Synonyms

Ageing in Place; Detection; Frailty; Psychological Frailty; Vulnerability

## Definition

In the US' Department of Health, Education, and Welfare, Office of Human Development Services, the Federal Council on [the] Aging defined frail older people as: "persons, usually but not always, over the age of 75, who because of an accumulation of various continuing problems often require one or several supportive services in order to cope with daily live."

## An Aging in Place Population

In our modern society, the older population is growing rapidly. The World Health Organisation estimates in their fact sheet 404 that between 2015 and 2050, the proportion of the world's population over 60 years will nearly double from 12% to 22%. This aging process is unprecedented, universal, sustainable, and far-reaching. Several explanations for this aging process are proposed. First, a continuous increase in life expectancy over the last decades results in a situation where more people attain very old ages. Mainly due to initiatives in the domain of public health and supported by enhanced nursing and medical care for older people, mortality rates are declining. Moreover, as birth rates are declining, an additional increase of the proportion of older people will take place (Grundy 2006).

In order to cope with the challenges of an aging population and to meet the preferences of older people themselves with regard to the place where they age, in Europe, governments have changed their vision towards health care provision (de Gooijer 2007). This policy mainly reflects a deinstitutionalization of long-term care services in order to provide opportunities for older people to stay in their own environment for as long as possible, also known as "Aging in place." Several studies demonstrated that this is the most preferred way of aging by older people themselves and addressed the impact of it on an individual's quality of life (Mitzner et al. 2014). It is more than a symbol of quality of life as it covers a basic need (accommodation) and has benefits on both physical and psychological health. It is also the place where intimate relationships with family members, relationships with friends/relatives, and leisure take place (Rojo Perez et al. 2001).

Clearly, aging in place creates opportunities to bind people. Indeed, older people are often reluctant to leave their community dwellings, even when it is difficult for them to manage the household chores, mostly because the familiar home environment provides them with a strong sense of meaning and belonging (Costa-Font et al. 2009). Older people's experience with their neighborhood and neighbors may be just as important

as their home itself. As a consequence, the residential area is not restricted to the home itself but also to the environment where the home is situated and to the people who live in the neighborhood (Satariano et al. 2012). This shift of mind is prompted by the prevailing belief among policymakers that an aging population inevitably means increasing demands on health care resources, social support, informal networks, etc. (Bond and Cabrero 2007). Moreover, aging in place is considered to be less expensive than institutionalization (Marek et al. 2012).

## Conceptualization of Frailty

A major challenge for European governments with regard to this aging in place policy lays in the early detection of frail or vulnerable older people so that appropriate and often preventive support can be provided as early as possible and unnecessary adverse outcomes may be prevented. Indeed, when aging in place, older people are confronted with the limits of their own resources, their informal and formal care framework, and of their living environment. If there is an imbalance between resources and demands, people can become frail or vulnerable (Grundy 2006). In order to identify these limits and to ensure that adequate care is provided to the right persons in time, detection of these limits seems essential, but not straightforward.

Although recognized as a syndrome for some time (Weindruch et al. 1991), frailty is now a fast growing research area in gerontology and geriatric medicine focusing on its causes, risk factors, and adverse outcomes (Gobbens et al. 2010). Within Western welfare policy and practice, frailty is increasingly used for classification of older people (Nicholson et al. 2012). The term "frailty" is derived from the Latin word "Fragilitatem" which means "being weak or flaw." The Federal Council on Aging (USA) proposed the first definition of frailty (see "Definition"), and since 1991, frailty is also a Mesh term (Medical Subject Heading) and defined as: "Older adults or aged individuals who are lacking in general strength and are unusually susceptible to disease or to other

infirmity.” The initial purpose of the Federal Council on Aging was to make an inventory about the care needs, but later on, frailty was recognized as an interventionist concept (Weindruch et al. 1991; Hertogh 2010) not in the least because the aging process is stereotyped as a period of losses and decline in physical and mental functioning. Some researchers consider frailty as a clinical syndrome, a pure biomedical problem.

Fried, one of the leading scholars regarding frailty, developed the phenotype approach (Fried 2001), which has received international attention and has been extensively validated in research literature. Criteria used by Fried to define frailty are: weight loss, endurance, inactivity, gait speed, and hand grip strength. Over the years, a wide range of other physical problems have been linked to frailty: gait speed, a 3 m walk test, a stand-up test, endurance, weakness, reduced physical activity, weight loss, mobility, exhaustion, cardiac functioning, grip strength, balance, strength, slowness, neuromotor performance, sarcopenia, etc. Thus, in this respect, frailty is considered as a medical/clinical syndrome in which the underlying physiological and biological processes result in multiple clinical manifestations.

However, other scholars recommend giving more attention to the psychological aspects of frailty. Conceptualizing frailty as a pure medical problem is neglecting both the capacities of older people themselves to withstand stress and their experiences (Hertogh 2010). As a consequence, psychological indicators (cognition, mastery, depression, anxiety, sadness, and management capacities) were introduced in frailty assessments in addition to biomedical indicators. This bio-psychological approach was criticized for neglecting the interplay of bio-psycho-social factors in frailty (Nicholson et al. 2012). As a consequence, social indicators like social support or social network were also introduced in frailty assessment.

Although a consensus about an operational definition of frailty is still lacking, one aspect is gaining consensus: frailty is an entity that can be distinguished from disability or comorbidity (Gobbens et al. 2010) and is associated with excess of healthcare costs ranging from medical

consultations to institutionalization. As a consequence, prevention becomes very meaningful.

## Frailty: Paradigm Shift

In literature, new debates are going on about the frailty concept. One debate explores the multidimensionality of frailty. According to (Hertogh 2010), psychological and social factors are overlooked in frailty. Additionally, some researchers also point to environmental factors associated with frailty (Markle-Reid and Brown 2003).

According to (Romero-Ortuno et al. 2010, p. 1) frailty is

loss of independence, vulnerability and impairs the quality of life and psychological well-being of many older people; it also poses an enormous challenge on families, carers and other structures of social care and social support. In the face of the rapid population ageing occurring in Western Societies, frailty is set to reach epidemic proportions over the next few decades.

As the number of older persons increases in society, the prevalence of frailty in the population will consequently also increase. The interest in frailty lies in postponing the decline in health and quality of life of frail older persons in order to improve their chances of living a longer and healthy life. Frailty is therefore frequently conceptualized as an antonym for successful aging, and some researchers state that frailty can be prevented, delayed, and eventually reversed (Lang et al. 2009). Because of the shift in focus towards prevention and risk reduction, some frailty conceptualizations neglect other critical aspects of aging (Hertogh 2010).

A second debate is about the way frailty is conceptualized. When older women were asked how they perceive frailty, most of the answers were not only linked to physical descriptions, but also to contextual, social, and emotional problems, suggesting that older people themselves have other definitions about frailty than clinicians (Grenier 2007). Gustafsson and colleagues investigated frailty from a health care professional's perspective. Seven dimensions were consistent with frailty: *being bodily weak and ill, being*

*negatively influenced by personal qualities, lacking balance in everyday activities, being dependent in everyday life, not being considered important, being hindered by the physical milieu and defective community service, and having an inadequate social network.* These results point to the fact that health care professionals' view of frailty in older persons differed from the current state of knowledge on frailty (Gustafsson et al. 2012). As a consequence, a paradigm shift regarding frailty is needed.

### Measuring Frailty in the Community

In most Western societies, frailty has been recognized as a major challenge the world is facing today for both formal health services and informal caregiving (Ceci and Purkis 2011). As a consequence, detecting frailty in primary care is a major challenge for primary care physicians. The I.A.G.G. (International Association of Gerontology and Geriatrics) and the G.A.R.N. (IAGG Global Aging Research Network) have already taken initiative in this domain and pointed to the need to concentrate on aging in place in order to prevent premature nursing home placement. According to Romero-Ortuno and colleagues (2010), the problem with the extant frailty instruments is that they are not readily applicable in primary care practice. The aforementioned phenotype of frailty has the advantage that it only requires the measurement of five variables, but while this is affordable from a primary care point of view, the problem arises with the construction of the measure as it requires considerable statistical expertise to dichotomize criteria measured on a continuous scale (e.g., grip strength) (Romero-Ortuno et al. 2010). Other scholars, however, state that using the extant screening instruments in community-dwelling frail people is impractical, because the assessment methods are complex and time-consuming and the results are difficult to report.

Altogether, if primary care providers need to screen for frailty, user-friendly instruments are required (De Lepeleire et al. 2008), but comprehensive tools to identify multidimensional aspects

of frailty in the primary care setting are still in the preliminary stages of development.

Moreover, different existing approaches of frailty are criticized because they are often based on a negative and stereotypical view of aging associated with becoming disabled (Markle-Reid and Brown 2003) and loss or declining abilities (Kaufman 1994). These instruments neglect the lived experiences of each individual (Grenier 2007), assuming that aging is a uniform process (Kaufman 1994). According to Gobbens and colleagues (2010), addressing frailty exclusively on physical components jeopardizes the attention for the individual as a whole. Markle-Reid points to the fact that frailty is a multidimensional non-age-related concept that must consider the interplay of various physical, psychological, social, and environmental factors. The fact that much biomedical research on frailty demonstrates great variations in frailty according to gender, socio-economic status, education, etc., points to the social production of frailty (Markle-Reid and Brown 2003).

While some authors have developed a measurement instrument for frailty aiming to meet the aforementioned critiques (e.g., Groningen Frailty indicator, Tilburg Frailty Indicator), they ignore the environmental aspects of frailty. In such an approach, however, frailty shifts from a microlevel analysis focusing on the individual only to a macrolevel analysis, where frailty is seen as a result of numerous intersecting factors, many of which are external to the individual. Additionally, some scholars (Grenier 2007) suggest to take the subjective perceptions of an individual into account, the so called lived experience. For example, social isolation, inadequate care and support, and living arrangements are risks associated with aging, but all these factors can have both mutual and individual antecedents and are experienced in different ways.

Beside the criticism on the operational definition of frailty, some scholars like Robertson (1997) expressed their concerns about the medicalization of aging due to the use of frailty measurements. For Robertson, the biomedicalization and gerontologization of old age are being reconceptualized as a new medical space requiring new supporting ideologies which protect the

new created space, with over servicing as a consequence, and requiring new customers. As a consequence, the socially constructed dependency of older adults serves those structural interests. Using functional and ill-health variables tends to a medical construction where older people are placed into classes (e.g., nonfrail, pre frail, frail, severely frail), and the distinction between normal and not normal is made. Those assigned with the status of frail become eligible for public and home-care services (Grenier 2007).

Not only does this approach overlook the social and emotional experiences, it also places older people in competition with each other for the scarce resources. In 1994, scholars like Kaufman already argued that frailty, constructed from within a health care context, transforms the older people's lived and experienced problems to diagnosis, then to treatment plans and rules about what ought to be done, leading to negotiated compliance. This view ignores the role of the broader environment and neglects the cumulative disadvantages build up during the lifespan (Grenier 2007). The implementation of frailty has no preventive aims but corresponds with an increased professionalism and efforts to ration care and thereby neglecting government initiatives to include older people in the society. Problems of aging are reduced to an individual level, moving responsibility from the government to the individual. As a consequence, the problem of frailty is depoliticized.

Some scholars point to the social construction of frailty (Lustbader 2000). In order to remain in the community, older individuals also rely on aspects in their social, psychological, and physical resources. Consequently adjusting the frailty measures for home-care clients to a biopsychosocial or more integrative approach may prove valuable. Furthermore, although social science literature acknowledges the merits of the frailty measurements in order to identify patient problems, it also points at a conflict between the biomedical conceptualization and the older people's experiences. On the other hand, it was found that when clinicians were asked to rate the different factors related to frailty, they rated mobility, stamina, and activities of daily living as most important and social and psycho-emotional factors as least important.

## Development of the Comprehensive Frailty Assessment Instrument

In order to answer the aforementioned critiques, the Comprehensive Frailty Assessment Instrument (CFAI), which assesses the physical, social, psychological, and environmental domain of frailty, was developed and validated (De Witte et al. 2013a, b). Each domain received equal attention. This self-administer instrument (CFAI) contains 23 indicators and demonstrates a high overall internal consistency and high consistency of its scales, thus supporting the validity and reliability of the instrument and highlighting the multidimensionality of frailty as described by Markle-Reid and Browne (2003). Indeed, in a sample of 33,629 community-dwelling older people, the CFAI has been proven to be internally consistent, with a Cronbach's  $\alpha$  of 0.812, explaining 63.6% of the variance in frailty (De Witte et al. 2013b). In a second study (N = 181), the CFAI was cross-validated with the Tilburg Frailty indicator. The internal consistency of the CFAI was 0.759. The correlation between the CFAI and TFI was 0.590. Correlations between the physical, psychological, and social domains of both scales were good, and the environmental domain showed weak correlations with all other domains, pointing to convergent and divergent validity (De Witte et al. 2013a).

The CFAI assesses frailty on four domains and all contribute to frailty, confirming the results of several studies have already addressed that frailty is more than just a purely physical phenomenon. Environmental indicators include the bad condition of the house, the house being uncomfortable, problems with heating the house, and aversion against the neighborhood. These factors are in line with scholars like Costa-Font and Wahl (Costa-Font et al. 2009; Wahl et al. 2009), who all highlighted the importance of the spatial context and environmental resources on which an individual depends when aging. As expected, social support also contributed to frailty.

The psychological domain added the most to the respondents overall frailty score. This is a new insight, which, to the best of our notion, has not

been addressed in earlier research. Therefore, literature was screened for possible indirect explanations. Although much research needs to be done to untangle this, psychological frailty seems to be very complex. Several theoretical explanations can be proposed, which all guide future research directions. A first topic could be mental health problems, the interdynamics between frailty and depression and the exploration of psychological risk factors like stress and ageism. Second, emotional well-being could be investigated where the differentiation between being frail and feeling frail could be made. A third research topic could be the relationship between psychological frailty and dependence. Finally, the study of individual's lifespan development could give more insight into the problem. Besides these topics attention to protective factors must be given. Here possible research topics could be psychological and existential well-being, having a purpose in life, environmental mastery, resilience, self-efficacy wisdom, and aging attitudes could be investigated.

## Conclusion

Frailty is a broad concept which is often assessed from a biomedical point of view. Considering population aging and aging in place constructs, biomedical assessments are too narrow to tackle the multidimensionality and complexity of frailty in community-dwelling older people. With the development and use of the Comprehensive Frailty Assessment Instrument, the multidimensionality of the frailty concept is confirmed. Moreover, frailty seems to be a very relevant psychological problem, as this domain contributed most to frailty. Due to the changing policy towards aging in place, the demographic challenges and scarce resources, focusing on the frailty balance between being frail and feeling frail is fundamental. This suggests a paradigm shift regarding frailty in community-dwelling older people and offers new opportunities for research, not in the least regarding the prevention of frailty.

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## Frontotemporal Dementia (FTD)

Maxime Bertoux<sup>1,2</sup>, Claire O’Callaghan<sup>3</sup>,  
Emma Flanagan<sup>1</sup> and Michael Hornberger<sup>1</sup>

<sup>1</sup>Norwich Medical School, University of East Anglia, Norfolk, UK

<sup>2</sup>Department of Clinical Neurosciences, University of Cambridge, Cambridge, UK

<sup>3</sup>Behavioral and Clinical Neurosciences Institute, University of Cambridge, Cambridge, UK

## Synonyms

Behavioural variant frontotemporal dementia; Frontal dementia; Semantic Dementia; Progressive non-fluent aphasia; Pick disease

## Definition

Frontotemporal dementia is an insidious neurodegenerative disease characterised by progressive deficits in behaviour and cognition. Three main clinical entities as well as overlapping syndromes affecting the young subject (< 65 years old) are described here on a clinical, neuropsychological and imaging point of view.

## Introduction

Frontotemporal dementia (FTD) is an insidious neurodegenerative disease characterised by progressive deficits in behaviour and cognition. FTD is a common type of dementia, particularly in patients younger than 65 years. It is the second most common form of younger-onset dementia after Alzheimer’s disease (AD) (Ratnavalli et al. 2002). Despite such prevalence, FTD has received far less recognition compared to other dementias. This is surprising considering the overlap FTD shares clinically and pathologically with many other dementias, making it a challenging condition in terms of diagnosis and treatment. Currently, three different FTD subtypes are clinically recognized: behavioral variant FTD (bvFTD) and two FTD subtypes with progressive aphasia (PPA) – semantic variant primary progressive aphasia (sv-PPA) and nonfluent variant PPA (nfv-PPA) (Hodges 2011). All three subtypes have specific but overlapping clinical, pathological, and neuroimaging features which will be discussed in detail shortly. First, we will give a brief historical and general introduction to FTD before discussing the main subtypes as well as the most prominent overlap syndromes.

FTD was first described by Arnold Pick in 1892 (Pick 1892). Pick published a series of patient cases which all showed significant behavioral and language changes. Importantly, postmortem examinations of the patients showed atrophy macroscopically in the temporal and frontal lobes and microscopically ballooned cells, called Pick bodies. The disease has been historically known as Pick’s disease, however was renamed frontotemporal dementia in the 1980s by

researchers in Lund and Manchester (Neary et al. 1986), according to the prominent macroscopic atrophy seen in these patients. Diagnostic criteria for FTD were first published in the 1980s with revisions in the 1990s (Neary et al. 1998). The most recent diagnostic criteria split the behavioral variant (Rascovsky et al. 2011) from the aphasic (Gorno-Tempini et al. 2011) subtypes to allow more detailed phenotyping of the variants.

Over the years, FTD has moved from being considered a condition that only occurred occasionally to a more prominent role. In particular, the genetic connection of amyotrophic lateral sclerosis (ALS) and FTD has highlighted that FTD pathology and associated symptomology are more common than previously assumed. The following book chapter will allow the reader to gain an insight into the FTD spectrum which will hopefully trigger further clinical and research interest in the FTD field.

## Behavioral Variant Frontotemporal Dementia (bvFTD)

### Clinical Symptoms

bvFTD is the most frequent subtype of FTD. The median survival (from first assessment) is about 3.0–4.5 years (Piguet et al. 2011a), with a disease onset usually around 60 years old, although younger and older cases have been frequently described. The clinical symptomatology of bvFTD is dominated by progressive and dramatic changes in patients' social behavior and personality that become gradually evident to their relatives, often to great distress. Apathy, behavioral disinhibition, inappropriate social conduct, lack of empathy, stereotyped and rigid behaviors, as well as changes in eating behavior are the clinical hallmarks of bvFTD (Piguet et al. 2011a; Rascovsky et al. 2011). Patients also exhibit a loss of insight that complicates their engagement and referral to the clinic (Hornberger et al. 2014; Eslinger et al. 2005), as they do not recognize either their deficits or the relevance of a medical consultation. These insight problems make a

comprehensive interview with informants crucial to establish symptoms. In that perspective, the use of carer questionnaires (such as the Cambridge Behavioural Inventory – CBI, Bozeat et al. 2000) to identify and quantify behavioral changes is particularly useful.

**Apathy** is observed in many, if not all, bvFTD patients. A striking reduction of motivation and interest in others, work, hobbies, and hygiene may be observed, resulting in social withdrawal and a significant reduction of premorbid activities (Chow et al. 2009) that could be mistaken for depression (Woolley et al. 2011). Importantly, although loss of libido may be commonly observed, patients generally do not report the other key symptoms that characterize depression, such as feeling of worthlessness or guilt, sleep disturbances, and recurrent sad thoughts. **Behavioral disinhibition** is also an early symptom of bvFTD and usually coexists with apathy (Le Ber et al. 2006; Seelaar et al. 2011). Patients can act impulsively without taking into account the consequences of their actions and thus make poor financial decisions and reckless purchases, or engage in pathological gambling (Manes et al. 2010). Another key symptom of bvFTD is **inappropriate social conduct**, manifesting as abnormal intimacy with strangers, loss of manners, and embarrassing or tactless personal remarks (Lu et al. 2006). Such socially awkward behaviors are further aggravated by a **lack of empathy** and a decreased ability to decode others' thoughts and beliefs. This leads to decreased interest and concern for others, including closest relatives, which is a major cause of carer and family distress (Baez et al. 2014; Lough et al. 2006). **Stereotyped behaviors** are commonly observed, with simple repetitive movements such as grunting, humming, food tapping, or lip smacking being frequent as well as the repetitive verbalization of words or phrases (Snowden et al. 1996, 2001). **Mental rigidity** is also habitually observed, manifesting as a rigid adherence to everyday routine, a lack of creativity, and, sometimes, compulsive ritualistic behaviors (Snowdmeeen et al. 2001; de Souza et al. 2010). **Change in eating behavior** is also an early symptom of bvFTD. Patients can be

gluttonous, which can cause significant weight gain. A deterioration of table manners, impulsivity to start eating before everyone else, snatching food from others and stuffing it into the mouth all at once are frequently observed symptoms (Ahmed et al. 2014; Piguët et al. 2011b; Woolley et al. 2007).

It should be noted that some patients differ in their progression, showing hardly any change over a decade (Davies et al. 2006) while still exhibiting the behavioral symptoms of bvFTD. Comparative investigations between these “phenocopy” patients and the patients who progress suggest that an absence of brain atrophy, normal or sub-normal executive functioning, and preservation of everyday living activities allow for accurate identification of these nonprogressors (Hornberger et al. 2009).

### Neuropsychology

Apart from the neuropsychiatric symptoms, the neuropsychological profile of bvFTD is dominated by deficits in all aspects of **social cognition**, including empathy, theory of mind, and emotion recognition (Lavenex et al. 1999; Gregory et al. 2002; Bertoux et al. 2013). Carer questionnaires such as the Interpersonal Reactivity Index (IRI – Davis 1983) can be useful to measure a decrease in empathic concern. Faux pas and sarcasm detection are among the most sensitive assessments to capture theory of mind impairments in bvFTD (Bora et al. 2015; Henry et al. 2014). Finally, emotion recognition tests show difficulties in identifying negative emotions (Bertoux et al. 2015a).

**Dysexecutive symptoms**, such as impaired organization and planning, decreased verbal fluency, difficulties in verbal and nonverbal conceptualization, inhibition dysfunctions, and working memory deficits are commonly observed, although they can be absent or subtle in the earliest stages of the disease (Lindau et al. 2000; Gregory and Hodges 1996; Rahman et al. 1999; Harciarek and Jodzio 2005; Perry and Hodges 2000; Hornberger et al. 2011). It should be noted that these symptoms have a poor discriminative value between bvFTD and AD or depression (Libon et al. 2007; Stopford et al. 2012).

Impairments in **decision-making** and **reward processing** have also been documented in bvFTD (Rahman et al. 1999). Patients exhibit a decreased sensitivity to reward (Fletcher et al. 2015), reduced aversion to losses (Chiong et al. 2016), an increased discounting of future reward (Bertoux et al. 2015c), and striking difficulties in reversing the selection of a previously rewarding item that becomes punishing (Bertoux et al. 2013).

Poor **episodic memory** has only recently been recognized as a possible cognitive symptom of bvFTD (Hornberger et al. 2010) and can be observed in 50% of bvFTD patients (Bertoux et al. 2014) although spatial orientation appears to remain relatively preserved (Tu et al. 2015).

The **language** profile of bvFTD is characterized by diminished spontaneous speech and deficits in noun and verb naming as well as impaired single word comprehension, but to a lesser extent than in sv-PPA (Snowden et al. 1996; Hardy et al. 2015).

**Praxis** disturbances can be observed after the earliest stages of the disease, particularly difficulties imitating face postures (Johnen et al. 2015).

### Neuroimaging

Structural imaging such as magnetic resonance imaging (MRI) scans show a typical pattern of atrophy that is ideally seen in coronal orientation. It is characterized by predominant frontal, fronto-insular and/or anterior temporal atrophy, which is sometimes asymmetrical (Agosta et al. 2012). Because atrophy can be very subtle in the early stages of the disease, a normal MRI should not exclude the diagnosis of bvFTD. Regions that are more likely to be atrophied in the earliest stages are the medial prefrontal and orbitofrontal cortices, as well as the anterior insula (Perry et al. 2006; Seeley et al. 2008). In the temporal lobe, the amygdala and hippocampus are also affected (Seeley et al. 2008; de Souza et al. 2013). Subcortical structures such as the striatum (Bertoux et al. 2015b), thalamus (Hornberger et al. 2012), and hypothalamus (Piguët et al. 2011b) are also involved, as well as white matter tracts such as the paracallosal cingulum bundle, corpus callosum, uncinate fasciculus, and fornix (Hornberger et al. 2012; Mahoney et al. 2015).

Functional imaging such as single photon-emission computed tomography (SPECT) shows important hypoperfusion in the fronto-insular and polar tempolar regions (Le Ber et al. 2006; Jeong et al. 2005). As amyloid deposition is not a neuropathological feature of FTD, amyloid tracer can efficiently distinguish bvFTD from AD (Rabinovici et al. 2011).

## Semantic Variant Primary Progressive Aphasia (sv-PPA)

### Clinical Symptoms

Sv-PPA, also called semantic dementia (Snowden et al. 1989; Hodges et al. 1992), is a progressive disorder of language. It is a presenile disease with onset commonly ranging between 66 and 70 years. Anomia and single-word comprehension deficits are the core features of the disease. Although these symptoms, particularly anomia, may be observed in other FTD variants or neurodegenerative conditions such as AD, these disturbances are especially severe in sv-PPA. The disease involves a gradual degradation of conceptual knowledge (thus affecting all modalities), which impairs object knowledge and object use after the earliest stages. Behavioral changes similar to those observed in bvFTD are also common symptoms of sv-PPA (Hodges and Patterson 2007; Bang et al. 2015; Gorno-Tempini et al. 2011). Finally, prosopagnosia can be observed, most commonly in sv-PPA with right predominant atrophy, which accounts for one third of sv-PPA cases and shares many behavioral similarities with bvFTD (Thompson et al. 2003; Evans et al. 1995; Kamminga et al. 2015).

**Anomia** is a key symptom of sv-PPA, occurring in the spontaneous speech that, by contrast with other PPA variants, is not marked by phonological or grammar difficulties. This symptom is obvious during language assessment (e.g., picture naming test) but less noticeable in spontaneous speech, as patients compensate for their difficulties with the use of circumlocutions (Hodges and Patterson 2007). A **single-word comprehension deficit** is also a hallmark of the disease. It is also

less obvious in conversation than during testing because of the critical importance that contextual cues have in a discussion. Similarly to what is observed with anomia, factors such as familiarity and prototypicality (e.g., “dog” for the category “animal”) influence performance (Rogers et al. 2015). The progressive **deterioration of conceptual knowledge** leads to an impairment of object knowledge and use, although patients should function normally with everyday objects at home (also reflecting an effect of familiarity for objects). **Surface dyslexia and dysgraphia** are also observed, where irregular words (e.g., “pint”) are pronounced or written as if they were regular (e.g., “mint”). Although symptoms and complaints preferentially focus on language impairment with less emphasis on behavior, **behavioral symptoms** are common and can mimic the changes observed in bvFTD (Kamminga et al. 2015; Seeley et al. 2005), particularly for sv-PPA with predominant right-sided atrophy. Therefore, apathy, behavioral disinhibition, changes in eating behavior (e.g., restriction of food preferences and bizarre food choices), and emotional withdrawal are commonly observed. Patients also often present with an abnormal egocentric behavior (Snowden et al. 2001; Belliard et al. 2007), extreme rigidity, and compulsions such as repetitive playing of puzzles (Hodges and Patterson 2007). Finally, newfound religiosity, collectionism, and eccentricity of dress are also reported (Edwards-Lee et al. 1997; Snowden et al. 2001). Insight abilities in sv-PPA are mostly impaired for behavioral changes but, by contrast, patients show only a mild anosognosia regarding language deficits (Hornberger et al. 2014; Savage et al. 2015).

### Neuropsychology

Alterations of language are the main causes of complaint and functional impairment in sv-PPA, as well as being the core features for its diagnosis. **Anomia** is especially salient during picture-naming tests, where specific terms tend to be replaced by more prototypical words or by the superordinate category name (e.g., “dog” or “animal” instead of “wolf”) or, in latest stages, by no

answer (Hodges and Patterson 2007; Belliard et al. 2007; Savage et al. 2013). Phonological cues such as pronouncing the first letter or the first phoneme of the word to help its production have little or no effect (Jefferies et al. 2008). **Semantic fluency** is dramatically impaired, reflecting a severe difficulty to generate words in a particular category, while phonemic/letter fluency is relatively preserved during the early stages (Hodges and Patterson 1996; 2007). After the earliest stages, **identification of objects** in any modality is also impaired and reflects a central semantic deficit (Golden et al. 2015; Luzzi et al. 2015; Hodges and Patterson 2007; Savage et al. 2013). Consequently, **object use** may also be altered (Hodges and Patterson 2007). Similarly to anomia, patients with sv-PPA invariably have an impaired **comprehension of single words**, which is strongly modulated by word familiarity (Hodges and Patterson 1996, 2007; Savage et al. 2013). Therefore, while patients may be able to repeat words without errors, difficulties arise when they have to provide **definitions**: definitions lack in detail at first and, in the most severe stages, can be impossible. When the patient is asked to read or write, “typicalization” errors are observed: irregular words are pronounced or written as if they were regular, including verbs (e.g., “drinked” instead of “drank”), which is typical of **surface dyslexia and dysgraphia** (Hodges and Patterson 2007; Savage et al. 2013).

**Executive functions** in sv-PPA are overall relatively preserved in left-sided presentations of sv-PPA and impaired in right-sided sv-PPA. Digit or visuospatial spans are well preserved, and semantic deficits may explain day-to-day working memory impairment as well as verbal fluency deficits (Laisney et al. 2009; Jefferies et al. 2008; Desgranges et al. 2007; Hodges et al. 1999). While alteration of cognitive flexibility may be observed in left-sided sv-PPA, it is more often seen in right-sided sv-PPA as part of a more general dysexecutive syndrome (Desgranges et al. 2007; Kamminga et al. 2015).

Although many patients complain of memory problems, this does not reflect a true amnesia. **Memory deficits** in sv-PPA are modality-specific,

occurring mostly on verbal tasks, with a relative preservation of day-to-day memory (Irish et al. 2016; Hodges and Patterson 2007) and autobiographical memory (Irish et al. 2011) as well as spatial navigation (Pengas et al. 2010).

**Visuospatial abilities** are well preserved (Desgranges et al. 2007; Perry and Hodges 2000) with normal copy of complex figures (Hodges and Patterson 2007). **Prosopagnosia** appears predominantly in right-sided sv-PPA and can be its principal symptom at presentation, helping to differentiate these cases from bvFTD. By contrast, it is rarely observed in cases with left-side predominant atrophy (Thompson et al. 2003; Kamminga et al. 2015).

**Social cognition deficits** can be seen in both left- and right-sided sv-PPA. Facial and musical emotion recognition is altered (Hsieh et al. 2012) as well as empathy and theory of mind. In particular, nonverbal sarcasm detection has been shown to be impaired (Rankin et al. 2009) as well as false-belief, mental-state inference, and attribution of intention (Irish et al. 2014; Duval et al. 2012).

### Neuroimaging

Structural imaging examinations show characteristic focal and bilateral, though asymmetric, atrophy of the temporal lobe, involving the polar, lateral, and inferior surface (including fusiform gyrus) with relative preservation of the superior temporal gyrus (Chan et al. 2001; Galton et al. 2001). This atrophy is typically left-sided (the right-sided atrophy is observed in one third of cases) and ideally appreciated in coronal orientation. Medial temporal structures are also involved, with the amygdala and hippocampus being severely atrophied as well, particularly anteriorly (Galton et al. 2001; La Joie et al. 2013). Involvement of the ventromedial frontal cortex and insula is also frequently observed (Agosta et al. 2012; Gorno-Tempini et al. 2004; Rosen et al. 2002).

Functional imaging shows hypoperfusion/hypometabolism in anterior temporal regions as well as in the hippocampus and orbitofrontal cortex, which is more marked on the left side (Rabinovici et al. 2008; Agosta et al. 2012).

## Nonfluent/Agrammatic Variant Primary Progressive Aphasia (nfv-PPA)

### Clinical Profile

Consistent with other syndromes on the FTD spectrum, nfv-PPA is a younger-onset condition with an average age of 60 years and equal prevalence in male and female patients (Johnson et al. 2005). Survival is approximately 7 years after symptom onset (Hodges et al. 2003; Kertesz et al. 2005). According to current diagnostic criteria, hallmark features of nfv-PPA are **agrammatism** and **slow, effortful speech**, typically with accompanying deficits in **syntax comprehension** in the context of spared single-word comprehension and object knowledge (Gorno-Tempini et al. 2011). Speech production in nfv-PPA contrasts with the fluid, syntactically correct, but meaningless speech production seen in sv-PPA, and patients are usually aware of their speech output deficits (Hodges and Patterson 1996). Speech becomes increasingly effortful over the disease course and typically ends in mutism. Communication via writing has been anecdotally reported as better preserved compared to speech output; however, formal assessment can reveal equivalent impairments in both domains (Graham et al. 2004). Prominent behavioral disturbance is uncommon early in the course of nfv-PPA; however, apathy, agitation, and depression have been documented (Rohrer and Warren 2010) and more profound personality changes and deficits in social functioning can emerge with disease progression (Grossman 2012). Neurological examination in nfv-PPA patients is often unremarkable, although the presence of extrapyramidal features is suggestive of an FTD overlap syndrome such as ALS or corticobasal degeneration (CBD).

### Neuropsychology

**Slow, effortful speech** in nfv-PPA is marked by errors, with abnormal prosody and a slowed rate of speech (Gorno-Tempini et al. 2004, 2011; Ogar et al. 2007). Errors can include distortions (lack of accurate articulation), deletions, substitutions, insertions, or transpositions of speech sounds. Changes in prosody can reflect the incorrect placement of stress or intonation on syllables or

words within a sentence (Leyton et al. 2011). Trial and error processes often accompany this speech output where the patient “grope” for the correct sound or mouth formation. Apraxia of speech (AOS), which refers to disordered articulatory planning and speech sound coordination, is a prominent mechanism underlying the labored speech in nfv-PPA (Josephs et al. 2006). Slowed rate and effortful speech are apparent in spontaneous speech output. On more standardized assessment, when nfv-PPA patients are asked to provide a description of a series of pictures or a visual scene, their rate of speech is less than one-third the speech rate of healthy control subjects and slower than other FTD variants (Ash et al. 2009; Wilson et al. 2010b; Grossman 2012). Formal assessment tools for this include describing the “Picnic Scene” from the Western Aphasia Battery (Kertesz 1982) or the “Cookie Theft” picture from the Boston Diagnostic Aphasia Examination (Goodglass and Kaplan 1983). These tools can also be used to quantify the frequency of agrammatic errors. **Severely reduced fluency** in nfv-PPA is also evident on classical tests of phonemic and semantic fluency (Nestor et al. 2003; Wilson et al. 2010b).

**Agrammatism** in nfv-PPA is reflected in the reliance on short, simplified phrases; omissions of grammatical morphemes such as function words or inflections; and errors in word arrangement (i.e., syntax) (Gorno-Tempini et al. 2011; Leyton et al. 2011). Frequency of grammatical errors also contributes to the reduced rate of speech production (Gunawardena et al. 2010). Related to this are deficits in **syntax comprehension**, where patients have difficulty understanding the syntactic aspects of speech (Hodges and Patterson 1996; Thompson et al. 1997). Agrammatism can be observed in spontaneous speech or tested informally by asking the patient to follow sequential commands that increase in their syntactic complexity (e.g., “put the pen on the watch before giving me the scissors”). Standardized assessment of complex sequential commands reveals impairments relative to healthy controls (Gorno-Tempini et al. 2004). Tasks that assess syntactic comprehension, such as responding to questions about a complex sentence (e.g., “The friendly boy that the

girl chased was nice.” versus a simple sentence, “The nice, tall girl chased the friendly boy.”) show pronounced deficits relative to controls, sv-PPA, and bvFTD (Peelle et al. 2008). Matching syntactically complex sentences with the correct line drawing using the Test for Reception of Grammar (Bishop 2003) also reveals significant impairment in nfv-PPA patients (Nestor et al. 2003).

**Repetition** of multisyllabic words (e.g., stethoscope) is particularly sensitive to nfv-PPA, and impaired repetition seen in the context of spared naming and comprehension supports a breakdown in grammatical processing or articulatory planning (Leyton et al. 2014). Testing of repetition can be done informally or using standardized repetition tests contained in language assessment batteries such as the Sydney Language Battery (SYDBAT) (Savage et al. 2013) and the Western Aphasia Battery.

In contrast to the striking language deficits, performance is better preserved in other cognitive domains, such as episodic memory, visuospatial skills, and nonverbal reasoning (Graham et al. 2004). However, measures of **working memory** (e.g., digit span) are reliably impaired in nfv-PPA (Nestor et al. 2003; Wilson et al. 2010b) consistent with a deficit in phonological rehearsal abilities (Leyton et al. 2014). Impairments in attentional set-shifting are also observed on the trail making test (Savage et al. 2013; Brambati et al. 2015).

### Neuroimaging

Structural MRI in nfv-PPA reveals gray matter atrophy in the inferior frontal region of the left hemisphere, which can extend to the anterior insula, frontal operculum, dorsal prefrontal cortex, and superior left anterior temporal lobe (Gorno-Tempini et al. 2004; Peelle et al. 2008; Rogalski et al. 2011; Grossman 2012). Progression of gray matter loss in the left frontal regions is evident in longitudinal studies, accompanied by involvement of subcortical regions (Brambati et al. 2015).

Metabolic abnormalities in left hemispheric regions are also documented by PET imaging (Grossman et al. 1996; Nestor et al. 2003). Local white matter abnormalities in the dorsal language network (e.g., superior longitudinal fasciculus)

are documented, as well as more diffuse white matter changes outside the language network (Galantucci et al. 2011; Schwindt et al. 2013). Fluency impairment has been directly related to gray matter volume in the left inferior frontal regions, insula, and superior temporal area (Ash et al. 2009), whereas apraxia of speech is associated with changes in the premotor and supplemental motor cortices (Josephs et al. 2006). Posterior regions of the inferior frontal cortex show functional abnormalities related to processing of syntactically complex sentences during fMRI (Wilson et al. 2010a).

### Neuropathology of FTD Variants

Neuronal loss, gliosis, and microvacuolar changes characterize frontotemporal lobar degeneration (FTLD). Specific patterns of abnormal protein deposition are observed in FTLD, such as microtubule-associated protein tau (MAPT), TAR DNA-binding protein with molecular weight 43 kDa (TDP-43), and fused-in-sarcoma protein (FUS). Ubiquitin-only, p62-only positive inclusions, or no inclusions are sometimes observed, but in many fewer cases (Mackenzie et al. 2010; Bang et al. 2015).

FTLD-MAPT or tau accounts for 36–50% of all FTLD cases, almost equally distributed between Pick’s disease, CBD, and PSP cases (Josephs et al. 2011; Sieben et al. 2012; Dickson et al. 2011). FTLD-TDP accounts for about 50% of all FTLD cases, with three major subtypes (A, B, and C) accounting for about half of the nfv-PPA cases (FTLD-TDP-A), two-thirds of FTD-MND cases (FTLD-TDP-B), and the majority of sv-PPA cases (FTLD-TDP-C) (Josephs et al. 2011; Sieben et al. 2012; Mackenzie et al. 2011; Le Ber 2013). Deposition of TDP-43 pathology in the hypoglossal nucleus and in the anterior cingulate cortex has been found to have high value to respectively identify MND and bvFTD patients (Tan et al. 2015). FTLD-FUS accounts for about 10% of all FTLD cases and is characterized by early-onset FTD with severe behavioral and psychiatric abnormalities without linguistic and motor impairments (Mackenzie et al. 2011).

Finally, AD pathology is observed at autopsy in 15–30% of patients with a diagnosis of FTD (Hodges et al. 2004; Grossman et al. 2007; Alladi et al. 2007), mostly in bvFTD and nfv-PPA.

### **Overlap Syndromes (ALS, AD, Logopenic, PSP, CBD)**

A number of syndromes overlap with the classical FTD spectrum, with shared clinical, pathological, and genetic characteristics. Overlap syndromes include ALS, progressive supranuclear palsy (PSP), CBD, AD, and logopenic aphasia.

#### **Amyotrophic Lateral Sclerosis (ALS)**

ALS is dominated by motor symptoms caused by lower and upper motor neuron dysfunction. These symptoms include weakness, spasticity, muscle wasting, dysarthria, and swallowing difficulties (Mitchell and Borasio 2007; Kiernan et al. 2011). Cognitive and psychiatric changes are increasingly recognized in ALS and 20–50% of patients meet diagnostic criteria for FTD (Ringholz et al. 2005). A proportion of FTD patients also go on to develop ALS motor features (Lomen-Hoerth et al. 2002). Cognitive dysfunction in ALS is characterized by executive impairment, personality changes, poor insight, and behavioral changes that include disinhibition and apathy (Flaherty-Craig et al. 2006; Phukan et al. 2007). Clinically, this presentation overlaps considerably with bvFTD (Lillo et al. 2012b). Neuroimaging in ALS patients with cognitive and behavioral dysfunction reveals frontotemporal atrophy (Lillo et al. 2012a; Mioshi et al. 2013). Consistent with the clinical overlap, FTD and ALS also share overlapping pathology and genetic susceptibility. TDP-43-positive inclusions are present in half of the patients with FTD and in the majority of ALS patients (Neumann et al. 2006) and expansions in the C9 or f72 gene are a common cause of both familial FTD and ALS (DeJesus-Hernandez et al. 2011; Renton et al. 2011).

#### **Progressive Supranuclear Palsy (PSP)**

PSP is characterized by vertical gaze palsy, postural instability, and cognitive decline (Litvan

et al. 1996a). Cognitive impairment occurs in the majority of patients and is characteristically “fronto-subcortical,” with mental slowing and executive dysfunction (especially attention and verbal fluency) and inefficient memory recall (Brown et al. 2010). PSP patients also exhibit significant levels of apathy and disinhibition (Litvan et al. 1996b; Aarsland et al. 2001). The combination of executive dysfunction and neuropsychiatric features supports a clinical overlap with FTD, and one case series identified over 30% of pathologically confirmed PSP cases met clinical criteria for possible bvFTD (Kobylecki et al. 2015). Pathologically, PSP is characterized by accumulation of tau protein and neuropil threads primarily in the basal ganglia and brainstem (Hauw et al. 1994; Williams and Lees 2009). Tau pathology represents a common substrate underlying PSP, which is also present in nearly half of FTD cases (Josephs et al. 2011). A PSP-FTD subtype has been proposed to identify those patients with a prominent FTD cognitive/behavioral syndrome. Those patients show more extensive cortical pathology compared to PSP without prominent cognitive/behavioral changes (Dickson et al. 2010).

#### **Corticobasal Degeneration (CBD)**

CBD is characterized by tau pathology and a combination of motor and cognitive/behavioral features related to frontoparietal neuronal loss and basal ganglia degeneration. Numerous diagnostic criteria and terminologies have been proposed (Riley et al. 1990; Boeve et al. 2003; Bak and Hodges 2008; Armstrong et al. 2013). The clinical motor syndrome commonly associated with CBD is parkinsonism, asymmetric rigidity, and corticobasal dysfunction evidenced by limb or oculomotor apraxia, cortical sensory deficits, and alien limb or dystonic limb posturing (Kouri et al. 2011). The cognitive/behavioral syndrome is characterized by language and visuospatial dysfunction and changes in behavior and personality (Burrell et al. 2014). Visuospatial dysfunction is typically striking and may include Balint’s syndrome (simultanagnosia, oculomotor apraxia, and optic ataxia) (Graham et al. 2003). Language features overlap with nfv-PPA (Kertesz et al. 2000;

McMonagle et al. 2006) and behavioral symptoms mirror those seen in bvFTD, particularly apathy and disinhibition (Kertesz and McMonagle 2010; Bruns and Josephs 2013).

### Alzheimer's Disease (AD)

AD is pathologically distinct from FTD; however, shared clinical features can make these diseases difficult to distinguish. AD is characterized by impaired ability to retain newly learnt information (anterograde episodic memory) (Kopelman 1985; Butters et al. 1987; Perry et al. 2000). Progression sees decline in other aspects of memory (i.e., semantic knowledge and remote memory), accompanied by attentional, executive, and visuospatial deficits (Hodges 2006). Cognitive decline in AD is associated with early hippocampal and medial temporal pathological changes and later frontal and parietal changes, which are apparent on structural, functional, and metabolic imaging (Jack 2012). Episodic memory impairment was previously considered a distinguishing feature to separate AD from FTD as it was presumed to be intact in FTD (Neary et al. 1998). However, memory impairment in FTD, in particularly bvFTD, can be equally severe as seen in AD (Hornberger et al. 2010; Bertoux et al. 2014). Atypically presenting AD may also manifest a “frontal” behavioral syndrome characterized by behavioral abnormalities and executive dysfunction (Warren et al. 2012). The potential overlap between memory impairment and behavioral change means in certain cases AD and bvFTD might only be distinguished postmortem. AD pathology involves the accumulation of beta-amyloid plaques and neurofibrillary tangles beginning in the transentorhinal cortex and hippocampus, before progressing to adjacent medial temporal regions and later neocortical association regions (Braak and Braak 1991).

### Logopenic Aphasia

Sv-PPA and nfv-PPA were the prototypical primary progressive aphasias prior to identification of a third variant known as logopenic aphasia (Gorno-Tempini et al. 2004). Word retrieval and sentence repetition deficits, accompanied by slowed speech with frequent word-finding pauses, are hallmark features of logopenic aphasia and

linked to a core phonologic short-term memory deficit (Gorno-Tempini et al. 2008, 2011). Although the slowed speech overlaps with the nfv-PPA presentation, logopenic aphasics do not exhibit the same degree of motor speech errors or agrammatism (Grossman et al. 1996). The confrontation naming impairment is typically less severe than in sv-PPA and characterized by phonological errors as opposed to semantic errors (Gorno-Tempini et al. 2004). Compared with the two other progressive aphasias, logopenic aphasia is associated with a more rapid progression toward a global dementia that encompasses non-verbal domains (Leyton et al. 2013). Imaging abnormalities in the left temporoparietal junction and dorsal language network are found in logopenic aphasia (Rohrer et al. 2010; Leyton et al. 2012). Amyloid imaging and neuropathological studies confirm that Alzheimer pathology is the most common underlying cause of logopenic aphasia (Mesulam et al. 2008; Rabinovici et al. 2008; Rohrer et al. 2012).

### Conclusion and Outlook

The current chapter gave an overview of the FTD spectrums as well as the most prominent overlap syndromes. As evident from the chapter, FTD is a complex and multifaceted disease, which covers different cognitive, neuroimaging, and pathological domains. More specifically, FTD patients can not only present with behavioral and language problems but can also show social cognition and memory deficits as well as motor symptoms. Similarly, brain regions affected by structural and functional changes can be widely distributed or focal. Finally, the admixture of tau and TDP-43 pathology adds the last level of complexity for this disease spectrum.

Such multifaceted complexity might at first seem daunting for any clinician or researcher. However, FTD is therefore emerging often as a critical disease to determine pathological specificity. More specifically, comparisons between FTD and other dementias allow to delineate cognitive, neuropsychiatric, and neuroimaging biomarkers specific to each conditions. This is particularly

relevant for phenotypological variability across dementias, i.e., where patients can show overlapping cognitive symptoms.

Taken together, our overview shows the importance of FTD as a syndrome within the dementias, especially for early-onset cases. Despite its lower prevalence than AD, FTD emerges as important syndrome to delineate different dementia pathologies on a cognitive and neuropsychiatric level. Clearly future investigations are needed to explore this further via novel cognitive biomarkers that can be then also used as outcome measures in disease modifying trials. Finally, the longitudinal trajectories of cognitive and neuropsychiatric changes are still virtually unknown in FTD, which are important to explore as to allow better symptom management in patients in the future.

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## Cross-References

- ▶ [Behavior Modification](#)
- ▶ [Behavioral and Psychological Symptoms of Dementia](#)
- ▶ [Challenging Behavior](#)
- ▶ [Dementia and Neurocognitive Disorders](#)
- ▶ [Language, Comprehension](#)
- ▶ [Language, Naming](#)
- ▶ [Semantic Dementia](#)
- ▶ [Social Cognition and Aging](#)
- ▶ [Young-Onset Dementia, Diagnosis, Course, and Interventions](#)

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## Gender Differences in Memory and Cognition

Agneta Herlitz<sup>1</sup>, Serhiy Dekhtyar<sup>1</sup>, Martin Asperholm<sup>1</sup> and Daniela Weber<sup>2</sup>

<sup>1</sup>Division of Psychology, Department of Clinical Neuroscience, Karolinska Institutet, Stockholm, Sweden

<sup>2</sup>World Population Program, Wittgenstein Centre for Demography and Global Human Capital, International Institute for Applied Systems Analysis, Laxenburg, Austria

### Synonyms

Ageing and retirement in Europe (SHARE); Cohort effects; Gender differences; Longitudinal assessment; Mathematics; Memory: episodic; Verbal ability; Visuospatial ability

Age and gender are variables that have been found to influence cognitive performance. In the following entry, findings of gender differences in cognitive functions will be reviewed, with a specific focus on examining to what extent the pattern and magnitude of these differences change over the adult life span. First, results on gender differences found in memory and cognition tasks in childhood and young adulthood are presented. This is followed by a discussion of the extent to which these differences change over the life span and/or over geographical regions. Lastly,

somewhat contradictory findings reported in cross-sectional and longitudinal studies will be highlighted.

In this review, the following main conclusions are drawn: There is little evidence to suggest that the rate of decline in cognitive performance over the life span is different for men and women. However, cross-sectional studies, comparing individuals of different ages, suggest that the magnitude of gender differences may change over time. Improvements in living conditions and better educational opportunities are factors that may lead to increased gender differences favoring women in some cognitive functions and decreased or eliminated differences in other cognitive abilities. These changes in gender differences seem to take place due to a general increase in cognitive performance over time, associated with societal improvements, where women improve more than men.

### Gender Differences in Cognitive Abilities

Not all cognitive tasks give rise to differences in test scores between men and women, but some do and have consistently been shown to do so. The focus in this entry will be on tasks assessing visuospatial, verbal, numerical, and episodic memory abilities – cognitive abilities that typically yield differences between men and women.

*Visuospatial ability.* Most research indicates that men perform at a higher level than women

when it comes to visuospatial ability. The most recent meta-analysis on the topic (Voyer et al. 1995) concluded that men perform at a substantially higher level than women on most visuospatial tasks, with the overall gender difference in visuospatial ability being  $d = -.37$  (effect size,  $d = (M_{\text{women}} - M_{\text{men}}) / Sd_{\text{total}}$ ). Although men outperform women, the size of the difference may vary depending on the task being assessed. The largest difference is found in mental rotations ( $d = -.56$ ; the ability to rapidly rotate two or three dimensional figures in mind), while it is somewhat smaller for spatial perception ( $d = -.44$ ; the ability to determine a spatial relation regardless of distracting information) and considerably smaller in spatial visualization ( $d = -.19$ ; the ability to manipulate complex spatial information when several steps are required to arrive at the correct solution).

The differences in visuospatial ability have also been examined in children. For example, studies conducted on 3- to 4-month-old (Quinn and Liben 2008) and 5-month-old babies (Moore and Johnson 2008) have shown that male infants are able to differentiate between rotated (compared to the orientation it had during the encoding phase) familiar figures and novel ones. In both of these studies, male infants displayed a novelty preference for the new figure, indicating that they recognized the familiar figure and therefore spent less time viewing it. This was not found for the female infants, who divided their attention between the two items equally. Others (Levine et al. 1999) have demonstrated that 4.5-year-old boys display the same kind of male advantage when it comes to spatial visualization and mental rotation tasks. The edge that boys have over girls at this age also persists into adolescence, as demonstrated by Herlitz and colleagues (2013) who found that these differences also exist around puberty and that the magnitude of the difference is similar across the examined age groups (12–14 years) (Herlitz et al. 2013).

*Verbal ability.* When it comes to verbal ability, the prevailing opinion has been that women outperform men. However, the picture is slightly more complicated. A meta-analysis on the existence of gender differences in verbal abilities

(Hyde and Linn 1988) showed an overall modest advantage for women over men ( $d = .11$ ). However, different tasks yielded different effect sizes, with the largest differences found in speech production tasks ( $d = .33$ ). In anagram solving, women's advantage was smaller ( $d = .22$ ), in vocabulary it was nonexistent ( $d = .02$ ), and in verbal analogies men had a slight advantage over women ( $d = -.16$ ). Further, in verbal production tasks, such as category fluency, an advantage favoring women is most often found (Maylor et al. 2007), but depending on the topic that the participants are asked to generate words from, no gender differences are sometimes found (Weber et al. 2014). Similarly to visuospatial abilities, studies examining the development of verbal abilities, specifically concerning verbal production tasks, find gender differences favoring girls as young as 5 years of age (Hyde and Linn 1988). In line with this, another study (Herlitz et al. 2013) has found that the magnitude of the gender differences is similar for 12- to 14-year-olds.

*Episodic memory.* Episodic memory refers to the conscious recollection of unique personal experiences in terms of their content (what), location (where), and temporal occurrence (when). It is typically assessed by first presenting some information (e.g., episodes, words, objects, or faces) and then asking the person to recall or recognize the earlier-presented material.

Although the first comprehensive review of gender differences in cognition did not find any differences between men and women when it comes to memory (Maccoby and Jacklin 1974), many more recent studies have found gender differences favoring women in episodic memory tasks (see Herlitz and Rehnman 2008 for an overview). Women consistently outperform men on tasks that require remembering items that are verbal in nature or can be verbally labeled. However, women also excel on tasks requiring little or no verbal processing, such as recognition of unfamiliar odors or faces. In contrast, there is a male advantage on episodic memory tasks requiring visuospatial processing. Thus, the pattern of gender differences in episodic memory mirrors the pattern seen in verbal and visuospatial tasks,

with the notable caveat that gender differences favoring women are also found in tasks requiring little or no verbal or visuospatial processing (Lowe et al. 2003). Studies of episodic memory function in children have found the same patterns as in adults, with girls having a slight overall advantage compared to boys as well as girls being better at verbal memory tasks and boys being better at visuospatial memory tasks (e.g., Lowe et al. 2003). Also, the magnitude of the difference in adolescents is similar to the difference found in adults, shown for example in a study examining memory in 12- to 14-year-olds (Herlitz et al. 2013).

*Mathematics.* Mathematics is an umbrella term that includes several different cognitive abilities concerning quantities, space, and numbers. Performing mathematical tasks therefore involves the recruitment of several cognitive abilities, and as a result, gender differences in mathematics often vary as a function of type of task. Although gender differences exist in school grades in mathematics, with girls having a small advantage over boys ( $d = .07$ ) (Voyer and Voyer 2014), this edge is typically not present on tasks assessing mathematical ability. A meta-analysis taking type of task into consideration showed that boys and men have an advantage over girls in general tasks ( $d = -.15$ ), with differences being larger in cognitively more demanding mathematical tasks such as mathematical complex problem solving. Further, the differences are also more prominent in samples performing in the upper percentiles of the distribution (Hyde et al. 1990). Interestingly, boys have a larger advantage over girls in later school years as compared to earlier (Hyde et al. 1990), indicating that the magnitude of gender difference may increase throughout childhood and adolescence.

Taken together, gender differences exist in some cognitive tasks, with girls and women outperforming boys and men in some of them, whereas the reverse is true in others. With the possible exception of mathematical ability, these differences seem to be present already in childhood and are preserved through adolescence and young adulthood without any change in magnitude.

## Gender, Age Decline, and Age Differences

Are there any reasons to expect that men and women decline cognitively at different rates in old age? Biologically, there are some factors that would suggest age-related variation in the magnitude of gender differences. One such factor is accelerated brain aging, or brain atrophy, with some reports suggesting that men show more brain atrophy than women (Raz et al. 2004). Such gender differences in age-related brain atrophy may lead to greater gender differences with increasing age on tasks in which women excel, and smaller differences on tasks in which men perform at a higher level than women. On the other hand, the positive health selection of men with advanced age (i.e., the men who survive into old age may be healthier than the average), together with an increased risk of women being affected by Alzheimer's disease, may lead to a minimization of gender differences in which women excel.

When investigating differences related to age, it is important to differentiate between longitudinal and cross-sectional assessments of gender differences across the life span. With longitudinal studies, it is possible to examine to what extent the same individuals or groups of individuals deteriorate with increasing age, whereas the cross-sectional assessment will show to what degree different age groups, measured at the same time point, vary with regard to performance. Naturally, age groups assessed at the same time differ not only with regard to age, but also with regard to the environment they have been exposed to. For example, later-born generations have typically grown up in societies in which individuals have received more years of education, better nutrition and health care, and more complex and stimulating environments. However, the exposure to these societal improvements may also vary between men and women, with women in many societies and age groups receiving less favorable exposure (Else-Quest and Grabe 2012).

*Longitudinal assessment.* There have been several longitudinal studies looking at gender differences in cognitive decline. One of these studies

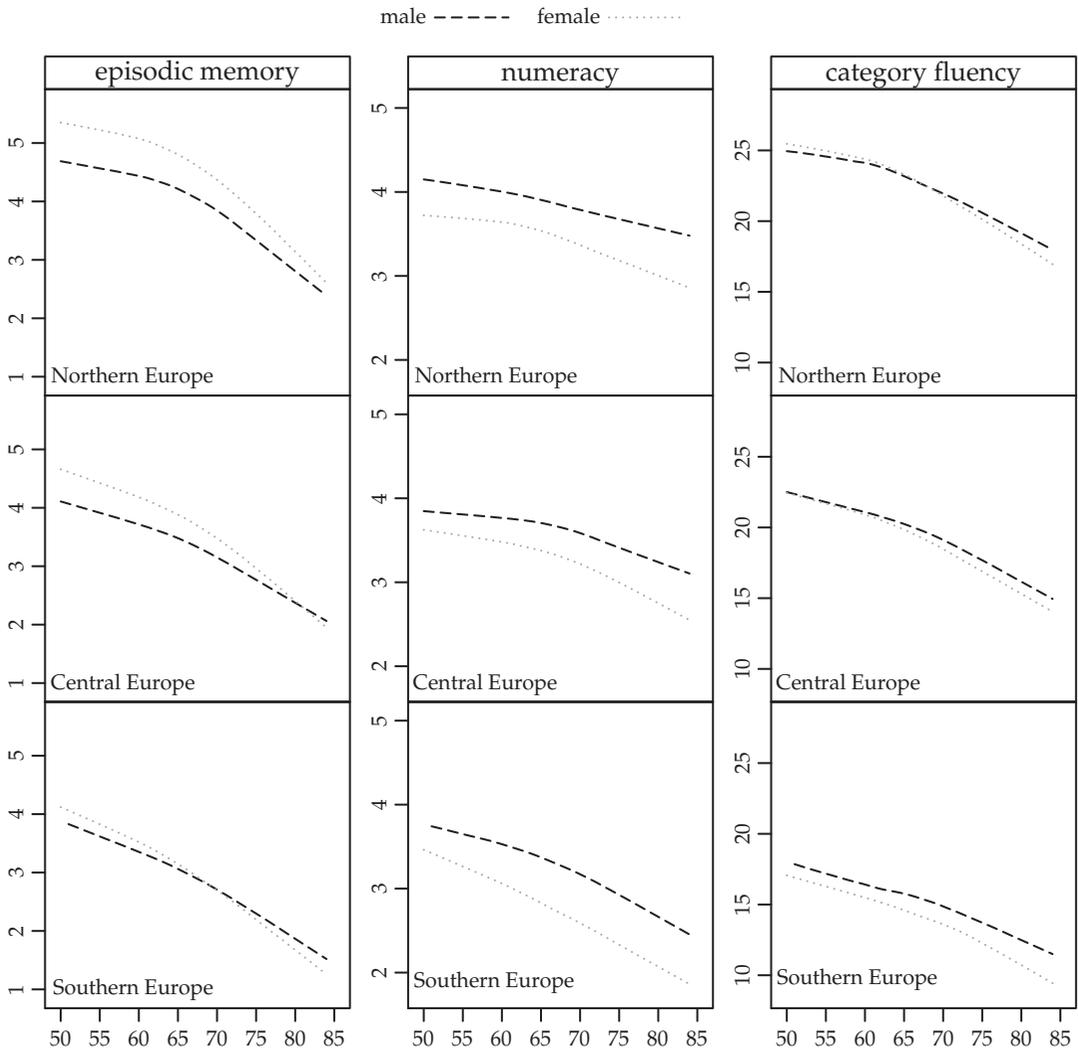
investigated cognition over a 10-year period in a population-based sample (De Frias et al. 2006), with over 600 participants (initially 35–80 years old). Regardless of initial age, it was shown that gender differences remained stable over the examined 10-year period: women performed at a higher level than men on some cognitive tasks (episodic memory, verbal production), whereas men performed at a higher level on a task assessing visuospatial ability. In line with this, results from the Berlin Aging Study, with participants aged between 70 and 100 years of age, showed that men and women declined virtually in parallel, with no evidence of any differences in decay over the 13-year period (Gerstorff et al. 2006). Further, a recent meta-analysis, where altogether 13 studies were included, came to the same conclusion (Ferreira et al. 2014). With very few exceptions, gender was not found to affect the rate of decline in the cognitive tasks assessed.

As is often the case in geropsychological research, studies are only rarely conducted in less affluent regions. This is also the case for studies on gender difference in cognitive decline, with most of them being conducted in Europe or in North America. Since it is possible that societal differences could influence men and women's rate of cognitive decline differently, future research is needed to determine if the same type of patterns are present in less affluent regions of the world where there often also is less gender equity.

*Cross-sectional assessment.* An issue related to the discussion above is whether the magnitude of cognitive gender differences varies when different age groups are compared at the same point in time. Indeed, cross-sectional studies have found that the magnitude of gender differences may vary depending on the age groups assessed. One such study (Maylor et al. 2007) gathered data on about 200,000 individuals between the ages of 20 and 65. The participants, stemming from 53 countries, completed web-based tasks in English assessing visuospatial ability, verbal production, and episodic memory. As usual, men performed at a higher level than women on the visuospatial tasks, whereas women outperformed men on the

category fluency and episodic memory tasks. However, although performance on all tasks declined with age, gender differences were smaller in the older age groups for the tasks where men outperformed women, and larger for the tasks in which women outperformed men. Although the underlying reasons for this pattern are unclear, it can be speculated that it is related to sample differences; older women around the world who both have access to computers and master English as a second language may have had to pass a higher cognitive threshold to acquire these capabilities, compared to participating men of the same age.

Other cross-sectional studies, however, have reported a different pattern of results (Weber et al. 2014). Data from the Survey of Health, Aging and Retirement in Europe (SHARE) were used to analyze over 30,000 individuals, aged 50 years and older, from 13 European countries. The participants were tested on tasks assessing episodic memory, numeracy, and category fluency. For the data analysis, these 13 countries were merged into three geographical regions: Northern Europe (Denmark, Sweden), Central Europe (Austria, Belgium, Czech Republic, France, Germany, The Netherlands, Poland, Switzerland), and Southern Europe (Greece, Italy, Spain). As expected, younger cohorts performed at a higher level than older cohorts, regardless of gender and geographical region. Further, there was a Northern advantage over Central and Southern regions, and gender differences varied systematically across age groups and regions (see Fig. 1). Using episodic memory as an example, women in Northern Europe performed at a higher level than men across all age groups, whereas women in Central Europe only had an advantage in the younger age groups. In Southern Europe, there was even less of a female advantage, with men in the oldest age group performing at a higher level than women. Similar patterns were found for numeracy and category fluency, with less or no advantage for men in Northern Europe, and more of a male advantage in Central and Southern Europe, especially in older age groups.



**Gender Differences in Memory and Cognition, Fig. 1** Mean performances in episodic memory, numeracy, and category fluency across age by gender for Northern, Central, and Southern Europe (Adapted from Weber et al. 2014)

Why would gender differences in cognitive performance be larger in some age groups? As discussed previously, there have been substantial and continuous increases in living condition with regard to, for example, health, economy, family size, nutrition, and education. Such improvements, taking place over time, have been connected to improvements in cognitive performance, called the Flynn effect (Flynn 1987). An example of this comes from a study of Norwegian

male conscripts who were tested on tasks assessing general cognitive ability from the mid-1950s to early 2000, where each yearly cohort was approximately 19 years old (Sundet et al. 2008). Results showed that the general cognitive ability increased more or less linearly and rather steeply (i.e., IQ increased from 100 to 108) from the mid-1950s to 1970, and to a lesser extent thereafter (i.e., IQ increased from 108 to 111). These increases in cognitive ability were strongly

associated with increases in height, thereby pointing to the importance of improvements in nutrition and health care, factors that also influence cognitive performance.

In the SHARE study mentioned above, the investigators wanted to determine whether improvements in living conditions and educational opportunities, with women initially being more disadvantaged than men (Else-Quest and Grabe 2012), would explain why the magnitude of gender differences varied systematically across birth cohorts and regions (Weber et al. 2014). In doing so, a regional development index was created, which was specific for each country and age group. Historical information about each nation's economy, fertility rate, infant mortality, life expectancy, and national education levels corresponding to the years when participants were 25–45 years old was collected. It was found that in countries with a higher regional development index, cognitive performance was also higher. More importantly, it could be seen that women improved in cognitive performance more than men did, suggesting that women were more affected by improved living conditions and education. Although it is unclear why this is the case, one could hypothesize that women benefit disproportionately from societal improvements because they may start from a more disadvantaged level (Else-Quest and Grabe 2012). If this hypothesis is correct, women would be expected to improve their cognitive abilities the most in regions that advance from relatively low levels of living conditions and educational opportunities to higher. Future research need to explore whether this assumption is correct.

## Summary

Taken together, there is little evidence to suggest that the rate of decline in cognitive performance over the life span is different for men and women. However, cross-sectional studies, comparing individuals of different ages at the same time point, suggest that the magnitude of gender differences may have changed over time. Improvements in living conditions and better educational

opportunities are factors that may lead to increased gender differences favoring women for some cognitive functions (e.g., episodic memory) and decreased (e.g., numeracy) or elimination (e.g., category fluency) of differences in other cognitive abilities. These changes seem to take place due to a general increase in cognitive performance over time, associated with societal improvements in living conditions and educational opportunities, where women are more affected than men.

## Cross-References

- ▶ [Age-Related Changes in Abilities](#)
- ▶ [Cognition](#)
- ▶ [Cohort Effects](#)
- ▶ [Language, Comprehension](#)
- ▶ [Language, Discourse Production and Communication](#)
- ▶ [Language, Naming](#)
- ▶ [Life Span Developmental Psychology](#)
- ▶ [Memory, Episodic](#)
- ▶ [Spatial Cognition and Wayfinding](#)
- ▶ [Survey of Health, Ageing and Retirement in Europe \(SHARE\)](#)

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## Genetics of Late-Life Mental, Physical, and Cognitive Function

Ruth O'Hara<sup>1,2,3</sup>, Josh Jordan<sup>4,5</sup> and Joachim Hallmayer<sup>5,6</sup>

<sup>1</sup>Department of Psychiatry and Behavioral Sciences, Stanford University School of Medicine, Stanford, CA, USA

<sup>2</sup>Sierra Pacific Mental Illness Research Education and Clinical Center, VA Palo Alto Health Care System, Palo Alto, CA, USA

<sup>3</sup>School of Psychology, The University of Queensland, Brisbane, QLD, Australia

<sup>4</sup>California School of Professional Psychology, Alliant International University, Alhambra, CA, USA

<sup>5</sup>Department of Psychiatry and Behavioral Sciences, Stanford University School of Medicine, Stanford University, Stanford, CA, USA

<sup>6</sup>Sierra Pacific Mental Illness Research Education and Clinical Center (MIRECC), VA Palo Alto Health Care System, Palo Alto, CA, USA

*Genetics* is the study of heredity, or how the characteristics of living organisms are transmitted from one cell to the next or from one generation to the next. A primary focus of genetics is the analysis of how mutations and variations in DNA relate to human characteristics, behaviors, and disorders. Epigenetics on the other hand refers to cellular and physiological phenotypic trait variations that are caused by external factors that switch genes on and off rather than being caused by changes in the DNA sequence itself. Epigenetic change occurs regularly and can be influenced by a range of factors including age, environment, and disease state.

Genetic epidemiologic studies have documented the heritability of clinically psychiatric disorders over and over again.

## Introduction

Molecular genetic studies have been challenging to conduct and success has been slow. However, the last decade has seen hundreds of positive genetic findings associated with a myriad of complex human diseases. This reflects the dramatic progress in the development and application of newer methodologies and technologies for the assessment and analysis of large genetic data. As important has been the development of the necessary infrastructure that has enabled large-scale collaborations on an unprecedented scale (Lehner et al. 2015). Resulting bio- and data repositories have made tens of thousands of patient phenotypes and millions of genotypes available to researchers all over the globe. Researchers are sharing data and biomaterials so that their use is maximized. However, with the exception of Alzheimer's disease, large-scale genome-wide association studies (GWAS) of late-life disorders are fewer. The field of late-life cognitive and psychiatric disorders is still dominated by candidate genetic approaches. Genetic approaches to older adults have emphasized outcomes such as cognitive processes, psychiatric disorders, resilience, and longevity.

## Genetic Basis of Longevity

According to recent census estimates in the United States, the proportion of older adults (>65 years and over) is expected to double by 2050 (Ortman et al. 2014). Among older adults, individuals aged 85 and over are projected to increase the most, by an astounding 137%. Longevity, typically defined as >85 years of age (Shadyab and LaCroix 2015), is the culmination of a number of factors. Lifestyle (e.g., smoking, exercise) is proposed to play a major role in longevity (Newman and Murabito 2013), and optimal health behaviors can add many years to one's life (Fraser and Shavlik 2001). However, there is evidence that individuals with longevity do not differ in lifestyle from those without (Rajpathak et al. 2011), suggesting that other mechanisms, such as genetics, play a role.

Prior to the advent of genome-wide association studies, family and twin studies were the primary way to determine whether there is a genetic basis to a disorder or trait. Twin studies help us understand the extent to which a trait is heritable by comparing the trait in monozygotic versus dizygotic twins. Approximately 50% of the genome is shared in dizygotic (DZ) twins, while the genome is shared entirely in monozygotic (MZ) twins. Factors that are more concordant in MZ, as compared to DZ twins, may have a stronger genetic basis, whereas factors associated with similar rates of concordance in MZ and DZ twin pairs suggest that there are both genetic and environmental factors at play. Twin and family studies suggest that approximately 20–35% of longevity is due to genetic factors (Ljungquist et al. 1998; Matteini et al. 2010; Newman and Murabito 2013). Siblings of centenarians tend to live longer than the general population as well, further supporting this notion (Perls et al. 2002). Indeed, research on specific genes associated with longevity has largely produced mixed findings. A recent review by Shadyab and LaCroix (2015) identified two genes that have consistently been associated with longevity – apolipoprotein E (APOE) and forkhead box O3A (FOXO3A). APOE is a plasma protein that is implicated in transporting lipids and is involved in the growth and recovery of nerves. It is expressed on chromosome 19 and contains three allelic variants ( $\epsilon 2$ ,  $\epsilon 3$ ,  $\epsilon 4$ ). The presence of the  $\epsilon 4$  allele has been associated with Alzheimer's disease (Corder et al. 1993), while both the  $\epsilon 2$  and  $\epsilon 4$  alleles have been associated with cardiovascular disease (Lahoz et al. 2001). FOXO3A lies within the insulin-like growth factor 1 signaling pathway. While its function is not entirely clear, it is likely associated with oxidative stress, maintaining insulin sensitivity, and cell-cycle progression (Newman and Murabito 2013). Telomere length has been proposed to be implicated in longevity, as telomere length decreases with age (Allsopp et al. 1992; Frenck et al. 1998). However, recent evidence suggests that telomere length is involved in healthy aging, not necessarily longevity per se (Njajou et al. 2009). There is also some evidence that mitochondrial DNA mutations may be associated with longevity as

well, through oxidative phosphorylation (Sevini et al. 2014).

One of the critical questions has been whether genetic markers associated with longevity might in fact subservise the medical illnesses associated with later life. Based on published GWAS investigations, Ganna et al. (2013) generated a genetic score from 707 common SNPs associated with 125 diseases or risk factors related with overall mortality. They then examined the association of the genetic score with time-to-death and also with incidence of nine major diseases, specifically coronary heart disease, stroke, heart failure, diabetes, dementia, and lung, breast, colon, and prostate cancers, in two population-based cohorts of Dutch and Swedish individuals aged 47–99 years. While the genetic score was significantly associated with time-to-death, the association between the genetic score and incidence of major diseases was stronger.

Epigenetic changes are thought to occur as a function of age, and patterns of DNA methylation can change during the lifetime in response to internal and external forces (Ben-Avraham et al. 2012; D'Aquila et al. 2013). Epigenetic regulation includes altered methylated states of regulatory DNA sequences, modifications of histone proteins, as well as expression of regulatory noncoding RNAs (Moskalev et al. 2014). MicroRNA (miRNA), specifically miR-34a, has been implicated in aging, as have miRNA-339 and miRNA-556 (Mehi et al. 2014). Long non-coding RNAs (lncRNAs) have also been proposed as a mechanism of aging (Moskalev et al. 2014).

It is important to acknowledge the effects of demographic selection in studies of the genetic basis of longevity. For example, although the APOE  $\epsilon$ 2 allele is more frequently observed in populations with longevity, this may reflect the fact that carriers of the  $\epsilon$ 4 allele have premature mortality (Perls et al. 2002). Additionally, inconsistent or null findings may reflect flaws in study design. Candidate gene studies are the most common design used and focus exclusively on one gene, which may attenuate findings. It is likely that polygenic and pleiotropic contributions, with interactions of different genes – rather than

individual effects – are most relevant in explaining the genetic basis of longevity (Sebastiani et al. 2012).

## Genetic Basis of Cognitive Function in Late Life

It is a little over two decades since the first genetic markers began to be defined in association with cognitive function. Given the age-related changes observed in cognition, it is not surprising that the major focus of these investigations was older adults. It began with the observation in 1993 of an association between Alzheimer's disease (AD) and the presence of the APOE  $\epsilon$ 4 allele that held the promise of a definitive marker for this debilitating neurodegenerative disorder. APOE, a plasma protein involved in the transport and metabolism of lipids, is implicated in the growth and regeneration of nerves following injury. It is expressed by a gene on chromosome 19 with three allelic variants ( $\epsilon$ 2,  $\epsilon$ 3,  $\epsilon$ 4). The  $\epsilon$ 4 allele is associated with reduced levels of APOE, conferring increased susceptibility and reduced response to neuronal injury (O'Hara et al. 2005). As the years passed, the accumulating evidence suggested that the  $\epsilon$ 4 allele is more a brain-vulnerability marker associated with impaired neuronal recovery from a range of physiologic challenges than a definitive marker for dementia per se. Multiple sources of evidence since then suggest that APOE  $\epsilon$ 4 is associated with decreases in memory and cognitive function over time, but not all individuals positive for the  $\epsilon$ 4 allele develop dementia.

Despite the well-documented association of APOE  $\epsilon$ 4 with cognitive impairment, decline, and dementia, comparing subjects who were cognitively intact or demented, Valerio et al. (2014) found that the association of APOE  $\epsilon$ 4 with dementia attenuated with advanced age. This finding is highly suggestive of a survivor effect model for successful aging, consistent with findings of other studies. Yet, not all age effects in genetics of late-life cognitive and/or psychiatric function reflect a survivor effect. Age can profoundly impact the expression of a gene, and physiological

changes with age can result in a very different impact of a genetic marker than occurs earlier in the lifespan.

Over the past two decades, a wide range of genetic markers have been associated in multiple studies with impairments in cognitive function in older adults. These include catechol-o-methyltransferase, which has been particularly associated with age-related changes in prefrontal and other cognitive functions (O'Hara et al. 2006); brain-derived neurotrophic factor (BDNF), which has been associated with improved cognitive function in older adults in a range of domains (Leckie et al. 2014); and serotonin transporter polymorphism (5-HTTLPR), which has been associated with variations in memory and cognitive control. These genetic markers have also been associated with measures of brain structure, activation, and connectivity that are believed to subserve the deficits seen in the cognitive manifestations of these markers (Waring et al. 2014; O'Hara et al. 2007).

While candidate genetic marker investigations of cognitive dysfunction in the elderly abound, large GWAS investigations are few and far between. In one of the most comprehensive, Ibrahim-Verbaas et al. (2016) conducted a GWAS on multiple cohorts of non-demented older adults from the Cohorts for Heart and Aging Research in Genomic Epidemiology (CHARGE) Consortium, aged 45 and older, assessed with multiple measures of executive functioning and information processing speed. They observed a significant association in the discovery cohorts for the single-nucleotide polymorphism (SNP) rs17518584 and in the joint discovery and replication meta-analysis after adjustment for age, gender, and education, in an intron of the gene cell adhesion molecule 2 (CADM2) with performance on digit symbol substitution. The protein encoded by CADM2 is involved in glutamate signaling, gamma-aminobutyric acid (GABA) transport, and neuron cell-cell adhesion. Their findings suggest that genetic variation in the CADM2 gene is associated with individual differences in information processing speed.

It has been speculated that one of the limitations of GWAS approaches to cognitive function with age is the presence of age-related medical disorders. As pointed out by Stacey et al. 2015, cognitive impairment, or decline, is not only a feature of dementia but also results from normal aging. They suggested that genetic association studies focusing on polymorphisms in and around inflammatory genes represented a viable approach to establish whether inflammatory mechanisms might play a causal role in cognitive decline, since cognitive function was frequently also assessed. This enabled the identification of specific genes potentially influencing specific cognitive domains. Some of these studies report significant cognitive domain-specific associations, specifically implicating interleukin 1 $\beta$  (IL1 $\beta$ ) (rs16944), tumor necrosis factor  $\alpha$  (TNF $\alpha$ ) (rs1800629), and C-reactive protein (CRP) in a range of cognitive domains. Further, GWAS implicated less direct and less obvious regulators of inflammatory processes in cognitive functioning, including PDE7A, HS3ST4, and SPOCK3. The authors called for better cohesion across studies with regard to the cognitive test batteries administered to participants as a means to further understand the basis of cognitive impairment and decline in older adults.

Just as the pleiotropic effects of genes for inflammation also impacted cognitive function, still others have begun to investigate whether there are pleiotropic effects of genes associated with psychiatric disorders that impact cognitive functioning. Hill et al. (2015) examined the role of pleiotropy in explaining the link between cognitive function and psychiatric disorders. Employing two large GWAS data sets on cognitive function – one from older age,  $n = 53,949$ , and one from childhood,  $n = 12,441$  – they found a genetic correlation of .711 ( $p = 2.26e-12$ ) across the life course for general cognitive function. In schizophrenia, they found a negative genetic correlation between older age cognitive function but not in childhood. They found that the pleiotropy exhibited between cognitive function and psychiatric disorders changed across the life course, with an association of cognition and

psychiatric disorders dependent on the disorder of focus and stage of lifespan.

## Genetic Basis of Late-Life Psychiatric Disorders

The study of genetics of psychiatric disorders has blossomed in recent years. Genetic studies of late-life psychiatric disorders have evolved more slowly. The majority of studies examining genetics within late-life psychiatric disorders are based largely on specific disorders or on specific candidate genetic markers (O'Hara and Hallmayer 2014).

Genetics certainly plays a role in the probability of developing a psychiatric disorder, and heritability appears to vary by disorder. For example, bipolar disorder and schizophrenia appear to have the highest heritability (85% and 81%, respectively), whereas panic disorder (43%), major depression (37%), and generalized anxiety disorder (28%) have lower rates of heritability (Bienvenu et al. 2011). A recent meta-review examined 1,519 meta-analyses and discovered 13 genetic variants that were common to two or more psychiatric disorders. These included serotonergic pathways (SLC6A4 5-HTTLPR, HTR1A C1019G, SLC6A4 VNTR, TPH1 218 A/C), dopaminergic pathways (DAT1 40-bp, DRD4 48-bp, COMT Val158Met), vascular pathways (APOE  $\epsilon$ 4, ACE Ins/Del, MTHR C677T, MTHR A1298C), glutamatergic pathways (DAOA G72/G30 rs3918342), as well as neurotrophic pathways (BDNF Val66Met), which suggests that there are common genetic variants that increase vulnerability to psychiatric disorders across a number of diagnoses (Gatt et al. 2015). The number of genes implicated in specific disorders varies greatly. For example, 97 different genes have been implicated in schizophrenia, and 65 have been implicated in bipolar disorder, but only 6 have been implicated in affective disorders (Gatt et al. 2015).

Such GWAS investigations of older adults are very rare to date. Most recently, Ryan et al. (2016) selected variants within three genes, BICC1,

PCLO, and GRM7, for examination in their own study, since they were identified in a prior MDD GWAS study. They first investigated whether these variants were associated with depressive symptoms in a population-based cohort of 929 elderly (238 with clinical depressive symptoms and 691 controls) and secondly investigated their associations with structural brain alterations. A number of nominally significant associations were identified, but none reached Bonferroni-corrected significance levels. Common SNPs in BICC1 and PCLO were associated with a 50% and 30% decreased risk of depression, respectively. Among depressed individuals, rs9870680 (GRM7) was associated with the volume of gray and white matter. Their results provide some support for the involvement of BICC1 and PCLO in late-life depressive disorders, and preliminary evidence suggests that these genetic variants may also influence brain structural volumes.

## Genetic Basis of Positive Traits in Older Adults

In addition to the genetic basis of psychiatric disorders, in recent years, we have seen increased consideration of the genetic underpinnings of positive psychological traits in late life, as they are believed to confer increase resilience to environmental stressors and protect against cognitive and psychiatric aging. Amstadter et al. (2014) examined resilience to stressful life events in 7500 adult twins and found resilience has a genetic heritability of approximately 31%. Mosing et al. (2009) measured optimism and found genetic factors explained 36% of the variation, with the rest due to non-shared environmental factors. Interestingly, they found that the genetic predisposition to high optimism also predisposed to good mental health and self-rated health, suggesting a potentially shared genetic basis among these variables. Twin studies of subjective well-being suggest that approximately 30 to 40% of its basis is genetic (Rietveld et al. 2013).

Arguing that resilience may have a cognitive basis, Mukherjee et al. (2014) defined executive

functioning resilience and conducted a GWAS analysis which found an association between RNASE13 and EF resilience ( $p = 1.33 \times 10^{-7}$ ). They implicated genetic pathways involving dendritic/neuron spine, presynaptic membrane, and postsynaptic density in association with EF resilience.

Another GWAS investigation that could be considered to be examining positive traits was conducted by McGrath et al. (2013) who performed a GWAS of the mental and physical components of health-related quality of life across multiple psychiatric diagnoses. After controlling for psychiatric diagnostic category and symptom severity, the strongest evidence of genetic association was between variants in ADAMTS16 and physical functioning.

Yet another candidate marker for positive traits is CACNA1C, with Strohmaier et al. (2013) finding that genetic variation in CACNA1C was related to lower levels of optimism as well as resilience. CACNA1C is a member of a family of genes implicated in calcium channels and considered to be key for normal function of both heart and brain cells. While findings are mixed, many recent investigations find CACNA1C to be associated with a range of psychiatric disorders, including schizophrenia, depression, and bipolar disorder. This raises a critical issue pertinent to understanding the genetic basis of positive traits. It may be that any genotype associated with a negative outcome, such as a specific psychiatric disorder, will likely have a genotype that is also associated with positive traits that characterize the absence of the disorder. As such, these genetic markers may be nonspecific for positive traits per se, but are associated with a range of positive traits by virtue of not being associated with the negative traits integral to mental health traits or symptoms.

In one of the few investigations to specifically investigate a range of genetic markers associated with positive traits in older adults, Rana et al. (2014) examined 426 women from the Women's Health Initiative study and found no significant SNP associations with optimism and resilience. The authors concluded that positive psychological traits are likely genetically

complex, with no one specific gene or SNP, but rather many loci having small effects that contribute to the phenotypic variation.

### Gene by Environment Interactions in Late Life

In older adults, environmental stressors can trigger the onset of a psychiatric disorder just as it can in younger populations. Genetic risk factors well-documented to be associated with the development of psychopathological response to stress are the serotonin transporter polymorphism (5-HTTLPR) and the BDNF Val66Met polymorphism. The 5-HTTLPR short allele and the BDNF Val66Met polymorphism have been shown to moderate the association between stressful life experiences and depression across the lifespan, in older adults, and the presence of both alleles also significantly predicts depression (Kim et al. 2007). Additionally, BDNF methylation has been shown to be associated with late-life depression and suicidal ideation (Januar et al. 2015; Kim et al. 2014), and 5-HTTLPR status has been shown to predict response to antidepressants among older adults experiencing their first major depressive episode (Shiroma et al. 2014).

However, while in a sample of 423 undergraduates, Stein et al. (2009) found *s* allele carriers of the 5-HTTLPR had reduced resilience to stress, this genetic marker was not found to be associated with resilience in an older adult sample, suggesting the association of the 5-HTTLPR with resilience attenuates with age (O'Hara et al. 2012). It has been however associated with poorer cognitive function in late life, with O'Hara et al. (2007) finding the *s* allele of the serotonin transporter polymorphism to be associated with poorer memory performance and reductions in the hippocampal structures that subserve memory. Further, in their 2012 investigation on resilience (O'Hara et al. 2012), the 5-HTTLPR *l* allele was not associated with resilience but was instead associated with better cognitive performance and self-rated successful aging. This raises the possibility that resilience may be a proxy variable for

cognition in older adults. Arguing that resilience may have a cognitive basis, Mukherjee et al. (2014) defined executive functioning resilience and conducted a GWAS analysis which implicated genetic pathways involving dendritic/neuron spine, presynaptic membrane, and post-synaptic density in association with EF resilience. Interestingly, our group found decreased neuroconnectivity among 5-HTTLPR s allele carriers (Waring et al. 2014), also suggesting a neurobiological basis for increased or indeed reduced resilience that would simultaneously impact the cognitive functions subserved by brain connectivity. Although there has been some examination of gene-environment interactions in recent years, further research is needed to further elucidate the mechanisms through which late-life psychiatric disorders are expressed.

## Conclusion

The field of genetic inquiry into late-life mental, physical, and cognitive disorders is maturing. The ultimate goal is for studies to be translated into a personalized medicine approach, but this will require larger replication studies before any of these results can be translated into clinical practice. Such replication studies should ideally become the norm for the field of late-life mental, physical, and cognitive health and will require large consortia across sites expert in late-life outcomes and disorders with common characterization of phenotypes in order to yield the appropriate sample size for replication. As eloquently stated by Rana et al. (2014), larger sample sizes that would facilitate GWAS as well as complementary approaches such as sequence-based association studies, copy number variation analyses, and pathway-based analyses are required for us to more fully understand the genetic factors influencing geriatric psychiatric disorders.

## Cross-References

► [Physiological Effects on Cognition](#)

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## Georgia Centenarian Study

Leonard W. Poon<sup>1</sup>, Peter Martin<sup>2</sup> and Mary Ann Johnson<sup>3</sup>

<sup>1</sup>University of Georgia, Athens, GA, USA

<sup>2</sup>Iowa State University, Ames, IA, USA

<sup>3</sup>Department of Foods and Nutrition, University of Georgia, Athens, GA, USA

## Synonyms

Centenarians; Functioning; Health; Oldest-Old; Successful Aging

## Definition

This entry outlines the goals, methods, procedures, and results of the Georgia Centenarian Study, an NIH-funded study of the oldest old 1988–2009.

Phase 1 (1988–1992) was a cross-sectional study. Names of community-dwelling centenarians who had to be cognitively functioning were obtained from voter registration lists. Additional participants were recruited through media, area agencies of aging, and church contacts. The two younger groups (i.e., octogenarians and sexagenarians) were recruited by random digit dialing by the Survey Research Institute at the University of Georgia. Altogether, we recruited 38 male and 53 female sexagenarians, 31 male and 62 female octogenarians, and 35 male and 137 female centenarians, for a total of 321 study participants. The majority of the participants were Caucasian (72.3%), but a sizeable number were African

American (27.7%). The race and gender distributions of the samples were representative of the population in the State of Georgia. There were no proxies involved in Phase 1 of our study.

The study was driven by two primary questions. One, what is a theoretical model of aging that would be appropriate to describe life satisfaction and functioning in extreme old age? Two, what are the strengths (and weaknesses) of cognitively intact and community-dwelling centenarians that could contribute to their longevity, well-being, and life satisfaction?

It can be said that gerontological research in the modern era had been heavy with data and significantly lacking in theories and models to consolidate and make sense of the aging processes. Nevertheless, a multidisciplinary model was needed to test hypotheses on the principal components that could contribute to well-being and satisfaction in extreme old age. The solution in 1988 was to draw upon extant aging models that could be adapted to isolate differences among three cohorts – the 60-year-old individuals, where most aging research had been conducted, and 80s, and 100s. The goal of such a model was to explore potential mechanisms that could contribute to well-being and satisfaction in the oldest old where limited research attention had been expended to date. The resultant model was adapted from the Duke Longitudinal Study of Aging (where Poon was trained as a postdoctoral associate) and the Bonn Longitudinal Study (where Martin did his doctoral study). The hypothetical model began by measuring individual moderating characteristics (age, gender, marital status, number of children, etc.), followed by intervening abilities and resources (cognition, personality, stress and coping, time used, religiosity, social and economic resources) that might provide adaptational mechanisms, as well as nutrition, mental, and physical health. The outcomes of the model were well-being and life satisfaction.

During the 4 years of data collection for Phase 1, it is fair to note that the research team had significant learning curves in understanding and adjusting the research methodologies, especially in sampling, recruitment, and testing of the oldest old. These issues were not trivial as design

and methodologies employed with 60-year-old participants may or may not be applicable to centenarians, even if the centenarians were cognitively intact and community dwelling. Detailed summary of trials and tribulation of centenarian studies can be found in Poon and Perls (2007).

Given the potential confounds between cohort and age in a cross-sectional design, Phase 2 (1992–1998) was a longitudinal follow-up of the three initial age groups (i.e., sexagenarians, octogenarians, and centenarians) to examine variations in results between cross-sectional and longitudinal findings. Sixty-eight centenarians were interviewed for a second time after 20 months, whereas sixty-three octogenarians and seventy sexagenarians were recontacted after 60 months. The primary results of Phases 1 and 2 were described in Poon et al. (1992, 2007), and the following are four noteworthy clusters of findings from the two phases. *One*, variability across individuals is significantly larger among the centenarians compared to the younger 80s and 60s age groups. This finding was replicated with similar measures in the Swedish Centenarian Study (Hagberg et al. 2001). Contrary to the stereotype of centenarians performing more poorly than other age groups, some centenarians performed at the same or higher levels compared to their younger peers. At the same time, centenarians as a group showed the expected lower performance-based scores with steeper decline over time. *Two*, the study uncovered a host of compensatory functions that allowed the centenarians to live independently in their communities. The primary compensatory functions were found in: (a) robust survival personality (i.e., higher scores on dominance and suspiciousness), (b) intact crystallized intelligence, (c) higher nutritional status (e.g., body mass index), (d) social and community support, and (e) good overall levels of mental health. *Three*, an analysis was performed to ascertain whether the collected data could predict the number of days of survival after 100 years (Poon et al. 2000). The five significant predictors were (a) being female; (b) father's longevity, e.g., age of death; (c) higher cognition; (d) better nutritional status; and (e) better social support. The global analysis substantiated the function-specific

analyses in understanding survival mechanics as well as substantiating and extending many public health recommendations for healthy aging, especially at extreme old age. *Finally*, the study found that individuals' subjective compared to objective assessments were more predictive of individuals' well-being and levels of successful aging among the oldest old (Cho et al. 2015). This finding on the utility of subjective assessment of well-being has been supported by studies of the oldest old in other countries.

Phase 3 (2001–2009) was a program project that extended Phases 1 and 2 with population-based samples of centenarians and octogenarians in four projects: (a) genetics, (b) neuropathology, (c) functional capacities (including cognition and neuropsychology, physical exams, medications, kinesiology, everyday functioning, blood chemistry), and (d) resources and adaptation (including personality, social and economic resources, life events, coping, and subjective well-being). The program project required the inclusion of five additional administrative units on (a) administration; (b) sampling; (c) cell, blood, and DNA; (d) data acquisition; and (e) data management. Two biologic archives were initiated to store and share specimen with qualified researchers: (a) centenarian blood, cell, and DNA at the Coriell Institute, New Jersey, and (b) centenarian brains at the Alzheimer's Center at the University of Kentucky. While Phases 1 and 2 were conducted with collaborations from two universities, the added complexity of Phase 3 included faculty researchers among nine universities. Description of the methodologies and selected findings can be found at Poon et al. (2007).

Phase 3 provided a design that could test the generalization of findings obtained from convenient samples of cognitively intact and community-dwelling study participants in Phases 1 and 2. For this study, we recruited population-based samples of 244 centenarians and near centenarians (98 years and older) and a comparison group of 80 octogenarians living in northern Georgia. Participants were recruited from skilled nursing facilities and personal care homes in North Georgia. In addition, we used voter registration lists to enroll additional participants.

The majority of centenarians were female (84.9%) and Caucasian (78.7%). Likewise, more octogenarians were female (66.3%) and Caucasian (82.5%).

Representative samples in Phase 3 contained a wide spectrum of functioning of the oldest old from those similar to Phase 1 to those who were severely demented, institutionalized, and with minimal functional capacities. Another advantage of Phase 3 was the availability of data to test interactions among gene and environment on a variety of outcomes in mortality, morbidity, and functioning among the oldest old.

Specific to geropsychology, Phase 3 was designed to examine cognition, neuropsychology, personality, stress and coping, impact of distal and proximal events, as well as family and social resources and relationships. A description of an examination of prevalence of dementia among a representative sample of centenarians in Georgia is used as an illustration of cognitive study here.

An unanswered question on the cognition of centenarians is a valid estimate of dementia among a representative population. In a review of literature, the reported prevalence was between 27% and 75% with a mean of 60%. Data from Phase 3 was used to validate the Global Deterioration Scale (GDS) (Reisberg et al. 1981) that had not been validated with centenarians, as well as to understand the large variation in prevalence estimates (Poon et al. 2012). Using the Phase 3 data, GDS was found to contain high and significant correlations with MMSE and CDR, two instruments commonly used in global dementia assessment. The GDS was also found to correlate significantly with a battery of neuropsychological tests that are used for dementia assessment (executive functioning, word fluency, memory, abstract reasoning, and similarity). High and significant correlations were found with basic and instrumental functions and mobility as well as with neuropathologic findings in the Braak score, cerebral atrophy, brain weight, and National Institute on Aging Reagan criteria for dementia. Finally, there was a perfect concordance between GDS ratings and blind consensus diagnoses among a clinical team in 27 out of 39 cases (69% agreement,  $p < 0.0003$ ).

The Phase 3 data was also used to provide potential explanations on the wide range of reported dementia prevalence in the literature. One potential explanation was some studies might have used convenient samples, and variation in sampling criteria (convenient versus representative) might have biased the outcome. Another potential explanation is that different criteria might have been used to define dementia. If one uses a criterion of adequacy of everyday functioning (GDS stages 1–3), the dementia prevalence is 52.2%. However, if one uses a strict criterion of any sign of mild confusion to severe dementia (GDS stage 3–7), then the prevalence is 77.5%. Finally, we used Phase 3 data to demonstrate sample characteristics (age, gender, education, and age distribution) could also influence the disparity of dementia prevalence reported in the literature (Poon et al. 2012).

Our 20-year exposure in research with centenarians taught us two major lessons. First, the study of aging at extreme old age may be equivalent to cross-cultural studies in that generalizations of designs and methodologies employed for 60-year-old persons may or may not be applicable to those at the end stage of life. Similar to cross-cultural studies, measurement invariance and large individual variability in abilities and functional capacities must be considered in measurement and analysis. Sampling strategies must be carefully considered. Testing time alone may be lengthened from twofold to fivefold. Second, because of large individual differences in performance outcome, main (direct) and interactive (indirect) effects among variables must be carefully considered to understand the highly variable aging processes.

Finally, since the beginning of the Georgia Centenarian Study in 1988, there are many new centenarian studies reported from different countries around the world. Owing to variations in culture and contexts, the reliability and generalizability of reported findings are unknown at present. We believe it is utmost important to design a metric or approach that would take into account the molar environmental, sociologic, and demographic moderating impact on individualized

biopsychosocial intervening processes in the determination of common outcomes such as mortality, morbidity, and functional capacities. In this manner, we would be able to compare and contrast contributing factors to health and longevity around the world using the same metric.

## Cross-References

- ▶ [Healthy Aging](#)
- ▶ [Psychology of Longevity](#)
- ▶ [Psychological Theories of Successful Aging](#)

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## Geriatric Neuropsychological Assessment

John A. Lucas

Department of Psychiatry and Psychology, Mayo Clinic, Jacksonville, FL, USA

### Synonyms

Geriatric Neuropsychological Testing

### Definition

Geriatric neuropsychological assessment involves a comprehensive evaluation of a patient that typically entails review of medical records and relevant medical test results, an interview with the patient and collateral sources, administration and scoring of diagnostically valid tests measuring a wide range of cognitive domains, and communication of results and recommendations to the patient and referral source.

### Introduction

With modern advances in science and medicine, the world population is expected to grow and age at exponential rates. According to the United Nations (United Nations Department of Economic and Social Affairs, Population Division 2015), the world population over age 59 will more than double by the year 2050 to 2.1 billion. The number of persons aged 80 and above is expected to more than triple, reaching 434 million over this same time period. As the population ages, it becomes increasingly important to understand the many changes that occur in normal aging and

distinguish them from the signs that herald disease onset. In this regard, neuropsychological assessment can often provide valuable information to assist in early detection of cognitive impairment, differential diagnosis, and patient care.

One of the common causes of abnormal cognition in older adults is Alzheimer's disease (AD), a dementia typically characterized by impairment in memory plus one or more other cognitive domains of sufficient severity to interfere with daily functioning. In the late 1990s, investigators began to recognize that characteristic patterns of cognitive inefficiencies on formal neuropsychological testing could help identify individuals at higher risk for developing AD and other dementia syndromes. Different terminologies were initially used to describe this risk condition, including mild cognitive impairment (MCI) (Petersen et al. 1999), questionable dementia (Devanand et al. 1997), and cognitive impairment, no dementia (Tuokko et al. 2001). The discovery underscored that dementia does not reveal itself overnight but instead develops gradually and can be detected in its early stages by psychometrically sound neuropsychological techniques. Over time, the scientific concepts and diagnostic criteria of mild cognitive impairment (MCI) have become most widely accepted in clinical practice and research, with diagnostic criteria recently updated by a consensus group of the US National Institute of Health and Alzheimer's Association (Albert et al. 2011).

Converging evidence suggests that the neuropathologic process underlying AD and other degenerative dementias most likely begins years, if not decades, prior to the first detectable signs of MCI (Sperling et al. 2011). Longitudinal studies at multiple times before the onset of MCI reveal a period of gradually progressive cognitive decline up to a decade before symptoms reach the threshold of clinical diagnostic criteria. The observed "preclinical" trajectory reflects a long, slow rate of presymptomatic cognitive deterioration followed by accelerated decline in the years immediately preceding MCI diagnosis (Howieson et al. 2008). Although reliable clinical prediction of disease is still not yet possible prior to overt symptom presentation, current research is exploring ways to

combine neuropsychological data with other biomarker information to generate risk profiles for dementia in much the same way algorithms of vascular risk factors are currently used to identify future development of heart disease.

Although effective dementia prevention therapies are not yet available, it remains important to identify neurodegenerative conditions early to provide appropriate symptomatic relief, education for patients and families, and opportunities to participate in clinical trials. It is also important to recognize that many medical conditions other than dementia can impact cognition in later life. Some cognitive impairment may be reversible, such as that due to primary medical or psychiatric disorders. Rehabilitation therapies can help patients with other conditions, such as stroke or traumatic brain injury, recover from or compensate for cognitive impairments. Accurately identifying the nature and potential etiology of cognitive disorders can help guide patient care in meaningful ways.

## Goals of Geriatric Neuropsychological Assessment

Neuropsychology is the study of brain-behavior relationships through the use of specialized cognitive assessment techniques. Neuropsychologists use these techniques to answer questions regarding cognitive status raised by neurologists, internists, primary care physicians, hospitalists, mental health providers, other referral sources, and patients themselves. The content and format of neuropsychological assessment depends on the specific referral question, clinical setting, and patient characteristics. In geriatric neuropsychological assessment, a comprehensive evaluation typically entails review of medical records and relevant medical test results (e.g., laboratory studies, neuroimaging), interview with the patient and collateral source to understand the presenting cognitive and behavioral symptoms, administration and scoring of tests measuring a wide range of cognitive domains, and communication of results and recommendations to the patient and referral source.

Commonly assessed cognitive domains in geriatric assessments include: attention (e.g., attention span, working memory, divided attention), memory (e.g., learning efficiency, free recall, recognition memory), language (e.g., naming, fluency, comprehension), visuospatial ability (e.g., perception, construction), and executive functions (e.g., mental flexibility, planning, problem-solving). Neuropsychological test administration follows standardized procedures, with scores derived according to established guidelines and compared to normative standards corrected for appropriate demographic variables. The neuropsychologist interprets the pattern of test scores and integrates them with behaviors observed during the test session and information obtained from the medical record and clinical interview.

The most common referral questions for neuropsychological assessment in older persons pertain to diagnosis (e.g., early detection of disease, differential diagnosis) and/or functional status (e.g., daily functioning, capacity to make decisions).

1. *Detecting cognitive impairment.* Neuropsychological assessment is commonly requested to determine whether perceived or observed cognitive changes are due to normal aging or acquired brain dysfunction. To accomplish this, neuropsychologists administer tests with proven diagnostic validity. Diagnostic validity refers to the sensitivity and specificity of a test. Sensitivity is the probability that someone with true cognitive impairment is identified by the test as being impaired (i.e., “true positive”) whereas specificity is the probability that someone without cognitive impairment is identified by the test as unimpaired (i.e., “true negative”). Because these metrics are probabilities, they range in value from 0 to 1, with values closer to 1 being more desirable (i.e., reflecting higher classification accuracy).

Ideal tests would have equally high sensitivity and specificity; however, in reality these metrics act in opposition to one another such that as one value increases, the other value decreases. Choosing appropriate measures

depends on the question being addressed and the consequences of an incorrect decision. A test with high sensitivity but low specificity is useful when it is imperative to detect everyone with impairment, even if a sizeable number of normal individuals are misidentified as impaired. For example, it may be preferable to identify someone without Ebola as being infected and isolate them for a brief time (i.e., false-positive error) than to release someone with the virus into the general population (i.e., false-negative error). Conversely, choosing a test with high specificity but low sensitivity is useful if one wants to ensure that only those with true impairment are identified. For example, clinical trial outcomes may be misleading if people without the condition of interest are enrolled, such that a test that excludes some eligible candidates may be desirable if all ineligible candidates are excluded by it.

It is important to note that sensitivity and specificity are necessary to select valid measures, but they only describe the function of tests *when the cognitive status of the individual is known*. They do not address the important clinical question of whether a patient with a particular score has true impairment due to disease. This information is conveyed by the positive predictive value (PPV) of a test. A complete review of PPV and other clinical utility metrics is beyond the scope of this entry; however, it is important to know that PPV is disproportionately affected by test specificity, such that increasing specificity increases PPV to a greater degree than an identical increase in sensitivity (Smith et al. 2008).

2. *Normal cognitive aging*. Declines in processing speed, memory, language, and executive functions are common in normal aging (Harada et al. 2013). Older adults learn less with initial exposure to new information and require longer or repeated exposure to learn the same amount as younger adults. They are also less efficient in retrieving learned information, although retention is relatively preserved. Age-associated memory changes may be related to slow processing speed (Luszcz and Bryan 1999), heightened

distraction (Darowski et al. 2008), or inefficiencies in learning or recall strategies (Davis et al. 2013; Delis et al. 2000; Isingrini and Tacconat 2008). Vocabulary and word recognition remain stable with age; however, the ability to come up with specific words or names declines (Singh-Manoux et al. 2012). Executive functions such as novel concept formation and mental flexibility also decline with age (Singh-Manoux et al. 2012; Wecker et al. 2000). Several neurologic correlates to these age-related cognitive declines have been identified, including loss of gray and white matter volume, damage in white matter pathways, and reduced neurotransmitter levels (Harada et al. 2013). These changes, however, are typically of insufficient magnitude to have a significant impact on daily functioning.

3. *Differential diagnosis*. Over the last decade, studies of MCI, AD, and other dementias have informed modern consensus diagnostic criteria, most of which include evidence-based descriptions of characteristic cognitive changes (Albert et al. 2011; Gorno-Tempini et al. 2011; McKhann et al. 2011; McKeith et al. 2005; Rascovsky et al. 2011; Roman et al. 1993). Although psychometrically sound test scores provide the clinician with important quantitative evidence of cognitive impairment, these data must be integrated with the clinical history, neurobehavioral presentation, knowledge of functional neuroanatomy, and knowledge of the literature to fully utilize consensus diagnostic criteria.

Impairment in the ability to learn and retain new information (i.e., episodic memory) is the most common neuropsychological deficit in MCI patients who progress to AD (Albert et al. 2011). By comparison, patients with Lewy body dementia (LBD) demonstrate early deficits in attention and visuospatial functions (Ferman et al. 2013; Hamilton et al. 2012). Disturbances of behavioral regulation and a pattern of relatively weaker executive functions than episodic memory are seen in early behavioral variant frontotemporal dementia (FTD) (Wittenberg et al. 2008), whereas early characteristic speech and

language deficits typify the progressive aphasia variants of FTD and AD (Gorno-Tempini et al. 2011). Patients with vascular cognitive impairment due to strokes often show multifocal neuropsychological deficits reflecting damage to the affected neuroanatomy and/or disconnected brain systems. Patients with chronic vascular risk factors (e.g., diabetes, hypertension) typically demonstrate deficits in processing speed, working memory, and mental flexibility due to chronic ischemic disruption of deep white matter frontal subcortical pathways (Sachdev et al. 2004).

As noted earlier, a number of conditions may produce reversible cognitive impairment in older adults. These include depression, medications, hydrocephalus, nutritional deficiencies, and metabolic/endocrine conditions (Tripathi and Vibha 2009). Neuropsychological profile patterns, medical consultation, and appropriate laboratory tests can often distinguish these disorders from static or progressive cognitive disorders.

4. *Longitudinal assessment.* Neuropsychological assessments conducted at a single point in time can sometimes yield inconclusive diagnostic information or may identify a disease process with a potentially dynamic course. In such cases, it is often helpful to obtain prospective, longitudinal assessments to more reliably establish the diagnosis, identify new patient/caregiver needs, or assess recovery/response to treatment. When a progressive neurodegenerative condition is suspected, neuropsychologists often will include a brief cognitive screening measure, such as the Mini Mental State (Folstein et al. 1975), Montreal Cognitive Assessment (Nasreddine et al. 2005), or Dementia Rating Scale (Jurica et al. 2001) as part of the baseline battery. This ensures the ability to briefly measure broad cognitive status when disease has progressed beyond the point where patients can tolerate a full neuropsychological assessment.
5. *Functional status.* An older adult's independence and other factors contributing to quality of life may be altered by cognitive changes. Not surprisingly, neuropsychological measures

tend to be better predictors of ability to perform activities that place high demands on cognition (e.g., managing finances) and are less robust in predicting ability to perform more basic or habitual self-care activities (Farias et al. 2003). The literature suggests that within geriatric populations, performances on measures of memory and executive functions are most strongly associated with ability to perform higher order activities of daily living (O'Bryant et al. 2011; Tomaszewski Farias et al. 2009).

Neuropsychological findings can help patients and families better understand and manage limitations in daily functioning due to cognitive changes and identify needs for assistance or safeguards. A special category of geriatric neuropsychological assessment is the capacity assessment. *Capacity* refers to one's ability to perceive and understand information accurately and to act on that information in a competent fashion. Capacity evaluations seek to determine if a patient can live independently, make medical decisions, enter legal contracts, manage finances, make or change their will, donate assets, name a power of attorney, etc. Measures of attention, comprehension, learning, recall, integration of information, planning, reasoning, and impulse control contribute valuable information to these important decisions.

Although the ability of neuropsychological assessment to identify cognitive impairment is often highlighted, assessment can also identify areas of cognitive strength that may be exploited to limit or compensate for the impact of disease on everyday functioning. Rehabilitation models have long helped patients with traumatic brain injury and stroke adapt to cognitive changes brought on by their condition, and in recent years, these models have been modified and applied to geriatric populations with MCI and early dementia. Clinical trials demonstrate improved cognition, mood, and psychological well-being after completing such programs (Talassi et al. 2007; Jean et al. 2010); however, these interventions only delay the time to dementia onset and do

not prevent disease progression. Nevertheless, lengthening the timeframe during which patients remain independently functioning can improve quality of life, reduce caregiver stress, and ease financial burdens associated with home health costs and assisted living.

## Considerations in Geriatric Neuropsychological Assessment

Regardless of the intended purpose of the neuropsychological assessment of the older adult, clinicians must be aware of the many confounds that may contribute variability to test scores beyond that due to brain disease. Some confounds can be addressed quantitatively by minimizing their influence through normative corrections. Others must be addressed through other means, such as accommodation, modification of procedures, or clinical judgment.

1. *Normative corrections.* Reducing the “noise” in test scores due to confounds increases test specificity which, as noted earlier, improves the probability that a low score is due to true cognitive impairment. Use of appropriate normative data serves this purpose. Since cognition declines with normal aging, correcting test variance due to age is essential in geriatric assessment. Most clinical assessment measures provide age corrections for older adults, although the availability of age-adjusted norms in the oldest old (age 90+ years) remains limited.

In addition to age, many cognitive tests are sensitive to differences in education and cultural diversity. Corrections for years of education are commonly available but considerable work remains to account for differences in test performance related to cultural, ethnic, and language variables. Research shows that these variables often serve as proxies for other societal influences that affect test performance, including socioeconomic status, nutrition, access to health care, health literacy, and lack of comfort/familiarity with testing (Brickman et al. 2006). Individuals from different

cultures, school systems, and language backgrounds are at heightened risk of scoring low on neuropsychological tests for reasons other than true cognitive dysfunction, and thus being mislabeled as “impaired” when no brain disease is present. Availability of ethnic and linguistic norms is growing but remains limited. It is therefore essential that neuropsychologists know when appropriate normative corrections are available, and understand the limitations of findings when patients do not closely match the demographics of the normative sample used.

2. *Testing modifications.* Some age-related changes are universal (e.g., slowed processing) and corrected when age-adjusted normative data are applied to test scores. Other common problems of aging, however, vary considerably from individual to individual and cannot be corrected by group normative data. Effects of these factors on test performance require consideration that may necessitate modifications to the test environment or assessment plan.

(a) *Primary sensory deficits.* Vision impairment is common in older adults due to a combination of age-related changes and higher prevalence of ocular disease (e.g., cataracts, macular degeneration). Hearing loss is also prevalent in older adults, and yet, for example, less than one third of US elders with hearing loss use hearing aids (US Department of Health and Human Services 2014). Such patients can often be accommodated with magnifying or amplification devices. Alternatively, the neuropsychologist may choose tests that minimize the sensory confound (e.g., giving a hearing impaired patient a word-list memory test where the words to be learned are presented in writing). Some patients with primary sensory deficits may require modification of test procedures that break standardization, such as using enlarged stimuli, allowing extra time for sensory-perceptual processing, or repeating misperceived stimuli or instructions. Such modifications should always be reported when interpreting and communicating test results.

- (b) *Sleep disorders and fatigue.* Sleep quality and quantity decrease with advanced age. Healthy older adults are less able to initiate and maintain sleep, and they spend less time in restorative slow-wave and rapid eye movement (REM) sleep (Espiritu 2008). Sleep may be further altered due to nocturia, medication effects, or changing life events such as the death of a spouse. Disorders of sleep such as obstructive sleep apnea, restless legs syndrome, and REM sleep behavior disorder are also more prevalent in older adults (Lee et al. 2008; Ohayon and Roth 2002; Markov et al. 2006).

Chronic sleep deprivation and daytime somnolence impact cognitive efficiency in characteristic ways, including slowed processing and attention deficiencies (Waters and Bucks 2011). Higher order cognitive functions are affected by sleep to the degree that they depend on attention and processing speed. Sleep disturbance has a dose-dependent effect on cognitive impairment, with greater severity of insomnia associated with greater cognitive impairment. Sleep-related cognitive deficits typically improve, however, once normal sleep patterns resume (Waters and Bucks 2011).

When assessing older patients with complaints of fatigue or somnolence, consideration should be given to prioritizing/shortening the test battery and including higher order cognitive measures that are less dependent on sustained attention and processing speed. The examiner should be vigilant for signs that fatigue is confounding test performance and consider breaking up the assessment over multiple sessions if necessary.

- (c) *Chronic pain.* Common causes of pain in older adults include arthritic conditions, musculoskeletal disorders, neuropathies, and vertebral compression due to injury or osteoporosis. Neuropsychological studies suggest that chronic pain is associated with deficits in attention and psychomotor

speed (Hart et al. 2000), most likely due to multiple factors, including acute discomfort, distraction due to heightened somatic focus, side effects of analgesic medications, pain-related sleep disturbance, and pain-related mood disturbance.

Chronic pain and its related symptomatology are a source of performance variance that may warrant postponing the neuropsychological assessment when symptoms are acute, severe, or not yet fully evaluated/controlled. When testing an older adult with chronic pain, the test environment may need to be adjusted by attending to appropriate ergonomics (adjusting table height, using large diameter writing implements, etc.), encouraging patients to bring/use orthotics, and allowing patients to stand or change positions as warranted to help minimize distraction due to pain.

- (d) *Mood.* Stress, losses, and illnesses of advanced age disrupt quality of life and contribute to mood changes in later life. Symptoms of late-life depression, however, may be subtle, atypical, or fewer in number than required to meet diagnostic criteria for clinical depression. The prevalence of major depression in community-dwelling elders over age 64 ranges from 1% to 5%; however, clinically significant depressive symptoms are reported by 15% (Fiske et al. 2009). When health concerns are present, the risk of depression increases twofold to threefold (Andreasen et al. 2014; Ali et al. 2006; Spijkerman et al. 2005).

Neuropsychological studies of late-life depression find reduced information processing speed, inefficient memory, and executive dysfunction (Dybedal et al. 2013). Similar to assessment decisions in patients with pain or fatigue, the decision to proceed with neuropsychological testing depends on the degree to which symptoms are managed at the time of testing. Depressed patients can generally sustain

sufficient effort on formal neuropsychological testing to yield valid results (Larrabee 2012); however, those who are acutely grieving or recently presented with an ominous diagnosis may not be able to produce valid neuropsychological profiles. In such cases, clinical judgment should dictate the approach to assessment.

3. *Rapport*. The ability to develop a working relationship with patients is essential to obtaining valid neuropsychological results across all populations; however, establishing rapport with older adults can present unique challenges. Attending to issues of sensory loss, pain, fatigue, and mood symptoms as described above can facilitate rapport because it demonstrates recognition and understanding of the patient's needs. The neuropsychologist should also understand that their assessment may represent the first time a patient has been referred to a healthcare professional whose title contains the word "psychologist." Generational differences in the perceived stigma of such a referral may engender anxiety or defensiveness in an older patient. There is also significant potential for patients to misunderstand the process or goals of neuropsychological assessment. Referring providers may not fully explain the rationale for ordering the assessment or the exact nature of the evaluation. Even when given appropriate information at the time of referral, patients with cognitive deficits may not fully understand or remember what they were told, or they may express trepidation about being evaluated. Moreover, large cohorts of older persons were not afforded the educational opportunities of subsequent generations and may feel intimidated by "testing." These and other expectations can often be identified and managed during the informed consent process at the outset of the assessment. Careful explanation of the nature of the assessment procedures, the type of information gathered, the way the information will be used to help the patient, and the voluntary nature of the process can help reassure otherwise reluctant patients.

Thoughtful attention to respectful interactions is another important component of rapport building with older patients. Oftentimes, the patient may recognize their cognitive decline and feel embarrassed by it. Those who formerly held positions of authority, efficiency, or pride may become uncomfortable or agitated when a much younger examiner begins to ask difficult questions, judge their responses, and observe task performances. Although test standardization may make it difficult to avoid these threats to rapport, a skilled examiner can repair the relationship between tasks by expressing sincere interest in the patient's greater life experience, recognition of their former expertise, or appreciation for important historical events, cultural movements, or values associated with the patient's generational cohort.

## Summary

Measuring and understanding cognitive symptoms in older adults is important in geriatric practice given that independent living, decision-making capacity, and other factors affecting quality of life may be affected when cognitive changes are suspected. Clinically meaningful geriatric neuropsychological assessment therefore warrants multiple considerations. The neuropsychologist performing the assessment must be knowledgeable about cognitive changes that accompany normal aging, characteristic symptoms that distinguish normal changes from early disease, underlying brain systems affected by disease mechanisms, and current consensus diagnostic criteria. The reason for assessment must be clear and the neuropsychologist must understand the symptom presentation and clinical history sufficiently to select assessment measures with the appropriate diagnostic validity and clinical utility. Ongoing attention must be given to potential confounds or threats to validity that may introduce variability to test performances, and consideration must be given to the appropriate corrections or accommodations required.

## Cross-References

### ► Neurocognitive Markers of Aging

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## Gerontechnology

Geoffrey Lane<sup>1</sup>, Tyler Haydell<sup>2</sup>, Mersina Simanski<sup>2</sup> and Cassandra Stevenson<sup>3</sup>

<sup>1</sup>Psychology Service, VA Palo Alto Healthcare System – Livermore Division, Livermore, CA, USA

<sup>2</sup>Stanford University, Stanford, CA, USA

<sup>3</sup>Physical Medicine and Rehabilitation Service, VA Northern California Healthcare System, Martinez, CA, USA

## Synonyms

Technogeriatrics; Technogerontology

## Introduction

Gerontechnology (GT) is an applied field of study and is a fusion of gerontology and technology. It is a relatively new field, with the term itself apparently first coined in the literature just prior to the 1990s (Micera et al. 2008). By its very nature, the field is dynamic, as it is predicated on the application of ever-changing technologies to the needs of an ever-changing birth cohort. It is also by its nature interdisciplinary, comprised of researchers, clinicians, and academicians in fields as diverse as (but not limited to) psychology, computer science, engineering, ergonomics and human factors, geriatric medicine, and architecture. *GT is concerned with the development, adoption, and use of technology for the purposes of maximizing the health, well-being, and functional independence in all domains (including social, occupational, vocational, and psychological) in older adults.*

## GT and the “Generation Effect”

The concept of technology generations, borne out of the field of sociology in the 1990s, describes the idea of birth cohorts being defined by their own particular experiences with technology (e.g., referring to youth of today as “internet generation”). Generation effects are a central issue to many aspects of GT and are especially relevant as regards issues such as user interface design, user acceptance, and usability across an array of technological products and applications. For instance, users who have not been exposed to a technology prior to a critical period of exposure (e.g., mid-20s) are far less likely to become fluent users of that technology. Younger adults today who began their lives exposed to search engine technology are far more familiar with the use of Boolean operators (defined as making use of words “and,” “or,” and “not” for the purposes of refining search engine results for greater accuracy) than their older adult counterparts. In contrast, older adults rely more on more familiar system tools, such as online encyclopedias (Rogers and Fisk 2010). More broadly, the idea behind the technology generation effect is that introduction of a *multilayered interface* to individuals socialized to single-layered user interfaces will invariably produce an obstacle toward technology adoption and usage behavior.

An example of a single-layered interface design is what was found in first-generation microwave ovens – with its analog controls, all device functions were fully visible to the user (e.g., dial for cooking time, switch to toggle high-low settings, button for power). In contrast, modern microwave ovens are now equipped with digital controls and menu-based, hierarchical interfaces, where software allows for various options and functions to remain invisible until selected by the user (Harrington and Harrington 2000). The concept of technology generations has received empirical support as an entity independent of cognitive and functional decline common to older adults (e.g., such as slowed processing) (Bouma et al. 2007). Technology generations have been grouped in different ways by various authors, with the predominant interaction style

(e.g., the way the user communicates with the technology) as the principal distinguishing factor. These groups are:

1. *The mechanical generation*, born prior to the 1940s
2. *The electromechanical generation*, born between the 1940s and 1960s
3. *The digital generation*, born from the 1960s on (Harrington and Harrington 2000)

### Gerontechnology: Theoretical Perspectives

Gerontechnology is a field relatively rich in data but has been historically poor in explicit theory development or, at least, explicit theoretical articulation – which runs the risk of ageist attitudes and frameworks coloring how inquiry is approached (Rogers and Fisk 2003). For example, the traditional focus on the use of surveillance and monitoring technologies with older adults, such as bed and chair alarms in nursing homes, may work for the laudable goal of insuring safety but may end up inadvertently reinforcing the role of older adults as inherently disabled and dependent.

There are a number of existing theoretical frameworks drawn from lifespan development work, motivational theory, and technology usability research that may be helpful to understanding how to frame GT in a more positive manner. Important theoretical perspectives relating to GT are drawn from motivational theory, theories of successful aging, health psychology, and information systems. Below is a brief selection of some of additional theoretical perspectives from which GT can potentially draw.

**Maslow's hierarchy of needs.** Abraham Maslow created his motivational theory of the hierarchy of needs in the 1950s as a counterpoint to the prevailing behavioral and psychoanalytic ethos of the time. He posits that all humans (older and younger alike) are motivated to satisfy a series of needs that go from the more basic to the more existential and higher order (Oppenauer 2009), namely:

1. *Physiological*: respiration, food, water
2. *Security and safety*: security of body, health, resources, money
3. *Social*: love, belonging, friendship
4. *Self-esteem*: love and respect of oneself and others
5. *Self-actualization*: morality, creativity, “peak experiences”

Maslow's theory is extremely popular and well-represented in GT literature. It has the benefit of suggesting concrete directions for inspiring technology design that goes beyond the traditional, dependency-driven framework mentioned above. However, it does not have much direct empirical support. The continuing popularity of Maslow's theory in the field of GT (and elsewhere) may be because of its broad interpretability. By the same token, its broad interpretability and the complex nature of needs within Maslow's hierarchy limit its usefulness as a guiding theoretical framework for GT.

**Selection, optimization, and compensation.** One potentially helpful way to make sense of the chaotic field of GT, and avoid invoking a dependency-focused framework, is to refer back to the extremely influential theoretical framework laid out by Paul Baltes: that of *selective optimization with compensation* (SOC).

Briefly, SOC theory posits that successful aging and adaptation consists first of *selection*, whereby an individual develops and elaborates personal goals, whether due to a freely chosen reweighting of what is personally valued or as a response to losses. There is *optimization*, i.e., the active process of devoting time, energy, and resources into developing or refining a new skill. Finally, there is *compensation*, whereby an older adult actively makes use of a new or alternative behavioral repertoire or activity in order to satisfy personal goals, in the face of physical, functional, or cognitive losses. This suggests that older adults will tend to focus their limited energies and resources on activities (or technologies) they feel will yield the greatest benefit for achieving their goals. For example, an older adult who, due to physical and functional losses, cannot travel to visit family will invest time and energy into

mastering the use of email and social networking applications to maintain valued social and family ties.

If these technologies do not present obvious perceived benefits to older adult users, successful adoption will not take place, and no compensatory benefits will be gained. Some issues that might degrade the perceived benefit of a technology to an older adult include poor user interface (UI) design, which refers to the method by which a computer and human interact. One well-known example of UI design is the “graphical user interface” or GUI – which the Apple Macintosh platform popularized in the early 1990s.

UI is of paramount importance when designing websites, particularly for older adults. If, for example, a website makes excessive use of “pop-up windows” in their website design, it could be confusing for older adults and lead to lower rates of use. Poor target marketing could be another factor in limiting perceived benefit of a given technology (e.g., new technologies are frequently marketed to consumers in their twenties and thirties by default).

Unlike Maslow’s hierarchy of needs, SOC theory does have the benefit of being more narrowly interpretable in certain ways. The theory continues to be refined in terms of its applicability to GT.

**Socioemotional selectivity theory (SST).** SST is another theory that relates to successful aging. It dovetails somewhat with SOC theory in that it addresses the issue of resource scarcity that is often part of aging. In SST, the issue is scarcity of time.

SST broadly speaks of two goals that appear to motivate adults in their quest for social connection, the first being information seeking, which can be relevant to professional or workplace goals and is instrumental in nature. The second is emotion regulation, with the goal being the maintenance of positive emotional states (the so-called *positivity bias*).

SST posits that as a person ages and their time becomes foreshortened, they will necessarily become more motivated by emotion regulation at the expense of information seeking. In contrast, younger adults tend to be motivated by both information seeking and emotion regulation.

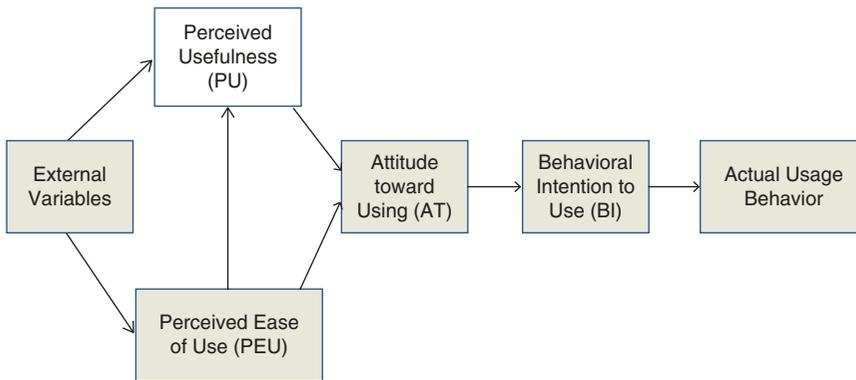
SST has implications for use of technology by older individuals. For example, if an older adult views email as a beneficial strategy for preserving close, intimate personal connections with friends and family, SST tends to predict they will gravitate toward using it. However, if email use is seen primarily as a vehicle for information seeking, older adults will tend not to adopt this technology. Similarly to SOC theory, SST may be more narrowly interpretable and therefore of more practical use as a framework for guiding GT.

**Locus of control and self-efficacy.** Health psychology also yields potentially important additional perspectives on technology usage behavior in older adults. As the initial development of locus of control theory suggests, people tend to vary in how much they see events being determined by their own behavior (internal locus of control) or by external, uncontrollable events. There is some suggestion that older adult technology users are more likely to feel less controlled by external circumstances and report greater feelings of empowerment. Likewise, self-efficacy about technology usage can be extremely powerful – essentially greater personal belief in technical problem-solving abilities in older adult users tends to predict greater use of positive coping strategies.

While the application of these attributional theories to GT is potentially powerful, their utility for guiding technology design is yet to be fully realized.

**Technology Acceptance Model (TAM).** Unlike the above theories drawn from gerontology and psychology, TAM was borne of the study of information systems technology and developed and later refined primarily with working-age adults in mind.

For any given technological innovation to be utilized, there needs to be a level of technology *acceptance*. Technology acceptance is a necessary precursor to successful technology *adoption*, both in the straightforward individual sense (e.g., whereby a novice, tentative user transitions to becoming an experienced, regular user of a given application or device) and in the sociological sense (e.g., where a given technology attains to critical mass of users to gain widespread, established use in a given population).



**Gerontechnology, Fig. 1** Technology Acceptance Model (TAM)

In TAM, for actual technology *usage behavior* (UB) to occur, a user needs to first have positive appraisals in terms of *perceived usefulness* (PU) and *perceived ease of use* (PEU). Both PU and PEU need to reach a threshold for a *positive attitude toward use* (ATU) and a foregoing *behavioral intention to use* to occur, which then lead to successful UB. The original model is below (Fig. 1):

TAM has been found in limited investigations to have utility in predicting older adult usage behavior as well. However, the applicability of the model has been limited somewhat by the fact that TAM was originally developed and envisioned using working-age adults with the adoption of workplace technology as the target behavior. In other words, the perceived usefulness of a given piece of technology in older adults will typically not be related to its perceived workplace utility. Instead, perceived usefulness will depend on factors such as its ability to improve the safety, security, and daily lives of users.

### Usability and Design Issues with Older Adults

Technology acceptance and use in older adults is critically dependent on *usability*, which is generally defined by the learnability and ease of use of a given man-made physical or virtual object.

The acceptance and adoption of new technology in older adults appears to be constrained by

factors that distinguish them somewhat from their younger adult counterparts. These factors include more limited energy as well as greater constraints in the availability of physical and cognitive resources. Although no one, including younger adults, has unlimited resources and energy to acquire and learn new technologies, older adults are by definition in a phase in life where some degree of cognitive and physical loss is expected.

Fortunately, there exist research-based guidelines that take into explicit account issues of task difficulty; age-related changes in cognitive, perceptual, and processing ability; and also cultural and cohort issues that influence technology acceptance and adoption. Some examples of design guidelines that are specific to older adults include (Hardy and Barid 2003; Mynatt and Rogers 2010):

- Strict adherence to ergonomic design principles (say, in home design) to account for the higher incidence of chronic medical conditions in older adults.
- In e-learning and web design, recommend flexibility in presentation (e.g., text, voice, animation) to compensate for sensory limitations.
- Manual and interface design should allow for a modest but significant difference between average literacy levels of older and younger adults.
- Flexible design approach to accommodate slower speeds of older adult users. Slowed speed of older adult operators is both a

consequence of normal, age-related cognitive changes and also may be related to the technology generation effect.

- Introduce design features that take into account single-layered design preferences common to the electromechanical generation (e.g., one control which controls one function, as opposed to a control with a multiple functions). If that is not possible, then have the most commonly used functions be accessible via the topmost layer of the interface.
- Consider the use of skeuomorphic design principles when designing interfaces (e.g., making software features retain features reminiscent of familiar physical objects), which may help to increase comfort and satisfaction of users.
- Consider the use of voice controls, or, if available, touch screen controls to reduce the cognitive load on users.
- Deliberately avoid the “egocentric intuition fallacy” in technology design (e.g., the assumption, often tacit, by technology design staff that they are representative of their end users). This can be avoided by focusing on basic user-centered design (UCD) principles – a process of constant feedback between end users and technology designers as a technological product is being developed.

### Special Populations: Dementia Care Recipients and Caregivers

Gerontechnology for older adults with dementia has been primarily devoted to developing surveillance technology for residential care facilities (e.g., chair alarms, bed alarms, and “WanderGuard” zone alarms) and assistive medical devices. When it comes to GT’s attention to this population, it has mostly been focused on older adults who are receiving caregiver, residential care, or both, as opposed to older adults still living and functioning independently in the community (Topo 1998). It is only recently that GT has begun to focus on providing for the needs of this population in the areas of functional enhancement, leisure, comfort, satisfaction, and social connection.

As the population of older adults has surged, the strain of overburdened care facilities and the negative emotional and physical effects of the loss of independence and decreased quality of life associated with admission to care facilities has given rise to the development of technologies that can help older individuals “age in place,” retaining independence and living at home for as long as possible. Telecare, telehealth, “smart home” and surveillance technologies, and cognitive orthotics all have utility in this arena. However, given the significant healthcare costs associated with loss of independent functioning in older adults, it is surprising how little attention has gone thus far toward research into technology purposed (or repurposed) for use by dementia caregivers themselves.

GT is also of potential use for informal caregivers of older adults. An informal caregiver is an unpaid individual (a spouse, partner, family member, friend, or neighbor) involved in assisting others with activities of daily living, including medical and social tasks. There are 43.5 million adults who care for a disabled or ill family member over the age of 50. There exists a correlation between caregiver well-being and health outcomes in both the caregiver and the care recipient. The outcomes for the caregiver are both physical and mental: 40–70% of family caregivers have clinically significant symptoms of depression with about a quarter to half of these caregivers meeting the diagnostic criteria for major depression (Zarit 2006). The caregiver population presents unique challenges for technology innovators. Intervention technologies will address the most prevalent caregiver needs, including:

**Coordination.** Caregivers become overwhelmed by the quantity of tasks they need to do, as well as the extensive time over which the caregiver role extends. Several tools for caregivers address this need by helping the caregiver compile and prioritize these tasks or delegate the tasks between multiple family caregivers.

**Access to resources.** National health organizations and academic journals have published extensive educational materials about best practices and disease state information

available to keep caregivers informed and in control. There are also many support groups, both in person and online, tailored to the disease or condition of the care recipient. New technologies should aim to deliver this information to the caregiver more effectively. Better access to social outlets and referrals to human resources should be addressed by innovators.

**Decision making support.** Many caregivers use support groups and other human resources to make important decisions about their loved ones' care, including when and how to transition to formal care, medications to take, and other facilities or services to use depending on the condition of the care recipient. Technological tools can aid the decision making process by using personalized information about the caregiver and care recipient.

**Personal health.** Caregivers are able to better provide care if they continue to engage in the activities and interests that will benefit their health. Tech solutions that promote healthy behavior for the caregivers themselves will improve the overall caregiving experience and reduce negative health outcomes.

Because caregivers fall outside the formal healthcare system, special efforts must be made to understand the complex needs of this population and develop technologies that will provide solutions to caregiving demands.

### Surveying the Gerontechnology Landscape

An emphasis on maintenance of independent functioning in the demented individual for as long as possible has both implications for preservation of function as well as nonspecific benefits to quality of life, well-being, and dignity for the individual. The gerontology canard "use it or lose it" certainly applies here. This can result in a spiral of low expectations, poor opportunities, and a societally based "de-skilling" phenomenon (Fig. 2).

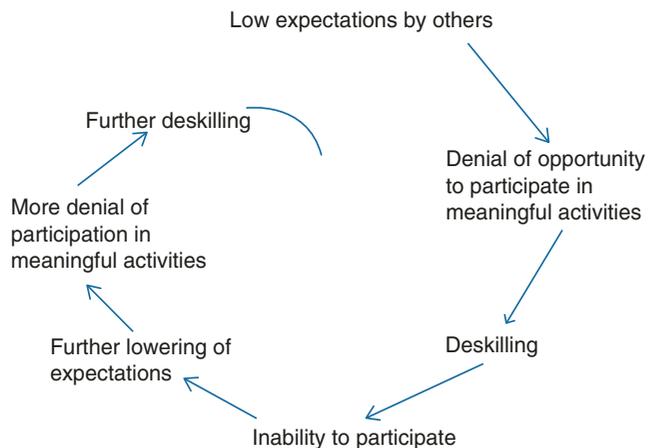
Some reasons for this include the wide range of variability and complexity in older adults that is only magnified by the presence of a dementia, as well as preexisting service delivery limitations, and public perceptions.

Telecare, telehealth, "smart home" and surveillance technologies, cognitive orthotics, and similar advances in technology all have utility in breaking out of this spiral. For example, an older adult who, due to mild dementia, would otherwise occasionally leave a stove on in the home could have a device that could alert him to turn off the stove if it is left on (or turn it off remotely itself), or to turn off faucets, or to remind the older adult to take medication (e.g., combines features of surveillance technologies, "smart" technology, and cognitive orthotics). The landscape of technologies available for these purposes is quite



#### Gerontechnology,

**Fig. 2** Downward spiral of de-skilling that can occur in dementia (Mountain 2013)



broad and continually expanding, and can be broken down into categories that include the following.

**Mobility.** This is a critical area for older adults, with mobility such as a central area for the maintenance of independence. Sidewalks, cars, stairs, elevators, escalators, and elevators all require attention to insure their accessibility and usefulness for older adults. Wheelchairs are a classic illustration of the transition from mechanical technology (typified by the motorized wheelchair) to electromechanical technology (the electric wheelchair or power scooter), to “intelligent wheelchairs,” where they are equipped with specialized software and sensors to decrease collision risk in users as well as climb stairs and curbs while keeping the user level at all times and allow the users to retain mobility for significantly increased periods than would otherwise be feasible (due to sensory or cognitive decline) (Rogers and Fisk 2003; Kalra et al. 2009). Most recently and significantly, the advent of autonomous vehicle technology or “self-driving cars” are poised to transform the extent and assist the mobility of older adults far beyond the traditional limitations posed by predominantly human-controlled vehicles. Concept vehicles promise the ability to augment or autonomize driving capabilities by monitoring and utilizing context-sensitive, real-time data regarding the vehicle, environment, and driver. Such cars might monitor the human driver’s physiological markers, such as visual attention and heart rate, and provide spatial information regarding the vehicle’s location via advanced navigation systems and monitor environmental conditions and obstacles. Of course, given the new and constantly evolving nature of such technologies, regulatory and liability barriers will need to continue to be addressed as these autonomous technologies become mainstream. As of 2015, only a few American states have passed legislation regarding the issues presented by self-driving cars (Yang and Coughlin 2014; Kalra et al. 2009).

**E-health.** *E-health* is a term that has been coined to refer to the various ways that people utilize the internet or other digital technology to access or receive health information. E-health

includes a variety of internet functions and applications and includes access to health information on the internet, access to health self-management tools, and access to health records. Surveys suggest that members of the “baby boom” generation (by far the largest group of older adults in North America) use e-health applications and the Internet for health information at rates comparable to their younger adult counterparts, while those of ages beyond the baby boomers (e.g., 65 and older) do so at somewhat lower rates. Second only to email use and search, e-health still remains by far one of the most popular reasons for older adults to access the Internet.

However, usability and design issues specific to older adults are a concern. Also, older adults may be less able to accurately evaluate the reliability and credibility of online health information compared to their younger adult counterparts. This may be due to lower average levels of educational attainment in older adults, lack of sophistication in search strategies (an outgrowth of the generation effect), the high cognitive demand placed on older adults when sifting through such enormous amounts of information on the Internet, or a combination of these and other issues (Roy and Pineau 2007).

**Telehealth.** Telehealth technology is defined as “the use of electronic information and telecommunications technologies to support long-distance clinical healthcare, patient and professional health-related education, public health, and health administration.” Shifts in the economic landscape of the healthcare market, shifting consumer preferences, and an ever-widening range of technological products and services have all militated to make telehealth technology increasingly attractive for use with older adult populations. Telehealth can include the use of systems to measurement of vital signs, (e.g., heart rate, blood pressure) via sensors and remote monitoring and data collection, videoconferencing, and other forms of communication. It can be used to supplement, or in some cases, replace, medical care and physician office visits but is also viable as a supplement or replacement for in-person mental healthcare appointments, including psychotherapy, and psychological assessments, including cognitive assessments.

Older adults may be homebound, and chronic illnesses may make travel to healthcare appointments a challenge, which militates in favor of wider deployment of healthcare technology for older adults. However – conversely – less educated, more rural older adults, and those with chronic illnesses are less likely to have reliable Internet access (Czaja et al. 2013). There are a number of other obstacles to wider use of telehealth technologies in older adults, which include usability and related issues as well as technology generation effects (e.g., overreliance on multilayered interfaces).

Regarding regulatory issues, mental healthcare delivery is another area where older adults can theoretically greatly benefit from the introduction of telehealth technologies. For example, it has long been recognized that older adults represent an underserved segment of the population as far as mental healthcare delivery is concerned. Secure videoconferencing, telephone, and email communications can all be viable in this regard. However, Medicare (which is the US Federal Government agency which monopolizes the health insurance market for older adults) currently imposes a number of limitations on how so-called tele-mental healthcare delivery is offered to older adults, which effectively denies older adults this service except in rare circumstances (e.g., such as being in a high service need area and receiving the service in a facility or doctor’s office) (Eramo 2014).

#### **Mobile applications and mobile technology.**

There has been an explosion of interest in developing mobile applications or apps for older adults, as well as their caregivers. There appear to be several classes of apps out there, such as apps designed for caregivers to help facilitate care coordination, formal support, wander prevention, and enhance the well-being of the caregiver. Another growing class of apps are designed to facilitate reminiscence activities in the care recipient as a way to calm and enhance the well-being of the caregiver. There is also the growing sector of cognitive orthotic apps (Horgas and Abowd 2004), which are apps specifically designed to extend and support the memory and cognitive functioning in older adults with mild cognitive impairment or dementia of mild severity.

According to the FDA, “Mobile applications can help people manage their own health and wellness, promote healthy living, and gain access to useful information when and where they need it.” The ubiquitous, continuous, and data-rich qualities of mobile technology enable these capabilities and align with the needs of the elderly population. In particular, mobile apps are well suited to address the following areas of need for older adults:

- **Chronic Disease Management.** Most older adults have at least one chronic condition (80%), and half have at least two. Mobile technology is well suited to address this area, and many app developers have focused their efforts here. Research of existing mobile tools in this area has found evidence of efficacy in improving disease management adherence.
- **Medication adherence.** Because of the prevalence of comorbidities in the older adult population, medication adherence is an especially critical issue.
- **Safety monitoring.** With the advancements in sensor technology, mobile apps are becoming increasingly able to remotely monitor activities and items in the homes of the older individuals.
- **Access to health information.** Aside from general search engines like Google, specific apps exist to help connect people with information regarding diseases and illnesses.
- **Wellness.** Wellness apps constitute a significant proportion of all mobile health apps and have gained widespread popularity.

However, barriers relating to usability concerns and the generation effect currently impede widespread adoption of mobile tools for the older adults. Increasing smartphone penetration, sophistication of technology, and user familiarity with mobile apps are eliminating previous barriers to adoption of mobile tools in the older adult population.

**Robotics.** Probably the simplest definition of a robot is a “computational device that can sense and act in the physical world.” Robots vary widely in shape and size and in recent years have been developed to resemble more lifelike creatures

(humans and animals). Robots can be classified into two basic categories: Assistive robotics and social robotics (also known as “carebots”).

*Assistive robotics.* Robotic technology has now become fairly commonplace and is being used in a variety of industrial, institutional, and home situations. Robotic assistants first came into widespread use in North America in the 1980s to assist with vehicle assembly and manufacturing. One of the first consumer mass-market robots for the home is the Roomba™, an autonomous robot built with sensor technology designed to vacuum as it roams. Institutionally, assistive robots are becoming more and more common and have been developed to assist with dispensing medications, performing “fetch and carry” tasks, and other activities (Roy and Pineau 2007).

Assistive robots have a variety of applications with older adults in the realm of aiding older adults in retaining functional capacities in the face of disability and illness. For older adults who have suffered strokes, exoskeletal-like robotics, or wearable biomechatronic systems that follow the movement of the subject and provide assistance with strength and mobility, will increasingly become an option (Micera et al. 2008). As was mentioned previously, robotic technology is increasingly being used to modify existing mechanical technology widely used with older adults, such as with wheelchairs. Telepresence robots are now beyond the feasibility stage with older adults, with obvious applications for allowing homebound or mobility-impaired older adults to attend outside functions and appointments and even for the purposes of facilitating leisure activities.

Quite simply, future iterations of robotic, “smart” assistive technology have the potential to maintain cognitive, physical, and occupational independence in older adults far beyond what was previously attainable.

*Social robotics or “carebots.”* Recently, there has been an interest in developing robots that interact with humans for the purposes of eliciting positive psychological variables such as comfort and relaxation and to reduce depression and anxiety. Japan’s Advanced Institute of Science and



**Gerontechnology, Fig. 3** The Paro robot

Technology in partnership with the Japanese government helped to develop what is currently one of the sole players in the social robotics field: the Paro robot (Fig. 3).

Paro is modeled on a baby harp seal and is fully animatronic and interactive. It is a product designed to elicit the same psychological and physiological benefits as animal-assisted therapies and has a growing body of literature to support its effectiveness in improving quality of life indicators, as well as managing mood and behavior problems in dementia. There are several other social robots that have been developed, but as of this writing, none have been offered on a mass-market basis (Kachouie et al. 2014).

It seems likely that this is a sector that will grow over time, with fairly obvious utility in residential care facilities for older adults, mainly by virtue of the fact that these kinds of devices will free up nursing staff from providing psychosocial and emotional support and allow them to focus on medical and personal care provision for their clientele.

There appear to be unique ethical concerns posed by the carebot/social robotics sector (Vallor 2011). For example, there is the concern that the use of social robots may lend itself to seeing loneliness as a technical problem to be solved rather than an expression of a universal human condition. There are other concerns – carebots may have the effect of reducing the dignity, quality of care, and privacy of

older adults and have the effect of replacing human contact. There are also concerns that carebots are inherently deceptive, particularly as regards older adults with dementia. So, there are costs to be weighed against the benefits of social robotics with older adults.

**Smart homes.** Smart home technologies incorporate connected systems of data collection, data processing, and information delivery to provide the user capabilities and knowledge otherwise unavailable. Specific aims of smart home technology include increasing understanding of a person's health and informing appropriate personnel during emergencies. As advancements in sensor technology allow them to be more affordable, discreet, and interconnected, technology capability no longer inhibits the utility and much of the adoption of smart homes. Additionally, as longevity increases, older adults will be in their homes longer at older ages. The confluence of these two developments aligns well with the implementation of smart home technologies.

Several categories of smart home products exist, including emergency detection, mobility tracking, and appliance and electronics monitoring. Additionally, smart homes intersect with the "Internet of things" field. Major companies are developing their own platforms to enable the interconnectivity of many devices, and though initially focused on a younger audience, the products developed for the Internet of things can be directly applied to the older adult category.

However, smart home technology faces several fundamental obstacles to widespread user adoption, including privacy concerns and the loss of autonomy associated with remote monitoring. The ability for developers to appropriately address these obstacles will dictate the adoption of smart homes (Marling 2007).

## Conclusion

GT is a continually evolving, vast and many-faceted landscape. As the baby boom generation ages, and humans continue to live longer lives, the growth of the aging population will continue to

drive and necessitate new technologies to enhance health and quality of life. It is hoped that GT will continue to be the exciting, dynamic, and rapidly-changing field it is today. Almost without a doubt, by its very nature, the GT landscape of tomorrow will likely be very different than today. We look forward to further refinement of theoretical frameworks, as well as further research and development that will continue to yield important insights and useful products to help older adults retain their independence, and to promote positive outcomes in all life domains.

## Cross-References

- ▶ [Age-Related Positivity Effect and Its Implications for Social and Health Gerontology](#)
- ▶ [Age-Related Changes in Abilities](#)
- ▶ [Challenging Behavior](#)
- ▶ [Housing Solutions for Older Adults](#)
- ▶ [Positive Emotion Processing, Theoretical Perspectives](#)
- ▶ [Social Media and Aging](#)
- ▶ [Technology and Older Workers](#)
- ▶ [Telemental Health](#)

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## Grandparenthood and the Changing Nature of Social Relationships

Da Jiang, Michael C. H. Chan, Minjie Lu and Helene H. Fung  
Department of Psychology, Chinese University of Hong Kong, Hong Kong, China

### Synonyms

Intergenerational relationships; Social network characteristics; Social support; Social ties

### Definition

In this current entry, grandparenthood is defined as the role that older people play as grandparents in a family.

Social relationships are associated with subjective physical and mental health outcomes in adulthood. As they age though, they experience changes in their preferences for social partners and the composition of their social network. In this entry, they first introduce age-related changes in social relationships in terms of their closeness and type. Then, they focus on a relationship that is particularly prevalent and important in older adulthood, i.e., grandparenthood. They discuss factors that may influence the meaning of grandparenthood and grandparenting behaviors, focusing specifically on gender and culture, and the outcomes of grandparenthood.

### Age Differences in Social Relationships

#### Number of Relationships

In the aging literature, studies consistently find that the number of social partners shrinks with age (Zhang et al. 2011), with research suggesting this is not simply due to functional losses and mortality (Lang and Carstensen 1994). Despite the change, subjective well-being in older adulthood does not appear to suffer by the decrease in

the number of social partners. In fact, subjective well-being tends to increase with age (Carstensen et al. 1995). Two reasons may explain this phenomenon. First, older adults may enjoy being alone more than do younger adults. For instance, Larson et al. (1985) found that older adults reported a greater sense of control when alone. A study by Lang and Baltes (1997) extended the aforementioned idea by considering the effect of context when older participants were alone. They found that the older old (i.e., those aged 85–103 years) felt the highest sense of autonomy with the least social contacts when they were facing difficulties in everyday life. The authors interpreted the results as a compensation mechanism, in which being alone in daily activities may allow older adults to maintain autonomous functioning and still spend time with people in other daily activities.

The above studies speak to the idea that aloneness in old age may not be as detrimental as conventionally believed. This argument might be particularly true for people from independent cultural backgrounds. In independent cultures, when people get older, they are less likely to attribute their loneliness to personal deficits (e.g., lack of pleasant personal characteristics) than do people in interdependent cultures. A study conducted by Rokach and Neto (2005) found that Canadians, who were from an independent culture, adjusted better in a lonely situation than their Portuguese counterparts, a group who was considered to be more interdependent. Researchers speculated that compared to interdependent individuals, independent individuals may have a less extended social network, which may make it easier for them to attribute being alone to relationship deficits rather than personal deficits – in turn making it easier for them to adjust to lonely situations (Rokach and Neto 2005). Consistent with this are findings from a study conducted in Hong Kong. In the study, a negative correlation between the number of peripheral social partners and self-reported loneliness was found among older adults who were higher in interdependence but not those who were lower in interdependence (Zhang et al. 2011).

Second and more importantly, older adults may be more selective in their social partners. Such

effects cannot be explained by structural factors alone, such as cognitive abilities and perceived health symptoms (Yeung et al. 2008). Compared with younger adults, older adults show a greater preference for close social partners (i.e., people whom the individual cannot imagine life without, typically but not always kin and close friends) (Yeung et al. 2008) over peripheral social partners (i.e., people who are not as close as close partners, but who are still important, such as colleagues and professional helpers). Although older adults have fewer peripheral social partners than do younger adults, they maintain a similar percentage of close social partners in their social networks as do their younger counterparts (Zhang et al. 2011). This may make it easier for them to maintain their subjective well-being or even increase their social satisfaction. Yeung et al. (2008) further examined the mechanism of the age-related decrease in peripheral social partners. They found that the number of peripheral social partners only decreased among those lower (and not higher) in interdependence. Zhang and colleagues (2011) further found that older people with higher interdependence reported lower loneliness when they increased their number of peripheral social partners in a two-year interval, suggesting that older people higher in interdependence could benefit from having more peripheral social partners (Zhang et al. 2011).

Recently, Lang and colleagues argued that, because emotionally close partners were more important for older adults than middle-aged adults, older adults might invest more effort to maintain emotionally close partners (Lang et al. 2013). Examining this question in middle-aged and older adults, Lang and colleagues (2013) found that perceived relationship effort was significantly associated with emotional closeness, such that people invested more effort in people who were more emotionally close. This effect was stronger in older adults than in middle-aged adults. The investment in emotionally close partners may contribute to the greater emotional well-being reported by older adults. In fact, English and Carstensen (2014) found that the social relationships of older adults were associated with less negative emotion and more positive emotion

than those of younger and middle-aged adults in a longitudinal study with three waves of 5-year intervals.

In sum, while the number of peripheral social partners decreases with age, emotionally close social partnerships remain stable across adulthood. Older adults make greater efforts to managing social relationships than do younger and middle-aged adults (Lang et al. 2013). They also benefit more from these social relationships in reducing perceived loneliness (Zhang et al. 2011), reducing negative emotions, and increasing positive emotions (Lang and Carstensen 1994) than do their younger counterparts.

## Types of Relationship

In addition to studying social network composition in terms of closeness, researchers have also investigated age-related differences in the types of relationship that older adults value (Fung et al. 2008). In German participants, Fung and colleagues (2008) found that older age was associated with a smaller proportion of nuclear family members and a larger proportion of acquaintances. In Hong Kong Chinese, however, older age was associated with a larger proportion of nuclear family members and a smaller proportion of acquaintances. Fung and colleagues argued that, compared with Germans, Hong Kong Chinese showed a greater family in-group bias in social network composition with age.

In a study using data from the World Values Survey (Li and Fung 2012), Li and Fung examined age differences in trust across 38 countries. They found that age positively correlated with general trust and also trust toward different social groups, including family, friends, neighbors, and strangers. However, the positive association between age and trust toward friends and strangers was weaker in countries that scored lower on individualism.

Friendship is another type of social relationship that can be as close as that experienced by family members but also as peripheral as acquaintances. Building upon the theoretical framework on friendships in old age proposed by Matthews

(1986), Miche and colleagues (2013) found that friendship network types in old age tend to be classified into four categories. In the first group, the discerning friendship style, individuals select a small number of close friends. The second group, independent friendship style, refers to a relatively larger group of friends with lower emotional closeness. The final two groups, selective acquisitive style and unconditional acquisitive style, have the largest number of friends that differ in emotional closeness, with selective acquisition as being emotionally closer than unconditional acquisition.

Despite the variations in styles, older individuals generally have more favorable experiences with friends than with family members (Rook and Ituarte 1999). This finding can most likely be explained by the structural differences between friendship and family relationships. Friendships are mostly formed and maintained on a voluntary basis, while family relationships are more or less predetermined. Older adults usually form friendships with individuals who share their interests and lifestyles and who have reciprocal social relationships with them. Friendships in old age also provide better companionship compared to family relationships. For example, Huxhold et al. (2014) examined the relationship between social activities with different social partners and the changes in affective well-being and life satisfaction among older adults across a 6-year interval. They found that social activities with friends were related to maintenance or positive changes of life satisfaction as well as a reduction in negative affective experiences among older adults. However, social activities with family members were associated with increased negative affective experiences in the sample.

To summarize, despite the decrease in the number of social partners as people age, subjective well-being is maintained or even increased. Research suggests that the change in social network size is more than a product of age-related structural changes such as mortality and functional losses. Instead, older adults actively prune their social network by keeping emotionally close social partners and cutting down relationships with peripheral social partners. The pruning

appears to contribute to the maintenance and even increase in subjective well-being of older adults. One particular emotionally close relationship valued by majority of older adults is that with their grandchildren. They discuss the relevance of grandparenthood in the next section.

## Grandparenthood

Grandparenthood is one of the major relationships that older adults maintain. It plays an important role in the subjective well-being of older adults and is increasingly important in older age. Previous research suggests that grandparenting is a goal-directed behavior. How people view grandparenthood is influenced by their perceptions of future time. Fung et al. (2005) summarized three dimensions of meaning associated with grandparenthood: (1) obligation and accomplishment (e.g., “having grandchildren makes me satisfied and complete in this life stage”), (2) beneficial gains (e.g., “life as a grandparent is wonderful”), and (3) perceived loss in absence (e.g., “I feel that my life would have lacked something had I have never been a grandparent”) (p. 135). Fung and colleagues found that when people perceived future time as more limited, they attached greater importance to grandparenthood in all three dimensions than did people who perceive future time as less limited. This finding is consistent with the line of research arguing that when one believes their time is limited, they select emotionally close social partners, such as family members. In another study, Thiele and Whelan (Fung et al. 2005) found that grandparents experienced greater happiness from grandparenting when they adopted the goal of generativity (e.g., pass along knowledge to future generation). These findings suggest that grandparenting behavior is influenced by the goal that older adults adopt.

## Gender and Grandparenthood

Previous research consistently reports the influence of socioeconomic factors in grandparenting behavior. For instance, those with lower levels of

education (King and Elder 1998) and better physical health (King and Elder 1998) tend to make more contact with grandchildren and elicit more role satisfaction when engaged in grandparenting behavior. Gender has been found to be another important factor in grandparenthood. The gender differences in grandparenthood tend to be related to gender differences in life expectancy (i.e., women generally live longer than men), social status (i.e., men have higher status than women), financial resources (i.e., men have better financial resources than do women), and socialization levels (i.e., men have more social exposure than do women) (Field and Minkler 1988). Gender roles also influence grandparenting behaviors. Traditionally, women are responsible for interpersonal dynamics within families, and men are responsible for task-oriented involvements outside the family (Szinovacz 1998). In line with this reasoning, research has found that grandfathers are more likely to provide instrumental supports, such as financial assistance, but have greater difficulty expressing their emotions toward grandchildren. In contrast, grandmothers were more likely to provide emotional supports (Smorti et al. 2012).

It also seems that grandmothers play a more diverse role than grandfathers in the work of grandparenting. For instance, grandmothers provide care and emotional support and participate in recreational activities with grandchildren. Therefore, grandmothers report greater contact with their grandchildren than do grandfathers. The grandchildren also perceived themselves as having more contact with, and greater closeness with, grandmothers than grandfathers (Smorti et al. 2012). As a result, grandmothers are more emotionally close and affectively supportive to grandchildren than are grandfathers. Although both grandmothers and grandfathers report similar levels of positive emotion toward their grandchildren and consider their role as supporting and providing care, grandmothers are more satisfied with their role and report a higher level of perceived influence and intimacy.

In addition to the gender of grandparents, the interaction between lineage and gender is another issue that has received much attention.

Two theories in the field of evolutionary psychology have been proposed to explain these effects: the kin-keeper theory and the kin selection theory. The kin-keeper theory argues that women (i.e., grandmothers and mothers) place greater emphasis on intra-family relationships, making them essentially the “kin-keepers” in a family. Due to their higher level of involvement, grandmothers and mothers build closer connections with family members, including the grandchildren, than do grandfathers. Accordingly, the theory would predict that grandchildren should be closer to maternal grandparents than paternal grandparents. In contrast, the kin selection theory is based on the assumption of inclusive fitness, which argues that one favors others who may be able to pass on one’s genes. Because men maintain fertility longer than women and have a greater chance to produce offspring, they invest less in each offspring, including grandchild, than do women (Surbey 1998). In addition, because male offspring may have a greater chance to pass on genes, people may have a closer relationship with grandsons than granddaughters.

Dubas (2001) compared and contrasted the kin-keeper theory and the kin selection theory in grandparenting by examining the moderating role of gender in the grandparent-grandchild relationship. She found evidence that partially supports the kin selection theory. The relation between maternal grandmothers and grandchildren was not closer than the relation between paternal grandmothers and grandchildren. However, granddaughters rated their relation with grandmothers closer and more important than did grandsons. Grandsons, on the other hand, rated their relation with grandfathers closer and more important than did granddaughters. Drawing on these findings, Dubas (2001) suggested that both matriarchal and patriarchal relationships were critical in grandparent-grandchild relationship.

## Culture and Grandparenthood

It is well documented that culture shapes human behavior. However, few studies have paid specific

attention to the influences of culture on grandparenting. In one exception, Sandel et al. (2006) investigated the lay theory of “grandmother” role in European Americans and Taiwanese Chinese through in-depth interviews. They found both universal and culture-specific aspects in grandparenting behavior. Grandmothers in both cultures engaged in similar activities and considered the role of being a grandmother to be distinctive from being a mother. However, they interpreted their roles in different ways. Specifically, European American grandmothers saw themselves as friends and playmates of their grandchildren and defined their role of being a grandmother in “companionship” terms. They considered giving advice to the parents (their children) on parenting to be problematic. Taiwanese Chinese grandmothers, however, defined themselves as temporary caregivers. They disciplined misbehaving grandchildren and advised the parents.

Research on ethnicity has also found ethnic variation in grandparenting. African American grandparents reported more contact with grandchildren than did grandparents from White cultures (Field and Minkler 1988). Phua and Kaufman (2008), using the data from US Census in 2000, found that Japanese grandparents were more likely than Asian Indian grandparents to take on the grandparenting responsibility. Collecting data from in-depth interviews with 30 New Zealand women from four different cultural backgrounds (i.e., New Zealand European, New Zealand Maori, Central European, and New Zealand Chinese), both similarities and differences between ethnicities were found (Phua and Kaufman 2008). Armstrong (Phua and Kaufman 2008) summarized that women from all four ethnic backgrounds considered “being a grandmother” to be an indicator of “being old” and of having a “shorter future.” Because their future was limited, the interviewed women expressed placing greater value on their relationship with grandchildren and an increased sense of generativity. Some interviewees even mentioned that they decided to retire early or reduce working hours, in order to take care of their grandchildren. Meanwhile, ethnic differences

were also observed. Different views of grandparenthood were found, in terms of social status, seniority, social renewal, and social integration. For instance, the New Zealand Chinese and Maori interviewees associated old age and being a grandparent with seniority and a higher level of social status. Such a pattern was not found among New Zealand Europeans and Central Europeans. The sense of social renewal is particularly salient in Central European grandmothers, because they all immigrated to New Zealand after World War II. New Zealand European grandmothers associated grandparenthood with an increased social support network and greater social engagement.

### Positive and Negative Outcomes of Grandparenthood

Much research has summarized the benefits of having grandchildren. According to Timberlake (1981), there are eight benefits of grandparenthood: (1) to support one's social identity as grandparent, (2) to perceive one's own life has being expanded, (3) to help, (4) to increase interpersonal connectedness with others, (5) to provide positive emotional experiences, (6) to provide a goal in older adulthood, (7) to assert influence on others, and (8) to obtain achievements over others. These benefits of grandparenthood correlated positively with better physical health (Hughes et al. 2007), engagement in exercise (Hughes et al. 2007), fewer depressed symptoms (Grundy et al. 2012), and a higher level of life satisfaction (Grundy et al. 2012). Christiansen examined the association between grandparenthood and mortality (Grundy et al. 2012). She found that among women who became grandmothers after the age of 50 years, being a grandmother was associated with a lower mortality rate (Christensen and Walczynski 1997).

Admittedly, grandparenthood can also be perceived as a burden by some older adults. Custodial grandparents report worse health, more symptoms of depression, and more functional limitations than do other grandparents (Grinstead et al. 2003). Such effects may be driven by the fact

that older adults have limitations in conducting activities with high physicality. Custodial grandparents spend considerable time with grandchildren and expend considerable energy that can impair the physical and mental health of the grandparents.

Overall, being a grandparent is a valued and important role for older adults, because it connects them with emotionally close social partners. An appropriate level of grandparenting engagement improves physical and mental health and in general advances life satisfaction in older adulthood. Gender is an important factor, with grandmothers generally building closer relationships with grandchildren than do grandfathers. Such a pattern may be derived from the traditional gender role that women are responsible to foster harmonious relationship within families. In addition to gender, previous studies also observe culture and ethnicity differences in grandparenting behaviors.

### Conclusion

Social network size shrinks as individuals age. The shrinkage of network size is associated with the active pruning of social partners by older adults: emotionally close partners are kept in the social circle, while peripheral social partners are reduced. This change in social network structure appears to contribute to maintenance and even improvement in the subjective well-being of older adults. Among these, grandparenthood is an especially valued and emotionally close relationship for older adults that has implications for subjective well-being that differs as a function of gender and culture.

### Cross-References

- ▶ [Aging and Psychological Well-Being](#)
- ▶ [Cross-Cultural Aging](#)
- ▶ [Intergenerational Relationships](#)
- ▶ [Loneliness and Social Embeddedness in Old Age](#)
- ▶ [Socioemotional Selectivity Theory](#)

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## Grief and Bereavement: Theoretical Perspectives

Kathrin Boerner<sup>1</sup>, Margaret Stroebe<sup>2</sup>, Henk Schut<sup>2</sup> and Camille B. Wortman<sup>3</sup>

<sup>1</sup>Psychology of Entrepreneurial Behavior, Institute of Psychology, University of Kassel, Kassel, Germany

<sup>2</sup>Department of Clinical and Health Psychology, Utrecht University, Utrecht, The Netherlands

<sup>3</sup>Department of Psychology, SUNY Stony Brook, Stony Brook, NY, USA

### Synonyms

Deep sorrow (caused by someone's death); Mourning (expression of grief); Personal loss

### Definition

The term *bereavement* denotes the objective situation of a person who has experienced the death of someone significant. *Grief* then refers to the emotional experience of the psychological, behavioral, social, and physical reactions the bereaved person might experience as a result of this death.

### Introduction

The loss of a loved one is a ubiquitous human experience, which is often regarded as a serious threat to health and well-being. This topic is relevant to the study of geropsychology for two reasons. First, there is consensus among researchers and practitioners alike that coming to terms with personal loss is a critical part of successful adult development (Baltes and Carstensen 1996). Second, losses tend to accumulate in late life. This can place survivors in a state of chronic stress and undermine their capacity to deal with any particular loss.

The death of a loved one provides an excellent arena to study basic processes of stress and adaptation to change. Unlike many stressful life

experiences, the death of a person is irrevocable and cannot be altered by the coping efforts of survivors. Indeed, the major coping task faced by those who have experienced the death of a loved person is to reconcile themselves to a situation that cannot be changed and find a way to carry on with their own lives.

The most common loss of a loved one for older adults is the death of a spouse (Carr et al. 2006). Therefore, the bulk of research on late life losses has focused on this type of loss. However, older adults may also experience other types of losses including the death of a child, grandchild, sibling, or close friend. These can also be major losses and may each have unique implications and challenges for the person who is faced with them. Research insights shedding light on these experiences, however, are much more limited. It is thus important to keep in mind that much of our understanding of and thinking about late life losses is derived from work on spousal loss.

Furthermore, it is important to define the key terms that will be used throughout this entry. The term *bereavement* is derived from the Latin word *rumpere* (to break, to carry, or tear away) and refers to the objective situation of a person who has suffered the loss of someone significant. In most cases, bereavement robs survivors of love and companionship, as well as future hopes and plans that they expected to share with the person who died. *Grief* is derived from Latin *gravare* (to weigh down) and refers to the emotional experience of a number of psychological, behavioral, social, and physical reactions to one's loss. The word *mourning* is derived from the Latin word *memoria* (mindful). It refers to actions expressive of grief which are shaped by social and cultural practices and expectations. Pointing to the timeless message of the original meanings of these terms, Jeter (1983) commented that "as the ancients, people today surviving the death of a family member do feel robbed, weighted down, and are mindful of the past, knowing that life will never be the same" (p. 219). But how do individuals cope with such an experience? To address this question, models and approaches that seem most influential to current understanding of bereavement and grief are examined.

## Classic Psychoanalytic View

One of the most influential approaches to loss has been the classic psychoanalytic model of bereavement, which is based on Freud's seminal paper, "Mourning and Melancholia" (1917). According to Freud, the primary task of mourning is the gradual surrender of one's psychological attachment to the deceased. Freud believed that relinquishment of the love object involves a painful internal struggle. The individual experiences intense yearning for the lost loved one, yet is faced with the reality of that person's absence. As thoughts and memories are reviewed, ties to the loved one are gradually withdrawn. This process, which requires considerable time and energy, was referred to by Freud as "the work of mourning." At the conclusion of the mourning period, the bereaved individual is said to have "worked through" the loss and to have freed himself or herself from an intense attachment to the unavailable person. Freud maintained that when the process has been completed, the bereaved person regains sufficient emotional energy to invest in new relationships and pursuits. This view of the grieving process has dominated the bereavement literature over much of the past century and only more recently has been called into question (Bonanno and Kaltman 1999; Stroebe 1992; Wortman and Silver 1989). For example, it has been noted that the concept of grief work is overly broad and lacks clarity because it fails to differentiate between such processes as rumination, confrontative coping, and expression of emotion (Stroebe and Schut 2001).

## Attachment Theory

Another theoretical framework that has been extremely influential is Bowlby's attachment theory (Bowlby 1969, 1973, 1980; see also Fraley and Shaver 1999; Shaver and Tancredy 2001). In this work, Bowlby integrated ideas from psychodynamic thought, from the developmental literature on young children's reactions to separation, and from work on the mourning behavior of primates. Bowlby maintained that during the course

of normal development, individuals form instinctive affectional bonds or attachments, initially between child and parent and later between adults. He believed that the nature of the relationship between a child and his or her mother or caregiver has a major impact on subsequent relationships. He suggested that when affectional bonds are threatened, powerful attachment behaviors are activated, such as crying and angry protest. Unlike Freud, Bowlby believed that the biological function of these behaviors is not withdrawal from the loved one but rather reunion. However, in the case of a permanent loss, the biological function of regaining proximity with attachment figures becomes dysfunctional. Consequently, the bereaved person struggles between the opposing forces of activated attachment behavior and the reality of the loved one's absence.

Bowlby maintained that in order to deal with these opposing forces, the mourner goes through four stages of grieving: initial numbness, disbelief, or shock; yearning or searching for the deceased, accompanied by anger and protest; despair and disorganization as the bereaved gives up the search, accompanied by feelings of depression and hopelessness; and reorganization or recovery as the loss is accepted and there is a gradual return to former interests. By emphasizing the survival value of attachment behavior, Bowlby was the first to give a plausible explanation for responses such as searching or anger in grief. Bowlby was also the first to maintain that there is a relationship between a person's attachment history and how he or she will react to the loss of a loved one. For example, children who endured frequent separations from their parents may form anxious and highly dependent attachments as adults and may react with intense and prolonged grief when a spouse or partner dies (see Shaver and Tancredy (2001), or Stroebe et al. (2005), for a more detailed discussion). Because it provides a framework for understanding individual differences in response to loss, Bowlby's attachment model has continued to be influential in the study of grief and loss (Shear et al. 2007). Mikulincer and Shaver (2013) have conducted sophisticated empirical research, confirming the importance of attachment security

in the prediction of adjustment to bereavement and providing fine-grained understanding of many associated phenomena.

## Getting Past Stage of Grief

While several theorists have proposed that people go through stages or phases in coming to terms with loss (see, e.g., Bowlby 1980; Horowitz 1986), perhaps the most well known of these models is the one proposed by Kübler-Ross in her highly influential book *On Death and Dying* (Kübler-Ross 1969). This model, which was developed to explain how dying persons react to their own impending death, posits that people go through denial, anger, bargaining, depression, and ultimately acceptance. It is Kübler-Ross's model that popularized stage models of bereavement. For many years, Kübler-Ross's model has been taught in medical, nursing, and social work schools. It has also appeared in articles in newspapers and magazines written for bereaved persons and their family members. As a result, stage models have strongly influenced the common understanding of grief in our society.

As research began to accumulate, it became clear that there is little support for the view that there are systematic stages. Although there are studies that purport to support stage models (Maciejewski et al. 2007), the weight of the evidence suggests that reactions to loss vary considerably from person to person and that few people pass through the stages in the expected fashion (see Archer 1999; Attig 1996, for a review). Several major weaknesses of stage models have been identified (Neimeyer 1998). First, they cannot account for the variability in response that follows a major loss. Second, they place griever in a passive role when in fact grieving requires the active involvement of the survivor. Third, such models fail to consider the social or cultural factors that influence the process. Fourth, stage models focus too much attention on emotional responses to the loss and not enough on cognitions and behaviors. Finally, stage models tend to pathologize the reactions of the majority of people who do not pass through the stages. As a result of

these and other critiques and a lack of empirical support, most researchers have come to the conclusion that the idea of a sequence of stages is not particularly useful (Stroebe et al. 2001).

## Trauma Theory and Meaning Making

An influential stream of thought in the field of bereavement has come from trauma theory. Even though one could argue that most late life losses may not involve experiences of a traumatic nature, for example, because the occurrence of the death may be considered timely in the context of the life course, there could be traumatic aspects to a loss experience in late life. For example, witnessing a prolonged period of serious illness and intense suffering of a loved one can have elements of trauma, even if the illness and death occur at an expected life stage. Similarly, the death of an older person can be experienced as very sudden, if this person had been in good health and highly engaged in life or even if the person died after years of chronic illness and decline. Therefore, it appears that conceptual thinking coming from trauma theory should be considered even in the context of late life loss.

The model of stress response syndromes by Horowitz and colleagues (1986) purports that traumatic experiences disrupt a person's life via blockage of cognitive and emotional processing. Similar to the notion of grief work as a necessary step toward recovery, the assumption here is that processing the trauma is essential if the person is going to be able to move on and that stressful life events play an important role in the etiology of various somatic and psychiatric disorders due to failure of such processing. A further line of research derived from the related field of trauma was that of Janoff-Bulman (1992), particularly through the identification of shattered beliefs which need to be rebuilt. This has been expanded to the study of "meaning making" particularly by Neimeyer and collaborators (2001, 2006).

The basic idea in the perspective is that major losses challenge a person's sense of identity and narrative coherence. Narrative disorganization can range from the relatively limited and transient

to more sweeping and chronic, depending on the nature of the relationship and the circumstances surrounding the death. According to Neimeyer, a major task of grief involves reorganizing one's life story to restore coherence and maintain continuity between the past and the future. However, difficulties in establishing the role of meaning making in adjustment remain (e.g., studies have not always succeeded in separating the process from the outcome, beliefs from adjustment, or establishing the direction of causality among these factors). Others have distinguished two components of meaning making. Davis, Nolen-Hoeksema, and Larson (1998) identified two distinct processes, making sense of the loss and finding benefit, which entail distinguishable psychological concerns for the bereaved person, with, for example, the former diminishing in importance in time, while the latter grows stronger as time goes on.

### Stress and Coping Approach

Over the past two decades, a theoretical orientation referred to as the stress and coping approach, or the cognitive coping approach (Lazarus and Folkman 1984), has become highly influential in the field of bereavement. Stress and coping theorists maintain that life changes such as the death of a loved one become distressing if a person appraises the situation as taxing or exceeding his or her resources. An important feature of this model is that it highlights the role of cognitive appraisal in understanding how people react to loss. A person's appraisal, or subjective assessment of what has been lost, is hypothesized to influence his or her emotional reaction to the stressor and the coping strategies that are employed. To explain why a given loss has more impact on one person than another, stress and coping researchers have focused on the identification of potential risk factors, such as a history of mental health problems, as well as protective factors, such as optimism or social support (for a review, see Hansson and Stroebe 2007; Pearlman et al. 2014; Stroebe et al. 2006, 2007). The appraisal of the loss, as well as the magnitude of

physical and mental health consequences that result from the loss, are thought to depend on these factors.

### Caregiving and Bereavement

As most deaths in late life are preceded by chronic illnesses, family members, in particular spouses, are often involved in prolonged periods of caregiving in the years, months, or weeks before their loved one's death. Therefore, conceptual thought that considers the specific case of bereavement after caregiving is particularly relevant to the topic of late life loss. Three major lines of thought derived from stress theory have emerged in the literature (for a review, see Boerner and Schulz 2009; Schulz et al. 2008) regarding bereavement in the context of caregiving. The cumulative stress perspective, or "wear and tear" hypothesis, argues that the combined effects of the stress of caregiving and the death deplete people's coping resources and result in greater adjustment difficulties following the loss. The stress reduction perspective makes the opposite prediction, arguing that the death brings relief because it puts an end to caregiving stressors and the suffering of the person who is dying and so results in more positive bereavement outcomes than found among non-caregivers. Finally, it has been suggested that caregivers more or less expect to be bereaved, which in turn allows at least some degree of anticipatory processing and preparation that may benefit the person after the death.

When all three perspectives are considered, the emerging picture seems to be a combination of depletion, relief, and anticipation effects (Schulz et al. 2008). For example, once the death occurs, the caregiver may feel extremely exhausted, but at the same time relieved that his or her loved one no longer has to suffer and that the immense strain of the caregiving role has ended and also may have had a chance to think about the impending death and their life afterward, possibly have a conversation with the loved one about these topics, and take care of some pragmatic necessities related to the death (e.g., financial planning, funeral arrangements).

The bulk of research studies to date indicate that many caregivers experience some sort of stress relief and/or benefit of anticipation rather than a depletion of their resources or at least that the first can outweigh the latter. However, bereavement outcomes following caregiving may also depend on how the loved one's end-of-life phase was experienced. For example, spouses of patients who died while on hospice care lived longer than spouses of patients who did not use hospice (Christakis and Iwashyna 2003). In contrast, family members were found to have poorer mental and physical health outcomes when aggressive treatments were performed at the patient's end of life (Wright et al. 2008). Besides consideration of such quality of life indicators characterizing the time preceding death, there is evidence that previous notions of anticipatory grief have been based on largely unfounded assumptions of the benefits of anticipatory grieving for post-death adaptation. Rather, findings have linked higher levels of pre-loss grief to higher levels of post-death grief (Liu and Lai 2006). This corresponds with the more general finding in the bereavement literature that those who experience high levels of distress before the death are also at risk of adjustment difficulties post-death (Bonanno et al. 2002; Schulz et al. 2006).

### **Bereavement-Specific Theories**

Much of the theorizing discussed above involved conceptual models that could be applied to bereavement, but they were not developed specifically to account for people's reactions to the death of a loved one. For example, the stage model by Kübler-Ross was developed to describe the experience of dying persons, Bowlby's attachment model was originally designed to explain distress resulting from mother-infant separation, trauma theories addressed the case of various traumatic experiences, and the stress and coping approach dealt with any type of stressor. While coping with the death of a loved one has elements of all these areas, one could argue that there may be unique coping challenges that do not apply in

the same way to other life experiences and that we therefore also need models specifically focusing on bereavement.

Two theoretical models reflecting this aspiration are Bonanno's four-component model (Bonanno and Kaltman 1999) and Stroebe and Schut's (1999, 2010) dual-process model. Bonanno's goal was to develop a conceptually sound and empirically testable framework for understanding individual differences in grieving. He identified four primary components of the grieving process – the context in which the loss occurs (e.g., was it sudden or expected, timely or untimely?), the subjective meanings associated with the loss (e.g., was the bereaved person resentful that he or she had to care for the loved one prior to the death?), changes in the representation of the lost loved one over time (e.g., does the bereaved person maintain a continuing connection with the deceased?), and the role of coping and emotion regulation processes that can mitigate or exacerbate the stress of loss. Bonanno's model makes the prediction that recovery is most likely when negative grief-related emotions are regulated or minimized and when positive emotions are instigated or enhanced (Bonanno 2001). This hypothesis, which is diametrically opposed to what would be derived from the psychodynamic approach, has generated considerable interest and support in recent years.

The dual-process model of coping with bereavement (DPM; Stroebe and Schut 1999, 2010) indicates that following a loved one's death, bereaved people alternate between two different kinds of coping: loss-oriented coping and restoration-oriented coping. While engaged in loss-oriented coping, the bereaved person focuses on and attempts to process or resolve some aspect of the loss itself. Dealing with intrusive thoughts about the death is an example of loss-oriented coping. Restoration-oriented coping involves attempting to adapt to or master the challenges inherent in daily life, including life circumstances that may have changed as a result of the loss. Examples of restoration-oriented coping include distracting oneself from the grief, doing new things, or mastering new skills. Stroebe and Schut have proposed that bereaved individuals

alternate between loss- and restoration-oriented coping and that such oscillation is necessary for adaptive coping. Hansson and Stroebe (2007) applied the DPM to the experience of bereavement in late life, cataloguing specific difficulties for older persons (such as the increased frequency and cumulative impact of multiple bereavements in the loss-oriented sphere and physical impairment, which may prevent the bereaved from carrying out the tasks that the deceased had taken care of, in the restoration-oriented sphere).

## Outlook

Today, the fundamental question facing bereavement theorists and researchers alike is the following: Why is it that some older adults are completely devastated by the death of a spouse, while others seem to emerge – sometimes after a period of intense suffering – relatively unscathed or even ultimately strengthened by what has happened? As noted above, accumulating evidence regarding variability in response to loss led researchers to move away from traditional grief models and instead employ frameworks, such as the stress and coping approach, Neimeyer's focus on meaning making, Bonanno and Kaltmann's four-component model, and the dual-process model, developed by Stroebe and Schut, each of which can account for divergent responses to loss. Drawing from these models, investigators are trying to identify risk and protective factors that influence the nature and course of grief following spousal loss. Below, we provide a brief summary of selected new directions that we think should be pursued to refine and expand conceptual thought in the field of bereavement.

To date, most of the bereavement literature has focused on adaptive processes within – rather than between – individuals. An intriguing question, however, is what happens to larger social units, such as families, when group members experience a shared loss in different ways (e.g., one family member expresses intense distress, whereas another shows less distress)? In such a case, would those who are more distressed be likely to benefit from the presence or availability of the less

distressed person? Or would the lack of congruence in the experience of individual members lead to a mismatch and potential interference of coping efforts? Future work addressing these questions would make an important contribution because people rarely face a loss in a social vacuum (Stroebe et al. 2013). Theoretical models that do not address interpersonal processes in grieving lack this vital component of coping with loss.

A related, also understudied, social context topic is the role of cultural influences on grief and bereavement. Ethnicity and cultural background have been found to be related to bereavement outcomes. For example, in a cross-cultural study, Chinese participants seemed to recover more quickly from bereavement emotionally compared to US Americans, but they also reported more somatic complaints (Bonanno et al. 2005). Culturally shaped spiritual convictions may also have an impact on how individuals deal with loss. For example, for a person who believes that life is suffering and death is transcendence, as seen in Zen Buddhism, the experience of loss may be easier to bear. There may also be culture-specific implications of particular losses. For example, in many cultures, losing one's husband involves loss of respect and basic human rights, which is likely to make coping more difficult, in particular for cohorts of older women who were not in a position to develop an autonomous lifestyle or status. Exploring in more detail whether and how the meanings associated with response to loss vary by culture might help us to gain a better understanding of the influence of culture-specific factors such as attitudes and expectations toward loss experiences.

Biological aspects of adaptation to a major loss could also be more important than expected so far (Curtis and Cicchetti 2003). There is some evidence for persistent alteration of stress mechanisms and brain functioning from early trauma. Early life stress apparently produces a sensitization of the cortical corticotropin-releasing neuronal system and the hypothalamic-pituitary-adrenal axis stress response, as well as structural and functional changes in the brain. Further, recent research has identified neurophysiological mechanisms linking stress to various negative

consequences with respect to the immune, gastrointestinal, and cardiovascular systems (O'Connor 2013). Using physiological methods and the means of brain research could enrich ongoing efforts in psychosocial research on bereavement. Finally, combining physiological and psychosocial factors into more complex models to predict reactions to loss might allow us to better understand why some people are devastated by a loss like the death of a spouse, while others weather this kind of life event well or even experience positive development or personal growth in the context of major loss.

Theoretical advancement through more active consideration of areas such as interpersonal and physiological processes, as well as cultural influences, has the potential to deepen our understanding of grief and bereavement. This is particularly important for the case of complications in grieving. However, while recognizing symptoms of complications in grieving is critical to identifying individuals who are at risk for poor bereavement outcomes that persist over time so that adequate support sources can be allocated, the focus on symptom alone does help us understand why a person's response to loss may develop into a derailed adaptation process and perhaps even how this development could be prevented. Therefore, continued conceptual development in the field of bereavement is a vital effort.

## Cross-References

- ▶ [Late Life Transitions](#)
- ▶ [Stress and Coping in Caregivers, Theories of](#)
- ▶ [Stress and Coping Theory in Geropsychology](#)
- ▶ [Widowhood in Late Life](#)

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## Health and Retirement Study, A Longitudinal Data Resource for Psychologists

Amanda Sonnega and Jacqui Smith  
Health and Retirement Study, Survey Research  
Center, Institute for Social Research, University  
of Michigan, Ann Arbor, MI, USA

### Synonyms

Aging cohort; Health; Longitudinal; Nationally  
representative data; Retirement

### Definition

Psychologists are discovering opportunities to explore complex questions using large datasets. This chapter describes and illustrates the value of the Health and Retirement Study (HRS), a nationally representative multidisciplinary dataset on aging in the USA featuring a rich blend of economic, health (including genetics and biomarkers), cognition, and psychosocial information.

### Introduction

Psychologists are increasingly using population-based multidisciplinary survey data to examine

questions about health and aging. A major data resource that may be less well known to psychological research scientists is the Health and Retirement Study (HRS). HRS is a nationally representative longitudinal study of more than 37,000 individuals aged 50 to 100+ (and deceased) from about 23,000 households in the USA. The survey, which has been fielded every 2 years since 1992, was established at the direction of the US Congress to provide a national resource for data on the changing health and economic circumstances associated with aging. HRS was the first longitudinal study of older people to collect detailed economic and health information in the same study (Juster and Suzman 1995). The goal was not only to build our understanding of aging but also to provide scientific data for studying national-level social and policy changes that may affect individuals. Indeed, the data are often used to study the effects and implications of different public policies. Thus, the topics covered include resources for successful aging (e.g., economic, public, familial, physical, psychological, and cognitive), behaviors and choices (e.g., work, health behaviors, residence, transfers, use of programs), and events and transitions (e.g., health shocks, retirement, widowhood, institutionalization).

HRS has rich longitudinal measurement of several domains – income and wealth; health (including biomarkers and genetics), cognition, and use of health care services; work and retirement; and family connections – linked to various

external sources of mortality, pension, Social Security, and medical care data. Since 2006, HRS participants have also reported on personal evaluations of their life circumstances, subjective well-being, lifestyle, and stress. The blend of economic, health, and psychosocial information in the HRS provides unprecedented potential to study increasingly complex questions about adult behavior and aging. In addition, HRS has become the model for a network of harmonized longitudinal studies of aging around the world, offering the opportunity for valuable cross-national comparisons (see Cross-Reference for examples).

Most of the data are public and are available at no cost to all registered users. Sensitive health data (such as genetic information) and restricted data (such as Social Security and Medicare records) require a separate application process that is detailed on the website. HRS is a large and very complex dataset. Various resources for getting started using the data are available on the website, and a free online help desk is offered for all users: [hqsquestions@umich.edu](mailto:hqsquestions@umich.edu). To increase the accessibility of this rich data resource, researchers at the RAND Corporation have created a user-friendly version of much of the HRS public data. The RAND contribution is available through the HRS website and is a good starting place for new users. Visit the HRS website ([hrsonline.isr.umich.edu](http://hrsonline.isr.umich.edu)), especially under the documentation link, for more information on all of the topics addressed in this chapter.

This chapter describes the HRS study design and provides descriptions of content in areas of particular relevance to geropsychologists including cognition and depression, physical health and limitations, anthropometric measures and physical performance, biomarkers and genetics, and psychosocial functioning. It also illustrates the potential of these data for psychological research.

## Study Design

### The Sample

Recruited in 1992, the original HRS cohort included individuals born 1931–1941, then

aged 51–61. The Asset and Health Dynamics Among the Oldest Old (AHEAD) study was fielded the next year to include the cohort born 1890–1923, then aged 70 and older. The two studies merged in 1998, and in order to make the sample fully representative of the US population over age 50, two new cohorts were enrolled, the Children of the Depression Age (CODA), born 1924–1930, and the War Babies, born 1942–1947. To keep the sample representative of the population over age 50, HRS refreshes the sample every 6 years with younger cohorts not previously represented. In 2004, Early Baby Boomers (EBB, born 1948–1953) were added, and in 2010, Mid Baby Boomers (MBB, born 1954–1959) were added. In 2016, the Late Baby Boomers (born 1960–1964) will be added. With all of these cohorts, in 2014 HRS includes a wealth of information about the life histories of older Americans over the last 100 years.

The HRS sample is based on a multistage area probability design involving geographic stratification and clustering and oversampling of African-American and Hispanic individuals. Sample weights are derived and provided to account for differential probability of selection and differential nonresponse in each wave (Heeringa and Connor 1995). To determine eligibility for the study, interviewers conduct a brief household screening interview. Adults over age 18 living in the household are listed with their age and couple status. A primary respondent is randomly selected from all age-eligible household members, and if the selected person is coupled, their spouse or partner is also recruited to the study, regardless of age. Household screening efforts have been conducted in 1992, 2004, and 2010. The core survey occurs every 2 years, making 2014 the twelfth follow-up of the initial 1992 participants.

Baseline response rates range from 81.6% to 69.9% more recently. While baseline response rates have been somewhat lower in recent years following national trends, follow-up response rates have remained high, ranging from 85% to 90%. Follow-up rates are based on the sample for which interviews were attempted. At each follow-up, interviewers attempt to locate the entire

sample that participated at baseline. If a respondent is not interviewed in one wave, he or she is contacted again in the next. Complete response rates and sample sizes for each cohort are detailed elsewhere (Sonnega et al. 2014).

### Special Design Features

HRS has several design features that enhance potential for psychological research. First, African-American and Hispanic households are oversampled at about twice the rate of whites, proportional to the US population. Ofstedal and Weir (2011) show that HRS has been successful at recruiting and retaining minority participants. In 2010, the minority sample from the Baby Boom cohorts was further increased by a supplemental screening effort. This increases opportunities for important subgroup analyses.

Second, as noted above, HRS enrolls both members of coupled households. In single households, respondents answer all questions. In coupled households, each member of the couple is designated as either a financial or family respondent. Questions about housing, income, and assets are asked of the financial respondent, and questions about family composition and transfers are asked of the family respondent. Individual responses are sought from both partners in a household about work, health, disability, cognitive status, and well-being. Likewise, psychosocial measures are collected individually for both members of the couple. Thus, HRS provides exceptional opportunities for dyadic analysis.

Third, when respondents are unable or unwilling to complete an interview by themselves, HRS interviewers seek a proxy respondent. Proxies are usually a spouse or other family member. In each wave, about 9% percent of interviews are conducted with a proxy respondent, about 18% for those who are 80 and older. Proxy interviews succeed in retaining individuals who are cognitively impaired, reducing attrition bias due to cognitive impairment in a study of aging individuals (Weir et al. 2011).

Fourth, HRS samples community-dwelling individuals in the first wave of data collection. However, respondents who move to nursing

homes after baseline are interviewed there. The result is that HRS now fully represents the US nursing home population. Among other things, this means that research can address the functioning and well-being of the oldest old. Finally, HRS monitors vital status through its own efforts to locate respondents and through linkages to the National Death Index. In addition, in the event of respondent death, HRS attempts an “exit” interview with a surviving spouse, child, or other informant to obtain information about medical expenditures, family interactions, disposition of assets following death, and other circumstances during the final stages of life.

### Data Collection

In HRS, the baseline (initial entry) interview is conducted in the respondents’ home face to face (FTF) every 2 years. It takes approximately 3 h to complete and constitutes the bulk of the data. The sample size is around 20,000 at any given wave. At the end of this core interview in every wave, there are 10 or so experimental 3-min modules that provide greater depth on a topic that is in the core or information on a topic that is not in the core but may be of interest. Each module is completed by a different random subsample of the core sample. Module sample sizes are about 1,500. Some psychosocial content is available in modules.

Prior to 2004, the primary mode for follow-up interviews was telephone, except for respondents over the age of 80 who are always offered FTF follow-up interviews. Since 2006, HRS has utilized a mixed-mode design for follow-up interviews in which a random half of the sample is assigned to an in-home FTF interview that is enhanced with physical and biological measures and a psychosocial questionnaire. The other half of the sample completes only the core interview mostly by telephone (again, those over 80 are offered FTF interviews). The half-samples alternate waves so longitudinal information from the enhanced FTF (EFTF) interview is available every 4 years at the individual level, and the expanded content is available at every wave on a nationally representative half-sample. Beginning in 2010, the EFTF begins with the baseline

**Health and Retirement Study, A Longitudinal Data Resource for Psychologists, Table 1** Timeline for collection of psychosocial data in HRS

							Planned	
	Prior	2004	2006	2008	2010	2012	2014	2016
Core sample	*+	+	+	+◆	+◆	+◆	+◆	+◆
EFTF sample			A	B	A	B	A	B

\* Various sample modules, + indicators of depression, ◆ single-item life satisfaction, *A* first random half sample, *B* second random half sample, *NB* physical measures and biomarkers also follow this timeline beginning in 2006

interview and alternates waves from that point on. Table 1 graphically portrays the design of the EFTF.

Finally, to expand data collection at lower cost and respondent burden, HRS also conducts studies in the off years from the core survey. These studies are fielded in subsamples as Internet-based surveys, mailed paper-and-pencil questionnaires, or in-home assessments. Sample sizes for these studies range from approximately 3,000 to 5,000 respondents. Some studies took place only once; others are biennial studies of varying duration.

**Linkages to Administrative Records**

HRS attempts to obtain permission from all HRS respondents to access and link their HRS survey data to their Social Security earnings and benefit records and from Medicare-eligible respondents to their Medicare records. Linkage consent rates range from 78% to 84%. In addition, HRS attempts to obtain a wide range of pension plan information from respondents’ current and past employers. Finally, health care utilization and other data from the Veterans Affairs (VA) health care system are linked to HRS respondents who have self-reported prior military service and have received VA health care. All of these sources of linked data not only provide validation of self-reported information but also add information not collected from respondents in the survey. These sources of linked data are made available to researchers under restricted data use agreements.

**Study Content**

Survey content from the 2010 wave of data collection, which is generally representative of the core interview, is summarized elsewhere

(Sonnega et al. 2014). This section highlights portions of the core survey that may be of particular interest to geropsychologists, specifically cognition, depression, physical health, and limitations. It also covers anthropometrics, physical performance, biomarkers, genetics, and psychosocial information, which are all obtained in the EFTF interview. Where available, associated HRS user guide/documentation reports are cited for content areas discussed in this section.

**Cognition and Depression**

From the beginning of the study, HRS researchers embraced a broad definition of health to include aspects of mental health and cognitive functioning. Measures of cognitive functioning included in most waves of HRS since 1992 include ten-word immediate and delayed recall to assess memory; a serial seven’s subtraction test of working memory; counting backward to assess attention and processing speed; object naming test to assess language; and recall of the date, president, and vice-president to assess orientation (Ofstedal et al. 2005). Information from these survey measures is summarized as a composite score ranging from 0 to 35 where a higher score indicates better cognitive functioning. This composite measure has been widely used to study trajectories of cognitive functioning.

An HRS supplemental study, the Aging, Demographics, and Memory Study (ADAMS), is an in-home neuropsychological assessment designed to provide a diagnostic determination of dementia or cognitive impairment without dementia (Heeringa et al. 2009). The study aimed to estimate the prevalence of dementia as well as risk factors and outcomes. ADAMS was

conducted in a subsample of the HRS population age 71 and older who would be at higher risk for cognitive impairment. The original sample of 1,770 was followed up through in 2002, 2006, and 2008, providing information on incident dementia and other longitudinal cognitive changes.

From its inception, HRS has included a short screening measure of depressive symptoms derived from the Center for Epidemiologic Studies Depression Scale (Steffick 2000). Beginning in the third wave, a short form of the World Health Organization's Composite International Diagnostic Interview was also administered. This scale determines a probable diagnosis of major depressive episode, as defined by the *Diagnostic and Statistical Manual of Mental Disorders*, third edition revised.

#### Physical Health and Limitations

At each wave, HRS assesses a range of health conditions. The survey asks respondents if a doctor has ever (or since the last wave) told them that they have high blood pressure, diabetes, cancer, lung disease, heart disease, stroke, and arthritis. For each of these conditions, respondents also report on whether they are taking any medications for that condition (Fisher et al. 2005). Questions are also included about symptoms such as pain, swollen ankles, headaches, vision, and hearing. The study also tracks several critical health behaviors. Respondents report on their use of alcohol, history of smoking, their sleep quality, and amount of exercise. Preventive health services assessed include mammography screening, breast self-exam, prostate exam, cholesterol screening, Pap smear, and flu shot (Jenkins et al. 2008).

HRS also captures information about physical limitations by asking respondents to report on difficulties with activities of daily living (ADLs) such as bathing, eating, dressing, walking across a room, and getting out of bed. Instrumental activities of daily living (IADLs) include preparing a meal, shopping, using a telephone, taking medication, and handling money. Limitations with these fundamental life tasks can indicate fairly severe disability. The third set of measures, the Nagi items, evaluate less fundamental tasks

including things like jogging a mile, walking up a flight (or several flights) of stairs, pushing a heavy object across the floor, and picking up a coin. These series of questions also include questions about respondents' receipt of help from other people with each of these activities and the use of assistive aids (e.g., walking stick). This section reflects the assumption that respondents need not be asked about relatively easy tasks if they reported being able to do more challenging tasks (Fonda and Herzog 2004).

#### Anthropometric Measures and Physical Performance

As noted above, the enhanced FTF interview includes physical tests and collection of biological specimens. HRS employs a set of standardized assessments of lung function (peak expiratory flow), grip strength, balance, and walking speed. Arterial blood pressure and pulse are also measured, and height, weight, and waist circumferences are obtained. Before each measure, respondents are asked whether they understand the directions for the measurement and if they feel safe completing it. If the respondent answers no to either question, the measure is not administered. Likewise, interviewers are instructed not to administer a measure if they do not feel it is safe to complete it (Crimmins et al. 2008).

#### Biomarkers and Genetics

Blood is obtained through fingerprick and is collected in the form of dried blood spots during the EFTF interview. Blood samples have been assayed for five biomarkers: total and HDL cholesterol, glycosylated hemoglobin (HbA1c), C-reactive protein (CRP), and Cystatin C, for which data from the 2006 and 2008 waves are currently available for analysis (Crimmins et al. 2013).

Respondents' saliva is obtained for DNA extraction. HRS saliva samples are genotyped by the Centers for Inherited Disease Research (CIDR) and archived with the database of Genotypes and Phenotypes (dbGaP) at the National Institutes of Health (NIH). To date, HRS has genotyped almost 20,000 respondents from 2006 to 2012. The genotype data through 2008 and a

limited set of phenotype measures have been deposited in dbGaP. In addition, HRS has prepared candidate gene and single-nucleotide polymorphism (SNP) files to provide access to carefully select subsets of the HRS genotype data available on dbGaP. These are smaller and more manageable files designed for users interested in a specific gene or SNP. Researchers wishing to use the HRS genetic data must first apply to dbGaP for access to the genotyped data. The process to request access to any dbGaP study is done via the dbGaP authorized access system. HRS also measures average telomere length using quantitative PCR (qPCR). The 2008 Telomere Data release includes average telomere length data from samples from 5,808 HRS respondents. These data are considered sensitive health data and require permission to use. Detailed access information can be found on each product's page on the HRS website.

### Psychosocial Functioning

Table 1 depicts the psychosocial content available in the core survey and in the Participant Lifestyle Questionnaire (PLQ), a questionnaire left behind at the end of the EFTF interview that respondents complete and return by mail. As noted above, HRS has included measures of depressive symptoms and probable depression in the core survey since the second wave (section D in the core). As of 2008, all participants in the core are also asked a single item of life satisfaction (section B in the core). Before 2004, HRS piloted several psychosocial measures that are available as part of experimental module data. In 2004, HRS piloted the PLQ and fielded the revised questionnaire in 2006.

The table also illustrates the design of the EFTF, which was described previously. Beginning in 2006, half of the core sample was randomly selected to participate in the EFTF and receive the PLQ (A). The other half of the sample received that EFTF in 2008 (B). The first longitudinal data from the EFTF and thus the PLQ were collected from half-sample A in 2010. Longitudinal data was collected in 2012 from the second half-sample (B). This rotational design will continue in future waves. Note that this table applies

as well to other data collected as part of the EFTF interview, namely, anthropometrics and physical functioning, biomarkers, and genetics.

As with the core survey, in coupled households, both members of the couple complete the PLQ, and in some cases, the questionnaire is completed by a proxy. A question at the end of the survey asks, "Were the questions in this booklet answered by the person whose name is written on the front cover?" Approximately 1–2% of psychosocial questionnaires are completed by proxy respondents. A caregiver often acts as a scribe for very old participants, especially if the participant is vision impaired or finds it difficult to hold a pen due to arthritis. Because the questionnaire was left with respondents at the end of the EFTF interview for them to complete and mail back to study offices, the questionnaire came to be known as and is referred to on the HRS website as the Leave-Behind and is listed as section LB.

This section describes the psychosocial measures available within each broad content area (summarized in Table 2). Some of the scales and measures in the PLQ are well known and widely used. Others are measures that have been developed by HRS researchers or other research psychologists. More detailed information about the scales and measures through 2010 is provided in the documentation report/user guide available on the HRS website (Smith et al. 2013). The user guide lists the actual items in the questionnaire and reports the response coding and interitem consistency (reliability) information. Variations in variable names across waves are also noted. With a few exceptions, the content of the PLQ did not change substantially from 2006 to 2010; however, variations across waves are documented in the user guide.

### Subjective Well-being

Well-being is assessed with several measures. Life satisfaction is measured with the five-item Diener Satisfaction with Life Scale, an established and reliable measure of subjective well-being that has been used extensively in international comparative studies (Diener et al. 1985). Domain satisfaction is assessed with seven items that tap satisfaction in several life domains: housing, city

**Health and Retirement Study, A Longitudinal Data Resource for Psychologists, Table 2** Summary of HRS psychosocial content

Well-being	Lifestyle	Social relationships
Life satisfaction	Activities in life	Spouse/child/kin/friends
Domain satisfaction	Neighborhood evaluation	Positive support
Depression	Religiosity	Negative support
Positive/negative affect	Discrimination	Closeness
Hedonic well-being	Lifetime traumas	Loneliness
Purpose in life	Early life experiences	Early parental relationships
Self-acceptance	Stressful life events	Friend contact
Personal growth	Ongoing stress	Child contact
Financial strain		
Personality	Work	Self-related beliefs
Extraversion	Work stress	Personal mastery
Neuroticism	Work discrimination	Perceived constraints
Openness	Work satisfaction	Hopelessness
Agreeableness	Capacity to work	Subjective age
Conscientiousness	Effort-reward balance	Perceptions of aging
Cynical hostility	Work support	Subjective social status
Anxiety	Work/family priorities	Optimism
Anger	Work/life balance	Pessimism

or town, daily life and leisure, family life, financial situation, health, and overall life satisfaction (Campbell et al. 1976). Positive and negative affect is assessed with an adjective checklist (e.g., afraid, upset, determined, enthusiastic, guilty, active, etc.) largely derived from the Positive and Negative Affect Schedule – Expanded Form (PANAS-X) (Watson and Clark 1994). Some items were obtained from other researchers’ work in this area of study (Carstensen et al. 2000). The Ryff Scales of Psychological Well-being (Ryff 1995) includes a seven-item subscale that measures purpose in life. The 2006 version of PLQ also included the dimensions of self-acceptance and personal growth. Beginning in 2012, the PLQ includes a measure of hedonic well-being, which asks respondents to rate how much they experienced seven different emotions

(happy, interested, frustrated, sad, content, bored, or in pain) while they were watching TV, volunteering, exercising, other health-related activity, commuting, socializing, spending time with spouse/partner, or running errands (Smith et al. 2014). A standard item of financial strain (Campbell et al. 1976) was added in 2008 that asks respondents how difficult it is to make monthly bill payments. As noted, depression is captured in the core interview.

**Lifestyle and Stress**

Activities in life assess the level of social engagement and participation across a range of 20 different activities (e.g., attending religious services, caring for others, work on a hobby or project, etc.) (Jopp and Hertzog 2010). Another set of questions has respondents evaluate the physical disorder (vandalism/graffiti, rubbish, vacant/deserted houses, crime) as well as the social cohesion/trust (feel part of this area, trust people, people are friendly, people will help you) of their neighborhood (Mendes de Leon et al. 2009). A four-item measure of religious beliefs, meaning, and values is used (Fetzer Institute 2003). Two dimensions of discrimination are evaluated. A six-item scale measures the hassles and chronic stress associated with perceived everyday discrimination (Williams et al. 1997), followed by ten potential attributions for discrimination such as age, race, weight etc. (Kessler et al. 1999).

Assessment of lifetime traumas asks about the experience of seven major lifetime traumas from an ongoing longitudinal study of the health consequences of trauma in older adults (Krause et al. 2004). From the same study, early life experiences assess traumatic experiences before age 18 (repeating a year of school, trouble with the police, parental physical abuse, and parental drug or alcohol abuse). Recent stressful life events (last 5 years) include three items related to unemployment, moving to a worse neighborhood, experiencing robbery or burglary, and being the victim of fraud (Turner et al. 1995). The 2006 PLQ included assessment of chronic stressors that includes eight ongoing problems such as financial strain, housing problems, and work difficulties (Troxel et al. 2003).



### Quality of Social Ties

A series of questions evaluates respondents' social network (four questions ask respondents if they have spouses/partners, children, family, and friends) and the level of closeness they feel and amount of contact they have with those contacts (Turner et al. 1983). For each category of contact, seven questions assess perceived social support or relationship quality (positive and negative). Loneliness is assessed in 2008 and 2010 using an 11-item scale developed by Hughes et al. (2004) for use in large-scale surveys. The first three items of the scale only are in the 2006 PLQ. The 2008 and 2010 PLQ include two items that assess the quality of early parental relationships (Rossi 2001).

### Personality

The "Big Five" personality dimensions of neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness are assessed with 31 descriptive adjectives. The 2006 and 2008 PLQ used 26 items taken from the Midlife in the United States study (MIDUS) (Lachman and Weaver 1997). In 2010, four items derived from the International Personality Item Pool were added to expand coverage of conscientiousness. Cynical hostility is assessed with five items from the Cook-Medley Hostility Inventory (Cook and Medley 1954), which have been used in studies evaluating potential health consequences of hostility. Five items were selected from the widely used Beck Anxiety Inventory (BAI). The Beck Inventory has been shown to distinguish symptoms of anxiety from depression and to be valid for use in older populations (Beck et al. 1988). Finally, the State-Trait Anger Expression Inventory (STAXI) is used to measure state and trait anger (Forgays et al. 1998).

### Work-Related Beliefs

HRS uses a 15-item scale to capture job stress and job satisfaction among working respondents. Based on the demand/control model of stress (Karasek 1979) and items like those contained in the Quinn and Staines Quality of Employment Survey, items were chosen and adapted to assess

multiple facets of job satisfaction and multiple work stressors. An eight-item scale taps the experience of chronic work discrimination (Williams et al. 1997). Capacity to work measures the perceived ability to work with respect to a job's physical, mental, and interpersonal demands (Ilmarinen and Rantanen 1999). Two dimensions of work support are captured: three items evaluate coworker support and five items tap supervisor support (Haynes et al. 1999). Twelve questions assess work/life balance and priorities, the extent to which work has a positive and negative effect on one's personal life, and vice-versa (MacDermid et al. 2000).

### Self-Related Beliefs

HRS assesses personal control with five widely used items that measure the extent to which individuals feel they are in control of their lives. Similarly, mastery is assessed with a commonly used five-item scale that assesses personal agency and self-efficacy (Pearlin and Schooler 1978; Lachman and Weaver 1998). Hopelessness is measured with two items from Everson et al. (1997) and two items from Beck et al. (1974). Subjective age is very simply measured by asking respondents, "Many people feel older or younger than they actually are. What age do you feel?" (Kastenbaum et al. 1972). An eight-item scale (Lawton 1975) taps into individuals' evaluation of the experience of aging and their positive and negative perceptions of their aging. HRS utilizes the MacArthur Scale of Subjective Social Status based on Cantril (1965). The measure shows respondents a graphic depiction of a ladder with 10 rungs and asks them to place an x on where they are on the ladder of social status. Dispositional optimism and pessimism are assessed with the widely used Life Orientation Test (Scheier et al. 1994).

### An International Model

HRS has also become the model for a network of 30 other international studies of aging (see Cross-References). HRS supports the development of

these surveys through technical assistance, interviewer training, and collaboration. These surveys not only provide data for individual countries but also offer the opportunity for cross-national comparisons. The Gateway to Global Aging Data (G2G) is a useful resource for researchers interested in cross-national data, also available through the HRS website. G2G provides interactive tools that allow researchers to find comparable questions across the surveys ([www.g2gaging.org](http://www.g2gaging.org)).

## Research Examples

Researchers are now using this wealth of data to investigate a wide range of topics in geropsychology. The value of the cross-national psychosocial data is illustrated in a study comparing the patterns of disability in the USA and the UK (Clarke and Smith 2011). Older adults in the USA report a very high sense of personal control, whereas older adults in the UK are much more likely to feel that events in life are not always under their control. The study finds much lower disability rates for older US adults with a high sense of personal control compared to their counterparts in the UK. Another study compares cognition in the USA and the UK and finds that older adults in the USA score much better than English adults on a measure of cognition despite the fact that they have more risks for heart disease and other diseases that may lead to poorer cognitive function (Langa et al. 2009). The study shows that American adults tend to be wealthier and better educated and have less depression, which accounts for some of the US cognitive advantage. They are also more likely to be taking medications for hypertension, which may also help cognitive function.

Investigators are beginning to realize the benefits of HRS couples data. For example, Roberts et al. (2009) investigate the impact of conscientiousness on health in older couples. While most research demonstrates that a conscientious personality is associated with a range of positive health outcomes, this study explores the potential impact of an individual's conscientiousness on his

or her spouse or partner's health, what they call compensatory conscientiousness. They show that having a conscientious partner is health enhancing regardless of personal conscientiousness. Similarly, a longitudinal analysis of personal and partner optimism shows that having an optimistic spouse or partner is beneficial for health beyond the positive impact of personal optimism (Kim et al. 2014).

Lastly, Ailshire and Crimmins (2011) examine the social relationships, feelings of loneliness, and satisfaction with life and the aging experience among the oldest old (age 90–104) and older adults (age 70–79). The oldest old report a higher level of social support and maintenance of social relationships with family and friends compared to the 70–79-year-olds. Despite this, the oldest old reported greater loneliness, likely associated with higher rates of widowhood. The older group reported greater life satisfaction overall but more negative perceptions of their aging.

## Conclusion

In sum, HRS is a representative sample of the US population over age 50, reinterviewed biennially throughout their lives. HRS encompasses a wide range of multidisciplinary content, and new data on biomarkers and psychosocial factors makes it a potent resource for psychologists interested in the modeling of causal pathways to health and well-being.

## Cross-References

- ▶ [China Health and Retirement Longitudinal Study \(CHARLS\)](#)
- ▶ [English Longitudinal Study of Aging \(ELSA\)](#)
- ▶ [Irish Longitudinal Study on Ageing \(TILDA\)](#)
- ▶ [Older People and Their Psychological Well-Being in Japan, Evidence from the Japanese Study of Aging and Retirement \(JSTAR\)](#)
- ▶ [Korean Longitudinal Study of Ageing \(KLoSA\): Overview of Research Design and Contents](#)

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## Health Consequences of Smoking and Benefits of Smoking Cessation in Older Adults

Brent Mills<sup>1,2,3</sup> and Eimee Villanueva<sup>1</sup>

<sup>1</sup>Palo Alto University, Palo Alto, CA, USA

<sup>2</sup>Veterans Affairs Palo Alto Health Care System, Palo Alto, CA, USA

<sup>3</sup>Sierra Pacific Mental Illness Research Education and Clinical Center, VA Palo Alto Health Care System, Palo Alto, CA, USA

### Synonyms

Cigarette use; Older adults; Smoking; Tobacco use

## Definition

Smoking is the process by which an individual inhales the smoke of burning tobacco through cigarettes, cigars, or pipes. Smoking can also occur by inhaling vapor infused with nicotine via electronic cigarettes. Individuals who engage in this behavior by inhaling smoke or vapor through the direct source are considered active smokers. Those who breathe in the residual fumes released by active smokers are passive smokers, also called secondhand smokers (Samet 2001; Groner et al. 2011).

Smoking behaviors vary across cultures and age cohorts. It has come under much scrutiny over the decades with voluminous amounts of literature documenting its adverse effects. Chronic cigarette smoking is linked to several physical health conditions for the elderly, which impact longevity and quality of life (Samet 2001; Groner et al. 2011; Rezzani and Rodella 2012; Cataldo 2007; Jha et al. 2013). Additionally, this behavior is associated with diminished cognitive capabilities (Durazzo et al. 2010). These well-documented disadvantages of smoking have paved the way for anti-smoking campaigns highlighting the short- and long-term health benefits of smoking cessation.

## Prevalence Rates of Older Adult Smokers

Current data looking at age cohort tobacco usage show a gradual decline in the prevalence of cigarette smoking across age groups in the United States over the past few decades (US Department of Health and Human Services 1990). Little statistical data is available regarding the number of current older adult smokers. However, past data from the 1999 Surgeon General Report indicated 10.5% men and 10.7% women aged 65 and older were current smokers. This statistic has since dropped, and in 2001, the CDC reported approximately 8.8% of older adults aged 64 and older are smokers. Another research indicates that smoking has declined for this population because of increased smoking cessation but also because of the relatively high mortality rates smokers experience versus never smokers (Burns 2000). However, this number has remained

fairly consistent since then. In 2008, the American Lung Association reported that more than 17 million Americans who are at least 45 years old are currently smokers. Of that 17 million, approximately 9% of Americans aged 65 and older currently smoke tobacco (American Lung Association 2015).

## Tobacco Smoke

There is a multitude of health effects associated with the long-term use of tobacco. The etiology of the detrimental health effects is due to the toxicity of the smoke inhaled by users. Tobacco cigarettes are composed of several additive compounds, such as tobacco, paper, and various organic materials (Samet 2001). When flames ignite a cigarette, the resulting smoke is comprised of a multitude of toxic chemicals, such as carbon monoxide, nicotine, acetaldehyde, hydrogen cyanide, benzene, benzo(*a*)pyrene, and several other harmful compounds and carcinogens (Samet 2001). There are two types of tobacco smoke: sidestream smoke and mainstream smoke. Sidestream smoke is the smoke that is released from the burning end of the cigarette. This type makes up approximately 85% of tobacco smoke released (Groner et al. 2011). Mainstream smoke is what is inhaled and exhaled by the active smoker and accounts for the remaining 15% of tobacco smoke. Substantial data has been collected to identify the composition of mainstream smoke (the smoke that is breathed). They have found that nearly 4,000 constituents have been found to make up mainstream smoke. Further data has shown that 400 chemical compounds are present in both mainstream smoke and sidestream smoke. For example, both forms of smoke contain carcinogens, mutagens, toxicants, and sensory irritants. Sidestream smoke, however, contains higher traces of toxic chemicals than mainstream smoke (Samet 2001; Groner et al. 2011).

## Physical Health Effects of Smoking

There are several physical health effects associated with chronic cigarette smoking that

significantly impacts older adults. An overwhelming amount of evidence suggests that smoking is linked as one of the most common causes of death in old age (Samet 2001). Furthermore, smoking is also associated with many ailments, disabilities, and chronic illnesses common in this age cohort (Rezzani and Rodella 2012). This section of this entry will describe some of the most common physical conditions older adults experience due to cigarette smoking. The most common types of ailments associated with prolonged smoking are cardiovascular complications, respiratory disorders, and cancer (Samet 2001; Rezzani and Rodella 2012).

### Cardiovascular Complications

There are several cardiovascular issues associated with tobacco use. These include coronary heart disease, strokes (cerebral vascular accidents), atherosclerosis (aortic aneurysm), and myocardial infarctions (heart attacks) (Samet 2001; Groner et al. 2011; Rezzani and Rodella 2012). These physical complications may occur as early as 40s or 50s, but are more commonly seen in populations 65 years and older (Rezzani and Rodella 2012).

Tobacco smoke has been causally associated with atherosclerosis (Samet 2001; Rezzani and Rodella 2012). This is a condition where the walls of the arteries narrow. There is also a considerable buildup of plaque within the arteries. Cigarette smoke also increases blood coagulation leading to a restriction of blood flow and an increased risk of blockages causing myocardial infarctions (Samet 2001). This greatly restricts blood flow causing certain areas of the heart and several other organs to be deprived of oxygenated blood. Tobacco smoke has been linked to several mechanisms of atherosclerosis, such as endothelial damage, increased proliferation of vascular smooth muscle cells in lesions, and reduced levels of high-density lipoprotein cholesterol (HDL-C) (Rezzani and Rodella 2012). The damage to endothelial functioning is largely responsible for atherosclerosis. This cardiac condition can affect any artery within the body, which could lead to several different types of complications (Rezzani and

Rodella 2012). If there is a reduction of blood flow to your heart muscle, chest pains (angina pectoris) or heart attack may occur increasing the risk of mortality (Samet 2001).

Another cardiovascular risk associated with smoking is stroke. Cerebral vascular accidents occur when there is bleeding in the brain resulting in the brain tissue not receiving sufficient oxygen, ultimately leading to tissue damage or death (Samet 2001). The other way in which strokes occur is when a clot blocks an artery in the brain resulting in a restriction of blood supply to particular areas (Samet 2001; Rezzani and Rodella 2012). The three types of strokes are ischemic strokes, hemorrhagic strokes, and transient ischemic attacks (TIAs). Ischemic strokes are the most frequent type of stroke comprising approximately 85%. This stroke occurs when the arteries in the brain become blocked or narrowed by plaque, severely restricting blood flow. Hemorrhagic strokes are caused by ruptured arteries in the brain causing bleeding. The bleeding places a significant amount of pressure on brain cells, causing them to become damaged. Lastly, TIAs involve a temporary restriction of blood flow to the brain caused by blood clots or other matters. Smokers have a significantly high probability of experiencing one or more strokes.

Cardiovascular risks have also been identified with passive smokers. Research literature demonstrates that individuals exposed to secondhand smoke are at a 30–50% increased risk of experiencing acute cardiac syndrome compared to nonexposed individuals (Groner et al. 2011; Rezzani and Rodella 2012). While passive smokers are more likely to experience cerebrovascular disease, their tobacco smoke exposure is less than 1% that of active smokers consuming 1 pack per day (Groner et al. 2011; Rezzani and Rodella 2012). The best recommendation for these individuals is to limit exposure to secondhand smoke to limit damage to the cardiovascular system.

### Respiratory Complications

The most common respiratory complication associated with prolonged tobacco use is chronic

obstructive pulmonary disease (COPD). Tobacco usage is the leading cause of COPD (Anzueto and Martinez 2009). This respiratory disorder includes two conditions: emphysema and chronic bronchitis (Samet 2001). This respiratory condition is a progressive disease that restricts breathing, leading to excessive coughing, large amounts of mucus secretion, shortness of breath, chest tightness, and other symptoms (Samet 2001; Anzueto and Martinez 2009). Typically, these symptoms are also called the “smoker’s cough.” In emphysema, the alveoli (air sacs) within the lung walls are damaged, causing them to lose their normal shape (Anzueto and Martinez 2009). This damage also deteriorates the wall linings of these air sacs, causing them to decrease in quantity within the lungs. This results in a decreased amount of oxygen getting absorbed into the bloodstream. Repeated irritation and inflammation of the airway linings are characteristic of chronic bronchitis, resulting in thickened airway linings (Samet 2001). This causes the body to secrete mucus in the airways, which makes it more difficult to breathe. Emphysema and chronic bronchitis commonly co-occur when an individual is diagnosed with COPD.

Since COPD is a progressive respiratory condition, those afflicted can expect for the condition to continue to worsen over time (Anzueto and Martinez 2009). It develops slowly, and people may notice that they slowly are having more difficulty with tasks they used to perform with ease (Samet 2001). In the later stages of this disease, basic activities, such as bathing, cooking, and walking, might prove too difficult for people to perform on their own (Samet 2001). It is common with individuals diagnosed with COPD to constantly feel as though they are suffocating. Due to the slow development of this disease, it is commonly diagnosed in middle-aged individuals and older adults. The prognosis is poor for both age groups, but the elderly are at greater risk for mortality (Samet 2001; Anzueto and Martinez 2009).

Older adults with COPD are at a greater risk of respiratory infections, such as the common cold or flu (Samet 2001). These respiratory infections are the leading cause of death among older adults with COPD. In general, a number of cohort studies

found that mortality from respiratory infections is higher in smokers compared to nonsmokers (Samet 2001). Unfortunately, there is no cure for COPD and the damage inflicted on the lungs is permanent. The main goal of treatment symptom relief is to slow down the progression of the disorder, preventing respiratory infections and trying to keep those afflicted active (Anzueto and Martinez 2009). Medications, such as steroids and bronchodilators, can be absorbed into the lungs via inhalers. These medications relax the muscles in the airway and reduce inflammation making it easier to breathe. In a recent study, 22,000 elderly COPD patients given steroid treatment were shown to have a reduced risk of readmissions to hospitals and decreased mortality rates (Anzueto and Martinez 2009). Surgical procedures may be necessary for air passage complications that restrict inhalation. This includes creating a hole in the neck and trachea of COPD patients in order to maintain appropriate breathing. In severe COPD cases, oxygen therapy can help patients breathe better by directly giving them oxygen through a mask or nasal prongs. This treatment is especially crucial in these severe cases because it helps these individuals perform more activities with symptom reduction, improves sleep quality, protects the heart and other organs, and increases longevity (Anzueto and Martinez 2009). Treatment of this disease is crucial because COPD accounts for nearly 80,000 deaths per year in the United States (Samet 2001).

## Cancer

*Lung Cancer.* The most common health association people make with smoking is lung cancer. A significant amount of evidence draws causal associations of cigarette smoke to this type of cancer. The carcinomas develop in the respiratory airways and alveoli of the lungs when cigarette smoke deposits the carcinogens during smoking inhalation (Samet 2001; Shames et al. 2008). When the cancer cells grow, they produce the symptoms associated with the condition and eventually spread to other areas of the lung or surrounding body tissues creating more

physiological damage (Samet 2001; Shames et al. 2008). Cells located within the lung airways of smokers show mutations causing them to become cancerous. The primary carcinogen in cigarettes, benzo(a)pyrene, binds to the *p53* gene, which has been found to be mutated in smokers with lung cancer (Samet 2001; Shames et al. 2008). Data has shown that there are specific differences in the patterns of mutations of smokers compared to nonsmokers (Samet 2001). Lung cancer has one of the highest mortality rates of any type of cancer, with approximately 13% of patients surviving 5 years post-diagnosis (Samet 2001). Studies additionally show causal associations of developing lung cancer with prolonged tobacco usage. It is estimated that there is a tenfold increased risk for tobacco smokers to develop lung cancer compared to nonsmokers. Studies have also found that the amount of cigarettes smoked per day and duration of smoking are associated with different lung cancer risks (Samet 2001). Specifically, higher doses and longer duration were associated with more aggressive forms of cancer and an earlier diagnosis than those who consume cigarettes on a less frequent basis (Shames et al. 2008). Data also provides benefits of smoking cessation, with the risk considerably decreasing following smoking cessation.

*Laryngeal Cancer:* Laryngeal cancer results from damage to the vocal cords. This cancer manifests similarly to lung cancer in the sense that the carcinogens infused in the smoke attach to the fibrous structures of the vocal cords, which closely resemble lung cells, allowing the cell mutations to begin (Samet 2001). Common early symptoms of this type of cancer are coughing, vocal hoarseness, and coughing blood. This type of cancer is less virulent, and most cases can be treated with surgical removal of affected areas combined with a course of radiation treatment. Similar to lung cancer, cohort studies have shown that developing this type of cancer is highly associated with tobacco smoking (Samet 2001). It has been found that a higher proportion of males develop this type of cancer due to smoking compared to females. It has also been observed that certain lifestyle choices, combined with cigarette smoking, increase one's risk of

developing this type of cancer. Specifically, individuals with heavy chronic alcohol consumption and that smoke are at greater risk of developing laryngeal cancer (Samet 2001). Similar to lung cancer, individuals who restrict their cigarette usage or completely quit greatly decrease their risk of getting this type of cancer.

*Oral and Esophageal Cancer:* Oral cancer is localized to the mouth and the throat. It is typically caused by squamous cancer cells, which grow on the surfaces of the oral cavity. Tobacco smoke creates nonmalignant lesions called leukoplakia within the mouth (Samet 2001). With continued cigarette smoking, the carcinogens in the smoke lead to genetic mutations in the oral cells, causing the cancer. In the mouth, the initial symptoms of oral cancer might arise as aching lumps, which might bleed. Recovery rates for this type of cancer are high and treatment is typically surgical removal of cancerous cells. This however might result in permanent disfigurement (Samet 2001). Esophageal cancers are also mostly caused by squamous carcinomas, similar to oral cancer, and their growth in the esophagus causes throat blockages. Data demonstrates that smokers are at a nearly five times as likely of developing this type of cancer compared to lifelong nonsmokers (Samet 2001).

## Cognitive Effects of Smoking

While it has been established that smoking adversely affects the physical health of older adults, how does it impact their mental thinking skills? There are several consequences associated with chronic cigarette smoking that impair cognitive processes. There is a substantial amount of research on the effects of smoking on a disease that is almost exclusively experienced by older adults: Alzheimer's disease (AD). Literature has consistently demonstrated that smoking is a risk factor related to AD (Durazzo et al. 2010; Chang et al. 2014). For a long time, there was conflicting evidence as to whether smoking was associated with the development of this disease, but with more epidemiological studies and brain imaging surfacing, tobacco use is correlated with AD

(Chang et al. 2014). Imaging studies have found that there is a strong correlation between chronic smoking and reduced gray matter densities and volumes in brain regions highly associated with AD (Chang et al. 2014). Smoking also plays a role with another neurodegenerative disease affecting older adults closely related to AD: vascular dementia.

The direct health effects of cigarette smoking on the heart have already been established. These serious cardiac issues are sometimes accompanied by neurological decline related to heart complications (Chang et al. 2014). Vascular dementia is a neurodegenerative disease where one experiences declining abilities in various cognitive domains following certain cardiac episodes (Chang et al. 2014). The extent of the cognitive decline is strongly associated with the severity and type of cardiac episode. Cognitive changes are mostly observed following a stroke, but cognition changes also accompany damage to blood vessels and reduce blood circulation. Smoking, high blood pressure, and high cholesterol are the biggest risk factors for developing vascular dementia.

There has been substantial data looking at smoking and how it correlates with Parkinson's disease (PD) (Chang et al. 2014). Results show that there are possible protective factors of cigarette smoking with PD. Past research has shown that there is possibly a 50% reduction of developing PD in chronic smokers (Chang et al. 2014). It is hypothesized that the protective effects come from the nicotine in cigarettes. Specifically, it is thought that nicotine can slow the production of a protein responsible for creating Lewy bodies within the brain: alpha-synuclein. Studies have found that chronic cigarette smokers had reduced Lewy-related pathology (Chang et al. 2014).

Smoking has also been found to decrease cognitive functioning unrelated to neurodegenerative diseases. Most of the research done in this area has concentrated on middle-aged or older adults (Durazzo et al. 2010). Data demonstrates that older adults who have been smokers for the majority of their lives are at risk of experiencing decline in certain neurocognitive domains. The

various cognitive domains are important for daily functioning and maintaining independence. It is common to see age-related decline in nearly all domains, but research shows that people with any history of cigarette smoking had diminished overall cognitive functioning (Durazzo et al. 2010). Despite achieving poorer scores on measures of global cognitive functioning, there is one area of cognition that is more affected by smoking than others (Durazzo et al. 2010). Some research has found that current older adult smokers demonstrated an abnormal decline in auditory-verbal memory, meaning they had difficulty recalling verbal details after a delay (Durazzo et al. 2010). This provides evidence that smoking cigarettes can impact parts of a person's memory functioning.

### **Demographic and Social Contributors to Smoking**

There are several demographic and social factors that influence smoking rates and maintenance in older age. Statistics of current smokers demonstrate that the prevalence rates in that population demographic decline as one approaches old age (Wray 2007). More specifically, as smokers approach old age (65 years and older), the likelihood of adult smokers quitting as they enter old age increases mostly due to the risk of mortality and health issues. Another reason for this decline is due to smoking-related mortality in middle-aged adults. Even though the current rates of quitting smoking between younger adults and older adults are the same, older adults are more likely to quit smoking cigarettes altogether compared to their younger counterparts (Wray 2007). While health issues are a large contributing factor to the decrease in smoking trends as one progresses toward old age, there are other contributing factors.

One research study discovered that nearly half of older adults in the United States (44%) are former smokers (Wray 2007). Looking at current trends, there are factors that are associated with higher rates of smoking as one enters old age. Statistics have found that the majority of smokers

in older adults are men, while women make up the majority of nonsmokers within this age demographic (Wray 2007). Differences have also been found between different races. European American, Hispanic, and Asian men had the lowest smoking rates compared to African American and American Indian men. Similarly, American Indian women had the highest rates of smoking, while Caucasian women were least likely to currently smoke cigarettes (Wray 2007).

Other factors that impact whether one continues smoking into old age are their economic and relationship status. Older adults with a higher social status are more likely to have never smoked or be past smokers compared to those in lower socioeconomic statuses. For example, since the 1960s, literature shows that individuals graduating from college are associated with quitting cigarettes at significantly higher rates than those only graduating from high school (Wray 2007). Marital status also plays into whether smoking persists into old age. Specifically, single older adults are more likely to be smokers than married older adults (Wray 2007).

One more factor that is correlated with higher smoking in older adults is physical activity level. Literature has demonstrated that the health, activity, and smoking status are correlated. Specifically, it has been observed that older adults currently smoking cigarettes are less likely to engage in physical activity (Wray 2007). These rates are amplified if the current smoker has completed less years of education and is experiencing multiple physical health complications (Wray 2007).

### Smoking Cessation and Health Effects

The information presented in this entry indicates that smoking in the older adult population is certainly a health issue. Smoking can be hazardous to health, but for older adults, smoking is associated with poorer quality of life, which includes deficits or a decrease in mobility, increased stress, decrease in happiness, and dissatisfaction in social

relationships (Cataldo 2007). Thus, smokers who are at least 65 years of age are at higher risk of death compared to nonsmokers in the same cohort (Samet 2001; Rezzani and Rodella 2012). Additionally, older adult smokers are at an increased risk of clinically significant cognitive decline (Durazzo et al. 2010; Chang et al. 2014). Smoking cessation is not always easy and there are a number of barriers to quitting among older adults. For many older adults, smoking has been a lifelong habit that cessation may be challenging at the least. This difficulty may be due to psychological effects of addiction to nicotine or an inability to imagine life smoke-free (Appel and Aldrich 2003). Older adults who do decide to begin cessation may encounter barriers to doing so successfully, such as cravings, loss of pleasure from smoking, symptoms of anxiety such as feeling tense and irritable, boredom, fear of failing to successfully quit, difficulty concentrating, and altered sleep (Orleans 1988). Other obstacles to initiate cessation include misinformation about the process, incorrect beliefs regarding smoking and cessation, and nicotine addiction (Appel and Aldrich 2003). Long-term smokers who decide to undergo smoking cessation may also experience some nicotine withdrawal symptoms such as anxiety, irritability, and anger, which may influence their quality of life and ability to continue cessation and completely quit (US Department of Health and Human Services 1990). However, a number of health benefits can be gained from smoking cessation. Some research posits that older adults are often motivated to seek smoking cessation for better health but also from social pressure. Thus, medical providers should take care to inform and educate the elderly about smoking and smoking cessation because of the frequency in which older adults make contact with their physicians (Kehlet et al. 2015).

One of the major benefits to smoking cessation is an increased life expectancy of 2 years for men and 3.7 years for women (Taylor et al. 2002). With added longevity, there is also the potential for an overall increase in quality of health and changes in quality of life. Individuals who are able to engage

in smoking cessation often find improvements in sleep, reduced pain, and increase in energy (Goldenberg et al. 2014). Smokers who suffer from cardiovascular disease and are able to quit reduce their risk of suffering from recurrent myocardial infarction. Smoking cessation can result in a reduced risk of cardiovascular disease, especially if one has not already acquired the disease, reduced risk of developing lung and other cancers, and a slower reduction in pulmonary function in general (Samet 2001; Groner et al. 2011; Rezzani and Rodella 2012; Anzueto and Martinez 2009; Shames et al. 2008). After a year of abstinence from smoking, an improvement in lung function is evident (Burns 2000) which can equate to a greater capacity and tolerance for exercise. A decreased risk of hospitalization for smoking-related issues including COPD also occurs with smoking cessation (Samet 2001; Anzueto and Martinez 2009). This decrease in hospitalizations allows individuals to stay home longer resulting in less family stress and improved interpersonal relationships. Smoking cessation may also lead to increase sense of self-control and a boost in self-esteem (Taylor et al. 2002).

Improvements in health continue long after smokers quit. Individuals who have successfully quit smoking will have a 30% decrease of cardiovascular mortality for every 5 years of sobriety (Mons et al. 2015). Such improvements are seen within the older adult population, as well. Older adults who quit smoking have a reduced risk of premature death, and those who stop smoking between the ages of 55 and 64 can expect to gain about 4 years of life (Jha et al. 2013; Sachs-Ericsson et al. 2009). Additionally, an added benefit of cessation is that individuals who quit cigarettes between 45 and 55 years old reduce the risk of mortality due to smoking-related disease (Jha et al. 2013).

## Conclusion

Chronic cigarette smokers expose their bodies to various toxic chemicals and carcinogens causing severe and, sometimes, irreparable damage to

their bodies and brains. Both active and passive smokers are at risk of developing several life-threatening medical issues that will not only impact their health but also their quality of life. It has been well established that chronic cigarette smoking leads to several physical conditions that are especially dangerous for the older adult age cohort. Cardiac complications include an increased chance of stroke and heart attack, along with blood flow irregularities. Older adults are also at risk of developing COPD, which severely restricts breathing and their quality of life. Older adult smokers are also susceptible to developing several different types of cancers. Smokers are also more likely to develop a certain neurodegenerative disease in later life, such as AD and vascular dementia, which will cause them to lose certain cognitive skills. The best way to promote good health and quality of life in old age is to abstain from smoking. Smoking cessation is shown to improve cardiac and respiratory health and can increase longevity by several years.

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## Health in Centenarians

Signe Hoei Rasmussen and Karen Andersen-Ranberg

Epidemiology, Biostatistics and Biodemography, Institute of Public Health, University of Southern Denmark, Odense C, Denmark

### Background

Extreme longevity has always fascinated mankind, as long-lived individuals were thought to hold the secrets of successful aging, i.e., aging without disease (Franceschi and Bonafe 2003). Many anecdotal descriptions supported this notion until the last quarter of the twentieth century, where the number of centenarians in the industrialized world increased exponentially (Vaupel 2010). The first centenarian studies embraced the successful aging theory and found centenarians to be exceptionally healthy. However, these studies were limited by selection bias, i.e., the more healthy centenarians were more likely to participate in research.

The idea of centenarians being living proofs of successful aging is in contrast to the knowledge that advancing age is associated with increasing morbidity and multimorbidity (Barnett et al. 2012). As both aging and illness result in a decline in physical health, centenarians ought to be more dependent on help than younger oldest-old. Centenarian studies from the last decade of the twentieth and the first decade in the twenty-first centuries have shown that there is more to it: centenarians can be healthy or unhealthy.

Investigating health in centenarians requires not only proper epidemiological methods but also consideration of the challenges related to this extreme age groups' high risk of suffering from disabling diseases. First, a representative sample drawn from a population register is desirable. Second, high participation rates are needed to avoid selection bias toward the more healthy centenarians. Third, personal interviews in the centenarian's domicile are better than telephone interviews or filling in postal questionnaires.

Fourth, self-reported, including proxy-reported, health information may suffer from information bias, recall bias, and desirability bias. Fifth, physician-reported health information and register-based health records are more valid and also less biased with respect to recall and socially desirable factors. Sixth, some conditions may have very few or subtle symptoms mimicking aging-associated declines and are therefore not recognized as potential diseases, e.g., myocardial infarction, which needs to be confirmed by an electrocardiogram (ECG). Seventh, very old and frail people, who include many centenarians, may be subject to less aggressive diagnosing, or even ageism, leading to underdiagnosing and undertreatment. Finally and eighth, as cognitive impairment is common in very old subjects, misreporting is likely.

The various studies describing health in centenarians differ with respect to sample size, sampling, and survey methodologies, which makes it difficult to overview the occurrence of diseases and functional health. For the purpose of this work, we mainly focus on larger and mostly population-based, cross-sectional centenarian studies. To interpret the reported findings, the survey methods of the selected studies are described. In a second part, the results of each of the included studies are reported, although some studies have limited information on objective health. It should be noted that although dementia is a very common disease in very old people, it is not included here.

## Presentation of Centenarian Studies

(Survey year in parentheses)

### Earlier Centenarian Studies

It was not until the beginning of the 1960s, when centenarians became less rare in countries with low mortality, that it became possible to conduct descriptive surveys of centenarians, and since then many studies have appeared. Noteworthy are the pioneer studies in the 1960s by Haranghy (1965) and Franke et al. (1970). Later, i.e., in the 1980s, the remarkable second Hungarian

Centenarian Study (Beregi 1990) followed, which had a cross-disciplinary team of medical specialists who drove around in Hungary in a bus equipped to do extensive clinical examinations (e.g., chest X-rays). Unfortunately, the most frail centenarians were excluded from the study.

### The Finnish Centenarian Study (1991)

This study was the first to assess a nationwide birth cohort of centenarians identified in the national Central Person Registry (Louhija 1994). The study was carried out by a specialist geriatrician, who traveled around in Finland to visit the centenarians at their domicile. Totally, 185 centenarians from the birth cohorts born in 1891 and earlier were eligible, and 181 participated in the study yielding a participation rate of 79% (including in the denominator eligible subjects deceased before interview). Females comprised 84% of the population, and 97% of the study population participated in the clinical examination. During the visit, a health interview, blood sampling, and an objective clinical examination were obtained. The health interview encompassed a wide range of diseases, hospitalizations, use of medication, and activities of daily living (ADL), of which the basic ADL comprised three questions: (1) assistance in having meals, (2) assistance in standing up, and (3) assistance in getting dressed. A final question on the need of daily assistance was also incorporated. The objective clinical examination included an ECG and blood samples. The data were supplemented with health records from the primary health-care physician, and cancer diagnoses were obtained from the Finnish Cancer Registry.

### The Danish 1895 Birth Cohort Study (1995–1996)

A few years later, the first Danish Centenarian Study, also named the 1895 Birth Cohort Study, was launched and included only centenarians aged 100 years (Andersen-Ranberg et al. 2001). Eligible were birth cohort members born in April 1, 1895–May 31, 1896, who were consecutively visited at their domicile as they turned 100 years. This method was used to minimize selection bias toward the more healthy individuals. As in the

Finnish study, all centenarians were identified in a national Central Person Registry. Of the 276 eligible, 75% ( $n = 207$ ) participated in a personal interview at their domicile, which involved a health interview including ADL functions, and an objective clinical examination. Katz ADL (Katz et al. 1963) was used to assess basic activities of daily living, and the results were reported according to three groups: relatively independent (groups A–C), some dependency (groups D–E), or totally dependent (groups F–G) upon help. The objective examination also included an ECG, blood pressure measurement, and blood sampling. About three-fourths of the centenarians accepted to participate in the clinical examination. Supplementary health information was retrieved not only from primary care physicians but also from the national register of hospital discharge diagnoses (in existence since 1977) and the national Danish Cancer Registry (in existence since 1943).

#### **The Tokyo Centenarian Study (2000–2002)**

Japan has the highest proportion of centenarians in the industrialized world, and many centenarian studies have been carried out. One of the most recent, the Tokyo Centenarian Study, was conducted on centenarians aged 100–108 years identified in a residential list of the Tokyo area (Gondo et al. 2006; Takayama et al. 2007). Of the identified 1,735 centenarians, a random sample of 1,194 (70%) was invited to participate in the study. In a first round, a postal questionnaire was launched, in which 593 (43%) participated. In a second round, questionnaire participants were invited to a home-based interview conducted by health professionals. The participation rate dropped to 26% ( $n = 304$ ) of the originally eligible centenarians. The interview was carried out by a medical doctor, a psychologist, and a geriatric nurse and involved among others a health interview including functional ability, a broad range of diseases common in old age, and current medication. The clinical examination included blood pressure measurement ( $n = 253$ ; 21%), ECG, and blood sampling, but only results related to blood pressure have been reported.

This study used another ADL scale, the Barthel Index (Mahoney and Barthel 1965), to assess

activities of daily living, and included feeding, grooming, bathing, dressing, bowel function, bladder function, toilet use, transfers (from bed to chair and back), mobility, and walk on stairs. The index is divided into the following groups: (1) independent, Barthel score 80–100; (2) minimal help, Barthel score 60–79; (3) partially dependent, Barthel score 40–59; (4) very dependent, Barthel score 20–39; and (5) totally dependent, Barthel score < 20. Those who obtained a score below 60 were categorized as “totally dependent,” “very dependent,” and “partially dependent,” in contrast to a score of 60–100, which categorized centenarians into “minimal help” or “independent.”

#### **The Galician Longevity Study (2001)**

In 2001, a population-based study, from the province of Galicia, identified all 99-year-and-older persons in a central registry (Rabunal-Rey et al. 2012). Out of 84 eligible, 80 (95%) accepted the invitation of a home visit by a doctor and a nurse. The questionnaire included information on diseases and ADL functioning by the Barthel Index, as in the Japanese study. The objective examination included blood pressure measurement, blood sampling, and ECG.

#### **The Korean Centenarian Study (2005)**

The Korean Centenarian Study investigated factors associated with ADL dependency (Kim et al. 2012). This study included 796 participants aged 100 years or older and is thus the largest centenarian study. Subjects were drawn from a national census survey in November 2005 and surveyed by regional officials within a few months. Data were collected on several functional disabilities and health states, where health state would be defined by questions on having had eight specific diseases common in old age. The number of reported diseases was trichotomized into “0,” “1,” or “2 or more” diseases. The functional status was obtained by information on basic ADL according to the Katz Index (Katz et al. 1963), and participants were classified into two groups: disabled, i.e., participants reporting having difficulties, i.e., “cannot do it all without help” in one or

more of the ADL items, and those not disabled, i.e., “can do it with no difficulty or some difficulty.”

### **The Danish 1905 Birth Cohort Study (2005)**

This cohort study was launched by the same research group that launched the 1895 Birth Cohort Study 10 years earlier (Andersen-Ranberg et al. 2001). In the 1905 cohort, almost the same questionnaire was used (Engberg et al. 2008), but in contrast to the 1895 cohort, home-based interviews were carried out by trained interviewers from the Danish Institute of Social Research. Out of 364 eligible 100-year-olds, 225 (62%) participated. The 1905 cohort was initially surveyed at baseline in 1998 as 92–93-year-olds, and follow-ups were made in 2001, 2003, and 2005. All eligible birth cohort members were invited to participate in the 2005 survey irrespective of whether they had participated in the earlier waves or not. Activity of daily living was assessed by self-reported information on questions from a modified Katz ADL (Engberg et al. 2008), which used the same indexes as in the 1895 cohort: bathing, dressing, toileting, feeding, and getting up from a chair/bed but leaving out incontinence. For each item, the centenarian was scored to be either independent or dependent in carrying out that particular activity. Self-reported information on diseases and use of medications was also collected but has not been reported from the 2005 survey.

### **The Australian Centenarian Study (2007–2009)**

A different sampling procedure was employed in the Australian Centenarian Study. The investigators used a convenience sample of 188 centenarians (100+-year-olds) who were surveyed in 2007–2009 (Richmond et al. 2012). The in-home interview collected information on 14 specified common age-related illnesses, and functional level was assessed by Katz Index of ADL (Katz et al. 1963). For a subset of 142 centenarians living in aged care facilities, further health information was retrieved from medical records. In addition, a blood pressure was measured during the in-home interview.

### **The Health and Retirement Study (HRS) (2010)**

All data were retrieved from the HRS, a prospective US study on aging, which launched its first wave in 1993, and included a representative sample of noninstitutionalized (from 1998 also institutionalized) individuals aged 70 years and older. Follow-up interviews were made every second year. The study was from the 2010 wave, thereby including data from 1993 to 2010 (Ailshire et al. 2015). The response rate at baseline and at follow-ups was 83% and > 90%, respectively. A study sample was selected from the total number of respondents who were born in 1910 or earlier and had undergone at least one follow-up survey ( $n = 1,158$ ). Out of these, a distinction was made between the “nonsurvivors” and the “centenarian survivors.” The “nonsurvivor” group consisted of individuals who died before reaching the age 100 ( $n = 1,045$ ), and the “centenarian survivor” group included the population reaching the age of 100 ( $n = 113$ ). Centenarians who had been in the HRS for fewer than 3 years were excluded from the survivor group, leaving the current study sample at 96 centenarians (survivors). Health was assessed according to six specified age-associated diseases. Classification of survival pathways was defined by “survivors,” “delayers,” and “escapers,” as in the NECS (Andersen et al. 2012). But in this study, the classification was used not only with respect to morbidity profiles but also in relation to functional ability. The latter was being assessed by the Katz Index of ADL (Katz et al. 1963).

### **The Hong Kong Centenarian Study (HKCS) (2011)**

The Hong Kong Centenarian Study used a quota sampling method based on the density of 85+ -year-olds in 18 geographical areas. Centenarians were recruited through two different networks: a social and a clinical (Cheung and Lau 2015). In the social network, 628 letters of invitation were sent to various community centers for elderly, to home support teams, and to the University of the Third Age centers. By this approach, 200 near-centenarians and centenarians were reached, of which 56 accepted to participate (participation rate 28%). In the clinical network,

a database of the elderly health clinic helped identify 210 centenarians and near-centenarians, of which 97 participated (participation rate 46%) (Cheung and La 2016). An in-home or center-based interview of the total 153 participants aged 95–108 years old was carried out in 2011. The interview comprised, e.g., self-reported information on 30 common age-related diseases and functional ability assessed by Katz Index of ADL (Katz et al. 1963). Additionally, blood pressure and physical performance tests, e.g., handgrip strength, together with a venous blood sample were obtained.

### **The Spanish Centenarian Study (2011–2013)**

This study was also based on a convenience sample of centenarians recruited from nine Spanish centers, where they were hospitalized (Martínez-Sellés et al. 2015). Among the 118 100+-year-olds, 62% were included on the day of hospital discharge. The health interview focused on cardiovascular morbidity and was obtained by direct interview with subjects and caregivers. In addition, an objective clinical examination was carried out, including not only an ECG but also an echocardiography. Due to sampling frame being in hospitals, it is likely that these centenarians were biased toward the less healthy centenarians.

### **The New England Centenarian Study (NECS) (2011)**

The NECS is an ongoing study, which has enrolled centenarians since 1994 (Andersen et al. 2012). In the present study, data was based upon 1418 long-lived participants divided into three age groups: supercentenarians ( $n = 104$ ), semisupercentenarians ( $n = 430$ ), and younger centenarians ( $n = 884$ ). Moreover, a group of nonagenarians ( $n = 343$ ) and a control group consisting of 436 individuals aged 47–96 years old also participated. The data was collected from 1994 via telephone or postal questionnaires. The participants were followed for an average of 3 years (range 0–13 years). From 2003, an annual follow-up was initiated, and the last follow-up was in 2011.

The respondents reported on different age-related diagnoses (CVD, hypertension, cancer,

chronic lung disease (COPD), dementia, diabetes, osteoporosis, and stroke) and their approximate age of onset. The response rate was 83%.

Based on the abovementioned information on diseases, three morbidity profiles were created: “survivors,” “delayers,” and “escapers.” From the list of the age-related diseases, “survivors” were those participants diagnosed before age 80 with at least one age-related disease. “Delayers” encompassed those who were not diagnosed with at least one disease before at least attaining age 80 and before age 99, and the “escapers” included those who were diagnosed for the first time after turning 100 years or not at all.

ADL scores were collected from 91% of the participants ( $n = 1,605$ ) and were obtained by the Barthel Index in the same way as described in the Tokyo Centenarian Study (Mahoney and Barthel 1965).

### **The Swedish Centenarian Study (2011)**

About the same time, a population-based sample of Swedes born in 1911–1912 was surveyed with home-based interviews conducted by trained survey agency interviewers (Parker et al. 2014). The study population included an oversampling of male centenarians to compensate for their low proportion compared to their female peers. Of the eligible 360 centenarians, 76% ( $n = 274$ ) participated (including in the denominator eligible subjects deceased before interview). The representativeness of the sample is high with a participation rate of 76% but included a high level of proxy-reported information (41%). No clinical examination was done, but the interview included questions on symptoms, diseases, and activities of daily living.

## **Other Studies**

### **The Swedish Study on Medicine Prescription (2008)**

Medication can be used as a proxy for disease. A study based on a national Swedish register on prescription medicine was used to study the use of

medications of all Swedish centenarians born in 1908 or earlier (Wastesson et al. 2011).

From this summary of relevant studies published within the last 25 years and reporting cross-sectional results of the health of centenarians, it is quite clear that the employed methodologies and sampling procedures vary a lot. This is important to keep in mind when interpreting the reported results. Tables 1 and 2 give an overview of the various studies with respect to diseases and activities of daily living.

## Diseases and Functional Health

### The Finnish Centenarian Study (1991)

This relatively early study was one of the firsts to show that centenarians are not healthy survivors. The most common diagnosis group, cardiovascular diseases, was present in 70% (Louhija 1994). Hypertension was 19%, when defined by a measured systolic blood pressure of  $\geq 160$  mmHg and a diastolic blood pressure  $\geq 90$  mmHg. No information was given on the use of antihypertensives alone, but cardiovascular medication was used by 61%, and more among home-dwelling than among institutionalized. Based on ECG, 17% had atrial fibrillation/flutter, 10% had pathological Q-wave indicating prior myocardial infarction, and 11% had diabetes. Lifetime cancer prevalence, including low-grade malignant skin cancers, based on data from the Finnish Cancer Registry, was about 30%. No comorbidity data have been published.

Of the three basic ADL activities, 17% males and 31% females needed assistance in having meals, and 28% and 43% needed assistance in standing up, while 41% and 53% needed assistance in getting dressed, males and females, respectively. Overall, 55% of males and 60% of females needed some assistance daily. The male centenarians tended to have better functional health than women, but not statistically significant.

### The Danish 1895 Birth Cohort Study (1995–1996)

As in the Finnish study, a high prevalence of diseases and common chronic conditions was

identified among Danish centenarians (Andersen-Ranberg et al. 2001). Cardiovascular diseases were present in 72%, when including hypertension, while osteoarthritis in major joints was present in 54%. Hypertension ( $>140/>90$  mmHg) was present in 52%, chronic heart failure in 32%, ischemic heart disease in 28%, atrial fibrillation in 17%, and diabetes in 10%. Cardiovascular medications were the most frequently used (by 64% of participants). The majority of the study population ( $n = 144$ ) had between three and six comorbidities (defined as actual and chronic diseases). The mean number of comorbidities was 4.3.

The clinical objective examination included blood pressure measurement ( $n = 158$ ) and electrocardiogram ( $n = 142$ ). The results from the clinical objective examination showed higher prevalence of hypertension, atrial fibrillation, myocardial infarction, and ischemia of the heart when compared to physician-reported diagnoses. Disease prevalence based on self-report was even lower than physician-reported diagnoses (Andersen-Ranberg et al. 2013).

According to Katz ADL (Katz et al. 1963), 41%, 24%, and 35% were relatively independent (groups A–C), had some dependency (groups D–E), or were totally dependent (groups F–G) upon help. Only 12% could be classified as autonomous, i.e., being cognitively intact, relatively independent in Katz ADL, and noninstitutionalized. A significantly larger proportion of male centenarians were relatively independent in ADL. For the reason of comparison with the 1905 cohort study, this ADL scale was used in a modified form, and results are given later.

### The Tokyo Centenarian Study (2000–2002)

Japanese centenarians have self-reported hypertension as the most common disease affecting 64% (including measured hypertension ( $\geq 140/\geq 90$ )), followed by cataract (46%), heart disease (29%), gastrointestinal disease (21%), cerebrovascular disease (16%), respiratory disease (13%), renal disease (13%), non-skin cancer (10%), and diabetes (6%) (Takayama et al. 2007). Among those who had a blood pressure measured, 56% had a systolic blood pressure

**Health in Centenarians, Table 1** Profiles of morbidity

A						
	Finnish Centenarian Study (Louhija 1994)	Danish 1895 Birth Cohort Study (Andersen-Ranberg et al. 2001)	Tokyo Centenarian Study (Gondo et al. 2006; Takayama et al. 2007)	Galician Centenarian Study (Rabunal-Rey et al. 2012)	Korean Centenarian Study (Kim et al. 2012)	Danish 1905 Birth Cohort Study (Engberg et al. 2008)
<b>Survey period</b>	1991	1995–1996	2000–2002	2001	2005	2005
<b>Birth cohorts</b>	1889–1893	1895–1896	1893–1900	Earlier – 1902	Earlier – 1905	1905
<b>Age of part</b>	100+	100	100+	99+	100+	100
<b>Study type</b>	Pop.bas. cohort study	Pop.bas. cohort study	Pop.bas. random sample	Pop.bas. cohort study	Pop.bas. cohort study	Pop.bas. cohort study
<b>Participation rate (%)</b>	<i>n</i> = 181 (79%)	<i>n</i> = 207 (75%)	<i>n</i> = 304 (26%)	<i>n</i> = 80 (95%)	<i>n</i> = 796 (83%)	<i>n</i> = 225 (62%)
Method	SR, CE	SR, CE	SR, CE	SR, CE	SR	SR
IWER mode	IW	IW	PQ, IW	IW	IW	IW
<b>Diseases</b>						
Heart failure	60%	32%	n/a <sup>a</sup>	n/a <sup>a</sup>	n/a <sup>a</sup>	n/a <sup>a</sup>
Hypertension	19% <sup>b</sup>	52% <sup>c</sup>	64% <sup>c</sup>	26% <sup>d</sup>	n/a <sup>a</sup>	n/a <sup>a</sup>
MI (ECG based)	10%	10%	n/a <sup>a</sup>	16%	n/a <sup>a</sup>	n/a <sup>a</sup>
Atrial fibrillation	17%	17%	n/a <sup>a</sup>	26%	n/a <sup>a</sup>	n/a <sup>a</sup>
Diabetes	11%	10%	6%	13%	n/a <sup>a</sup>	n/a <sup>a</sup>
Stroke	8%	n/a <sup>a</sup>	16%	n/a <sup>a</sup>	n/a <sup>a</sup>	n/a <sup>a</sup>
Cancer, non-skin	11%	n/a <sup>a</sup>	10%	n/a <sup>a</sup>	n/a <sup>a</sup>	n/a <sup>a</sup>
Cancer, skin	19%	n/a <sup>a</sup>	n/a <sup>a</sup>	n/a <sup>a</sup>	n/a <sup>a</sup>	n/a <sup>a</sup>
Chron. lung	4%	n/a <sup>a</sup>	13%	n/a <sup>a</sup>	n/a <sup>a</sup>	n/a <sup>a</sup>
B						
	Australian Centenarian Study (Richmond et al. 2012)	HRS (Ailshire et al. 2015)	HKCS (Cheung and Lau 2015)	Spanish Centenarian Study (Martínez-Sellés et al. 2015)	NECS (Andersen et al. 2012)	Swedish Centenarian Study (Parker et al. 2014)
<b>Survey period</b>	2007–2009	2010	2011	2011–2013	1994–2011	2011
<b>Birth cohorts</b>	Earlier –1909	Earlier – 1910	1905–1915	1901–1911	n/a <sup>a</sup>	1911
<b>Age of part</b>	100+	100+	95+	100+	100+	100
<b>Study type</b>	Convenience sample	Pop.bas. cohort study	Community-based quota sample	Convenience sample	Pop.bas. cohort study	Pop.bas. random sample
<b>Participation rate (%)</b>	<i>n</i> = 188 (percentage not indicated for convenience samples)	<i>n</i> = 96 (≥83%)	<i>n</i> <sub>1</sub> = 56 (28%) <i>n</i> <sub>2</sub> = 97 (46%) <i>n</i> <sub>total</sub> = 153	<i>n</i> = 118 (percentage not indicated for convenience samples)	<i>n</i> = 1418 (≥83%)	<i>n</i> = 274 (76%)

(continued)



**Health in Centenarians, Table 1** (continued)

B						
	Australian Centenarian Study (Richmond et al. 2012)	HRS (Ailshire et al. 2015)	HKCS (Cheung and Lau 2015)	Spanish Centenarian Study (Martínez-Sellés et al. 2015)	NECS (Andersen et al. 2012)	Swedish Centenarian Study (Parker et al. 2014)
Method	SR	SR	SR	SR, CE	SR	SR
IWER mode	IW	IW	IW	IW	PQ	IW
<b>Diseases</b>						
Heart failure	31%	n/a <sup>a</sup>	7,2%	70% <sup>e</sup>	n/a <sup>a</sup>	n/a <sup>a</sup>
Hypertension	38% <sup>c</sup>	35% (at baseline) <sup>f</sup>	65% <sup>f</sup>	n/a <sup>a</sup>	n/a <sup>a</sup>	33% <sup>g</sup>
MI (ECG based)	n/a <sup>a</sup>	n/a <sup>a</sup>	n/a <sup>a</sup>	15%	n/a <sup>a</sup>	n/a <sup>a</sup>
Atrial fibrillation	n/a <sup>a</sup>	n/a <sup>a</sup>	n/a <sup>a</sup>	26%	n/a <sup>a</sup>	n/a <sup>a</sup>
Diabetes	10%	2% (at baseline)	13%	n/a <sup>a</sup>	n/a <sup>a</sup>	6%
Stroke	24%	6% (at baseline)	7%	15%	n/a <sup>a</sup>	n/a <sup>a</sup>
Cancer, non-skin	14%	n/a <sup>a</sup>	3%	n/a <sup>a</sup>	n/a <sup>a</sup>	n/a <sup>a</sup>
Cancer, skin	27%	n/a <sup>a</sup>	n/a <sup>a</sup>	n/a <sup>a</sup>	n/a <sup>a</sup>	n/a <sup>a</sup>
Chron. lung	24%	0% (at baseline)	9%	n/a <sup>a</sup>	n/a <sup>a</sup>	6%

Participation rate: The rate is calculated based on the entire eligible study population (included the ones who died during the survey period)

Method: *SR* self-reported, *CE* clinical examination

Interview mode: *PQ* postal questionnaire, *IW* interview questionnaire

*SBP* systolic blood pressure

*MI* myocardial infarction (defined by pathologic Q wave recorded on electrocardiogram)

<sup>a</sup>n/a not available

<sup>b</sup>  $\geq 160/\geq 90$  mmHg: only measured blood pressure

<sup>c</sup>  $\geq 140/\geq 90$  mmHg: measured and antihypertensive medication

<sup>d</sup>  $\geq 140/\geq 90$  mmHg: only measured blood pressure

<sup>e</sup>Based on echocardiography on a subsample ( $n = 55$ )

<sup>f</sup>Limit for hypertension not defined

<sup>g</sup>Results estimated on a graph

$\geq 140$  mmHg (Shimizu et al. 2008). Although medical medications acting on the cardiovascular system, including hypertension, were used by 43%, the reported higher proportion of cardiovascular diseases indicates that either Japanese centenarians are undertreated or their self-reported disease prevalence is overreported.

ADL assessed by the Barthel Index (Mahoney and Barthel 1965) showed that 34% were totally dependent, 15% very dependent, and 14% partially dependent and 13% needed minimal help, while 24% were independent in activities of daily

living (Gondo et al. 2006). All in all, 63% were in the category of being totally dependent, very dependent, and partially dependent, while less than 10% were totally independent. Males had significantly lower levels of dependency than females.

### The Galician Longevity Study (2001)

This study focused on objective examination on cardiovascular diseases and identified that 30% of centenarians suffered alone from ischemia and/or heart failure (Rabunal-Rey et al. 2012).

**Health in Centenarians, Table 2** Profiles of functional ability in basic activities of daily living

A						
	Finnish Centenarian Study (Louhija 1994)	Danish 1895 Birth Cohort Study (Andersen-Ranberg et al. 2001)	Tokyo Centenarian Study (Gondo et al. 2006; Takayama et al. 2007)	Galician Centenarian Study (Rabunal-Rey et al. 2012)	Korean Centenarian Study (Kim et al. 2012)	Danish 1905 Birth Cohort Study (Engberg et al. 2008)
<b>Survey period</b>	1991	1995–1996	2000–2002	2001	2005	2005
<b>Birth cohorts</b>	1889–1893	1895–1896	1893–1900	Earlier – 1902	Earlier – 1905	1905
<b>Age of part</b>	100+	100	100+	99+	100+	100
<b>Study type</b>	Pop.bas. cohort study	Pop.bas. cohort study	Pop.bas. random sample	Pop.bas. cohort study	Pop.bas. cohort study	Pop.bas. cohort study
<b>Participation rate (%)</b>	<i>n</i> = 181 (79%)	<i>n</i> = 207 (75%)	<i>n</i> = 304 (26%)	<i>n</i> = 80 (95%)	<i>n</i> = 796 (83%)	<i>n</i> = 225 (62%)
Katz	n/a <sup>f</sup>	Yes	n/a <sup>f</sup>	n/a <sup>f</sup>	Yes	Yes
Gr. A–C <sup>a</sup>		41%				
Score 5 <sup>b</sup>		14%				21%
Gr. D–E <sup>a</sup>		24%				
Score 3–4 <sup>b</sup>		42%				42%
Gr. F–G <sup>a</sup>		35%				
Score 0–2 <sup>b</sup>		45%				37%
Barthel < 60	n/a <sup>f</sup>	n/a	63%	46%	n/a <sup>f</sup>	n/a
Others	Disabled <sup>d</sup> 60% (F) <sup>c</sup> 55% (M) <sup>e</sup>				Disabled <sup>g</sup> 59%	
B						
	Australian Centenarian Study (Richmond et al. 2012)	HRS (Ailshire et al. 2015)	HKCS (Cheung and Lau 2015)	Spanish Centenarian Study (Martínez-Sellés et al. 2015)	NECS (Andersen et al. 2012)	Swedish Centenarian Study (Parker et al. 2014)
<b>Survey period</b>	2007–2009	2010	2011	2011–2013	1994–2011	2011
<b>Birth cohorts</b>	Earlier – 1909	Earlier – 1910	1905–1915	1901–1911	n/a <sup>f</sup>	1911
<b>Age of part</b>	100+	100+	95+	100+	100+	100
<b>Study type</b>	Convenience sample	Pop.bas. cohort study	Community-based quota sample	Convenience sample	Pop.bas. cohort study	Pop.bas. random sample
<b>Participation rate (%)</b>	<i>n</i> = 188 (percentage not indicated for convenience samples)	<i>n</i> = 96 (≥83%)	<i>n</i> <sub>1</sub> = 56 (28%) <i>n</i> <sub>2</sub> = 97 (46%) <i>n</i> <sub>total</sub> = 153	<i>n</i> = 118 (percentage not indicated for convenience samples)	<i>n</i> = 1,418 (≥83%)	<i>n</i> = 274 (76%)
Katz	Yes	Yes	Yes	Yes	n/a <sup>f</sup>	Yes
Gr. A–C <sup>a</sup>				42%		

(continued)



**Health in Centenarians, Table 2** (continued)

B						
	Australian Centenarian Study (Richmond et al. 2012)	HRS (Ailshire et al. 2015)	HKCS (Cheung and Lau 2015)	Spanish Centenarian Study (Martínez-Sellés et al. 2015)	NECS (Andersen et al. 2012)	Swedish Centenarian Study (Parker et al. 2014)
Independ. all items <sup>c</sup>			56%			
Gr. D–E <sup>a</sup>				21%		
Depend. 1–2 items <sup>c</sup>			32%			
Gr. F–G <sup>a</sup>				37%		
Depend. ≥3 items <sup>c</sup>			12%			
Barthel < 60	n/a <sup>f</sup>		n/a <sup>f</sup>	n/a <sup>f</sup>	n/a <sup>f</sup>	n/a <sup>f</sup>
Others	Katz mean score 3,65 (SD = 1,8)	24% “survivors” 58% “delayers” 18% “escapers”			n/a <sup>f</sup>	Disabled <sup>h</sup> 71% (F) <sup>e</sup> 52% (M) <sup>e</sup>

<sup>a</sup>Katz ADL: An index to rank individuals according to performance and using the categories, A, B, C, D, E, F, and G. The index summarizes overall performance in six basic ADL functions: bathing, dressing, feeding, transferring, going to the toilet, and continence. Gr. A–C, relatively independent; Gr. D–E, relatively dependent; Gr. F–G, very dependent

<sup>b</sup>Katz modified: 1 point for each of 5 items performed independently in Katz (bathing, dressing, toileting, transferring, feeding)

Range: 5 (independent in all items), 0 (dependent in all items)

<sup>c</sup>Katz ADL: six items (as in <sup>a</sup>Katz ADL). Independent = Gr. A; dependent one to two items = Gr. B–C; dependent ≥3 items = Gr. D–G

ADL Barthel: Score range, 100 (independent in all items), 0 (dependent in all items). A score below 60 indicates being partially, very, or totally dependent in ADL functions

<sup>d</sup>Disabled defined as needing daily assistance

<sup>e</sup>F female, M male

<sup>f</sup>n/a not available

<sup>g</sup>Based on Katz items but reported as “nondisabled” defined as “can do it with either no difficulty or some difficulty,” “disabled” defined as “cannot do it at all without help”

<sup>h</sup>Reported as needing assistance in B-ADL

Hypertension, defined as a measured blood pressure above >140/>90 mmHg, was identified among 26% centenarians but did not include subjects adequately treated with antihypertensives. By ECG examination, 26% suffered from atrial fibrillation, and 16% had a Q-QS pattern indicative of prior myocardial infarction. Only 8% had a normal ECG. Diabetes was present in 13%. Out of the 80 participants, 81% used a medication on a daily basis (mean 3.2 (SD 2.1); range 0–11). The Barthel score showed that 46% scored ≤ 60, i.e., being dependent on help.

### The Korean Centenarian Study (2005)

Although this large study had a main focus on functions, a count of diseases, which included heart diseases, hypertension, diabetes, stroke, liver diseases, dementia, osteoarthritis, and cancer, were also reported (Kim et al. 2012). A majority of 45% reported having no present disease, while 14% reported having two or more diseases. According to Katz Index of ADL (Katz et al. 1963), participants were divided into two groups, disabled or nondisabled. Almost three-fifths (59%) of Korean centenarians were disabled

and needed help with basic ADL. Female participants were significantly more disabled than males.

#### **The Danish 1905 Birth Cohort Study (2005)**

According to the modified Katz ADL, 21% women and 22% men were nondisabled (Engberg et al. 2008). The corresponding proportions for moderately disabled women and men, respectively, were 43% and 39% and, in severely disabled, 36% and 39%. There was no significant difference between genders. No results on morbidities have been published, but based on Danish nationwide hospitalization register data, in the period from 1977 to 2007 of all members of the 1905 birth cohort, those who attained the age of 100 had fewer hospitalizations at any age compared to those who died before the age of 100, thereby suggesting that centenarians in the past had fewer or less severe diseases compared to their cohort peers (Engberg et al. 2009).

#### **The Australian Centenarian Study (2007–2009)**

This study showed that the most prevalent self-reported conditions were ocular diseases identified in 71% (mainly cataracts), followed by arthritis (58%); hypertension (40%); heart disease, including angina, heart attack, cardiac arrhythmia, or congestive heart failure (31%); osteoporosis (28%); skin cancer (27%); and respiratory condition (including asthma, previous pneumonia, chronic obstructive pulmonary disease) (24%) (Richmond et al. 2012). Based on blood pressure measurements, about 33% had hypertension defined as  $\geq 140/\geq 90$  mmHg (Richmond et al. 2011). Including those who were under current antihypertensive treatment, the proportion rose to 38%. A history of cardiovascular disease (heart disease or stroke) was indicated by 29%. Activities of daily living were assessed by Katz (Katz et al. 1963), and a mean score of 3.65 (SD = 1.8) was reported (Richmond et al. 2011).

#### **The Health and Retirement Study (HRS) (2010)**

In parallel to the hospitalization register study in the 1905 cohort, the HRS study (Ailshire

et al. 2015) could show that those who survived to become centenarians (survivors) had significantly lower overall disease prevalence in the past compared to those who did not attain the age of 100 years (nonsurvivors), 35% and 43%, respectively. For the six diseases, only cancer was equally present in survivors and nonsurvivors, while heart disease, stroke, lung disease, and diabetes prevalences were significantly lower and hypertension was insignificantly lower. According to morbidity profiles, 56% were “survivors,” 21% “delayers,” and 23% “escapers.”

In terms of basic ADL functions, there was no difference in the average ADL score between nonsurvivors and centenarians at baseline.

#### **The Hong Kong Centenarian Study (HKCS) (2011)**

The most common diseases based on self-report were cataract (75%); hypertension (65%); heart disease, including coronary heart disease, irregularly irregular pulse, and congestive heart failure (28%); and diabetes (13%) (Cheung and La 2016). The mean number of age-related diseases was 2.9, and the Charlson Comorbidity Index, which covers serious health conditions, was 6.6 (Charlson et al. 1987).

Based on Katz Index of ADL (Katz et al. 1963), 56% were independent in all six items, while 32% and 12% were dependent in one to two items and  $\geq 3$  items, respectively.

#### **The Spanish Centenarian Study (2011–2013)**

This study focused on cerebro- and cardiovascular diseases, which were found to be prevalent in this convenience sample of centenarians recruited from hospitals. Reported heart failure was the most prevalent (34%), followed by stroke (15%) and myocardial infarction (13%) (Martínez-Sellés et al. 2015). Based on the objective clinical assessments, atrial fibrillation/flutter was identified in 26%, and 15% had a pathologic Q-wave indicating prior myocardial infarction. In a subsample ( $n = 55$ ), echocardiography showed diastolic dysfunction affecting almost 70% of the examined centenarians. Other very common echocardiographic conditions were left atrial enlargement (62%), left ventricular hypertrophy (45%), and moderate-severe pulmonary artery hypertension.

According to Katz index of ADL (Katz et al. 1963), 42% had minor or no dependency (group A–C) at all, and 21% were moderately dependent (group D–F), while 37% were totally dependent upon help (group G–H).

### **The New England Centenarian Study (NECS) (2012)**

The morbidity profiles in the age groups were determined by the age of onset of six age-related diseases (cancer, CVD, COPD, dementia, diabetes, and stroke) (Andersen et al. 2012). The prevalences of these diseases were not mentioned in the article. The results showed that the disease-free period (escapers) was extended in the highest ages compared to the younger groups. In the group of supercentenarians, 69% was escapers and, in the semisupercentenarian group and centenarian group, 56% and 30%, respectively.

The Barthel scores were higher at the time of inclusion among the supercentenarians than in the semisupercentenarian group. And the semisupercentenarians had a higher Barthel score than the centenarians. Men had significantly higher Barthel scores than women.

### **The Swedish Centenarian Study (2012)**

Based on self-report or proxy report, disease prevalence was high for cardiovascular diseases (42%) and for hypertension (about one-third) in Swedish centenarians (Parker et al. 2014). Diabetes prevalence and chronic lung disease were present in about 6% each. Disabling symptoms were very common: 60% reported pain in the musculoskeletal system, 44% complained about dizziness, 40% suffered from incontinence, and 31% from edema of lower extremities. According to Katz ADL assessment, about one-third were able to take a shower or bathing without any help. In all the other Katz ADL items, more than 50% could do them independently. A significant higher proportion of females (71%) needed help with basic ADL, compared to males (52%).

### **The Swedish Study on Medicine Prescription**

Of the total 1,775 100+-year-olds alive in Sweden in 2008, 94% ( $n = 1,672$ ) took a prescribed medication, and 60% of the study sample was

institutionalized. On average, the centenarians used 5.1 medications per person. Institutionalized centenarians used a median number of five drugs, whereas noninstitutionalized used a median number of four drugs. The most commonly used types of medications were high-ceiling diuretics (40% and 47%, community-dwelling and institutionalized, respectively), minor analgesics (25% and 49%), antithrombotic agents (38% and 35%), beta-blockers (22% and 15%), hypnotics/sedatives (29% and 36%), opioids (12% and 16%), medicine for peptic ulcer and gastroesophageal reflux (15% and 19%), and antidepressants (11% and 23%). Moreover, compared to equivalent data from octogenarians surveyed at the same time, centenarians used significantly more high-ceiling diuretics, potassium-sparing diuretics, analgesics (both minor and opioids), hypnotics/sedatives, and anxiolytics, while ACE inhibitors, beta-blockers, antithrombotic agents, and antidepressants were used significantly less.

## **Conclusion**

The centenarian studies described here show a huge variation in methodology, sample size, and survey design. This probably explains the variation in the results. However, based on those studies using the best survey methodology and the highest participation rates, which should minimize a selection bias toward the more healthy centenarians, it is clear that centenarians cannot be described as healthy even though only a limited range of diseases have been reported such as cardiovascular diseases (myocardial infarction, atrial fibrillation, stroke, and hypertension), cancer, diabetes, and chronic lung diseases. Of these, hypertension was the most prevalent affecting at least 50% when defined as having a high measured blood pressure ( $\geq 140/\geq 90$ ) or ongoing antihypertensive medication. Defined by self-reported hypertension alone or hypertensive blood pressure, measurement alone lowered the prevalence to about 25–30%. Also, objective signs of previous myocardial infarction were present in 10–16% and atrial fibrillation in 17–26%. It is important to note that the prevalence of atrial

fibrillation, myocardial infarction, and blood pressure measurement was higher in objective examinations compared to self-report, and it shows how important it is to include such examination when assessing the health of centenarians. Few studies have reported on other chronic and disabling somatic diseases than the previously mentioned, such as osteoarthritis, depression, incontinence, osteoporosis, and vitamin deficiencies, or on symptoms, such as pain, dyspnea, dizziness, poor vision, poor hearing, edemas in lower extremities, falls, and insomnia. Osteoarthritis affected more than half of the Australian and Danish centenarians, and more than 60% of Swedish centenarians reported pain in the musculoskeletal system.

Disability, assessed according to various definitions, affected about every second centenarian, and studies show quite similar proportions (50–60%). However, although similar they may not be directly comparable due to methodological discrepancies. Also, the comprehension of when a given physical ability is reduced to a level where it is perceived as a disability may vary according to sociocultural background. The unchanged high proportion of disabled centenarians observed over the course of the past 25 years should therefore not be interpreted as a constant condition, which cannot be improved. In fact, the comparison of two centenarian birth cohorts 10 years apart and from the same country and research unit, the Danish 1895 and 1905 Birth Cohort Studies, has shown an improvement in basic ADL functions in the most recent cohort, although only for women (Engberg et al. 2008). But whether this improvement was due to a cohort or a period effect could not be established. However, in a recent study comparing a 93-year-old of the 1905 birth cohort with a 95-year-old of a 1915 birth cohort, it was shown that the most recent cohort performed better than the former despite being 2 years older (Christensen et al. 2013). Interestingly, there was a parallel improvement in cognitive functions. Although this study was carried out in nonagenarians, the result is indicative of improving functional health in at least the nearest future cohorts of centenarians as well. Whether the same improvements will be seen with respect to

diseases remains to be seen. But in the meantime, it should not be forgotten that many centenarians are capable of living an independent life despite functional limitations and morbidities. This is, though, not to be interpreted as centenarians being healthy.

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## Health Promotion

Julia Alber<sup>1</sup> and Karen Glanz<sup>2</sup>

<sup>1</sup>Center for Health Behavior Research, Perelman School of Medicine, University of Pennsylvania, Philadelphia, PA, USA

<sup>2</sup>Perelman School of Medicine, University of Pennsylvania, Philadelphia, PA, USA

## Synonyms

Behavior change strategies; Health education; Promoting healthy behaviors

## Definition

Health promotion is “the process of enabling people to increase control over, and to improve, their health” (World Health Organization 2009). Health promotion involves the development of individual, institutional, community, and policy-level strategies to influence health-related behavior and, ultimately, to create environments supportive of health. Health promotion for older adults is often focused on the prevention and management of disability and chronic disease in order to improve health outcomes and quality of life for those aged 65 years and older. Increasing healthy life expectancy, or the expected number of remaining *healthy* years, in addition to extending life expectancy, is of primary concern in health promotion for older adults (Haber 2013).

## Introduction

The proportion of the population classified as “older adults” has increased dramatically in

recent decades. Globally, the number of older adults is expected to almost triple in the coming decades, increasing from an estimated 524 million in 2010 to 1.5 billion by 2050 (National Institute on Aging et al. 2011). Soon, for the first time in recorded history, older adults (65 years and older) will outnumber children under 5 years of age (National Institute on Aging et al. 2011). As the proportion of older adults increases, there is a concomitant shift in the leading causes of disability, disease, and death. Thus, there is a growing need for the development and implementation of strategies for the prevention and management of chronic diseases that are tailored to the specific needs of the aging population.

### A Brief History of Health Promotion

The twentieth-century introduction of the concept of health promotion can largely be attributed to the World Health Organization's 1984 release of the paper, *Concepts and Principles in Health Promotion* (World Health Organization 2009). This paper introduced a definition, key principles, priorities, and challenges in health promotion and led to the first International Conference on Health Promotion in 1986. Countries across the world came together to discuss future directions and, more importantly, to identify strategies for moving toward a new public health. Five key action areas were identified during this conference including to (1) create supportive environments, (2) build healthy public policy, (3) develop personal skills, (4) strengthen community action, and (5) reposition health services. While new factors have emerged since 1986, such as increased recognition of health inequalities, global environmental changes, urbanization, and new consumption and communication patterns, these five actions remain priorities in health promotion. Today, health promotion focuses on understanding the role of individual, community, environmental, and social factors in influencing and changing health behavior.

### Health and Health Behavior Among Older Adults

Promoting healthy aging involves addressing the various dimensions of health related to social,

physical, and mental well-being. These dimensions can interact and impact each other, as well as affect overall health. For example, research has established the existence of a bidirectional relationship between mental and physical health among older adults, where increases in physical activity correspond to improved mental health and vice versa (Steinmo et al. 2014). Successful health promotion involves understanding how each dimension impacts the others and also overall health.

Health promotion includes approaches for reducing lifestyle risk factors (e.g., smoking) and increasing healthy behaviors (e.g., physical activity). Because older adults are at increased risk for chronic disease and certain geriatric conditions, targeting behaviors that directly relate to these conditions is crucial for improving health and quality of life in this population. A healthy diet, including fruit and vegetable consumption, can reduce likelihood of chronic disease and risk of mortality and improve physical function among older adults (Nicklett and Kadell 2013). However, many older adults are not eating the recommended amounts of fruits and vegetables and, therefore, may not be obtaining the necessary amounts of certain vitamins and minerals (Nicklett and Kadell 2013). Similarly, physical activity among older adults has been shown to decrease disability, increase quality of life, and extend years of active independent living (Sun et al. 2013). While many older adults participate in physical activity, certain groups of older adults, such as women and older age groups (85 and up), are less likely to exercise regularly (Sun et al. 2013). Certain behaviors, such as substance use, are frequently misidentified and underdiagnosed and represent a growing health concern among the older adult population. Alcohol and tobacco use, while less prevalent among older compared to younger adults, are still common among older adults (Crome and Wu 2015). Participation in other preventive behaviors, such as screenings and immunizations, is also important for healthy aging. Yet, older adults disproportionately experience morbidity and mortality as a result of vaccine-preventable diseases (High 2007). In order to successfully increase healthy behaviors and decrease risky

behaviors, theory-driven and evidence-based approaches should be used for health promotion research and practice.

## Health Behavior Theories and Models in Aging

When selecting a theory for understanding or predicting a health behavior, it is most useful to consider the ecological factors that affect the behavior. Ecological models focus on the interrelationships among individual characteristics, social influences, and one's physical and sociocultural environment. An ecological perspective concentrates on creating policies and environments conducive to making healthy choices and then educating and motivating individuals to make those choices. According to Sallis and Owen (2015), there are five core principles related to the ecological perspective of health behavior: (1) multiple levels of influences exist, (2) environmental context can form or constrain determinants of health behavior, (3) influences interact across levels, (4) ecological models should be specific to a behavior, and (5) interventions addressing multiple levels should be most effective for behavior change. Ecological models provide a framework for incorporating multiple health behavior theories and building comprehensive approaches for health promotion interventions (Sallis and Owen 2015). A variety of theories and models are available for guiding health promotion interventions and research for improving health among older adults. Five theoretical frameworks commonly applied in the field of health promotion, which have been applied for targeting older adults, will be briefly described below.

### Social Cognitive Theory

Social cognitive theory (SCT) describes behavior using a three-way, reciprocal model in which personal cognitive, socioenvironmental, and behavioral factors continually interact with each other (Bandura 1986; Kelder et al. 2015). Personal cognitive factors refer to a person's ability to self-regulate behaviors and to reflect and analyze experience. There are three main constructs related to personal cognitive factors including

knowledge (*level of understanding about engaging in a behavior*), self-efficacy (*confidence in ability to perform a behavior*), and outcome expectations (*judgments about the likely outcome of a given pattern of behavior*). Socioenvironmental factors include features of the physical or perceived environment that promote, allow, or discourage participation in a specific behavior. The constructs directly related to these factors include observational learning (*influential role models*), normative beliefs (*cultural beliefs about the perceived prevalence and social acceptance of a behavior*), and social support (*the perception of support received from one's social network*). Finally, behavioral factors include behavioral skills existing as behavior capability or coping skill, one's intention or goals to add or modify a behavior, and reinforcement or the rewards or punishment received for engaging in a behavior. Reciprocal determinism, a key construct of SCT, suggests that the environment and human agency interact and influence each other, which in turn leads to individual and social change (Kelder et al. 2015). In this sense, an individual can be seen as both a responder to change and an agent of change. SCT has been applied to understand physical activity in older adults. For example, in an 18-month prospective study of older adults, researchers tested the utility of a model based on SCT for predicting physical activity behavior (White et al. 2012). Self-efficacy was found to be the strongest predictor of physical activity. Further, the results indicated that self-efficacy was directly and indirectly (through outcome expectations) related to physical activity (White et al. 2012). While SCT has served as an action-oriented approach to understanding human behavior, its primary focus on individual change has sometimes led to limited research on the environmental influences. It is important to understand and assess multiple constructs of SCT at different levels of the social and physical environment.

### The Transtheoretical Model

According to the transtheoretical model (TTM), there are different stages of readiness in health behavior adoption (Prochaska et al. 2015). More specifically, there are six stages of behavior change

including precontemplation (*no intention or interest in taking action within 6 months*), contemplation (*thinking about taking action within 6 months*), preparation (*plans to take action within a month and has made behavioral steps toward this plan*), action (*has adopted behavior change for less than 6 months*), maintenance (*has maintained ongoing behavior change for more than 6 months*), and termination (*does not have temptation to stop and has 100% confidence*). There are ten processes of change, or activities used to advance through stages, that have received the most empirical evidence. These processes include consciousness raising, dramatic relief, self-reevaluation, environmental reevaluation, self-liberation, helping relationships, social liberation, counterconditioning, stimulus control, and reinforcement management (Prochaska et al. 2015). The TTM was applied in the development of a health promotion program, HealthStages, aimed at promoting physical activity among older adults (Lach et al. 2004). This program developed specific activities for each stage of change. For example, bone density testing and a bone health fair aimed at increasing osteoporosis awareness were targeted at individuals in the precontemplation stage. Other intervention activities, such as informational brochures on bone-strengthening exercises, were aimed at those individuals in the complementation stage. Strength-training exercise courses were used to target individuals in the action stage. Finally, ongoing exercise and walking groups were targeted at those in the maintenance stage. While the TTM has been applied to as many as 48 different behaviors in various populations, this model also has limitations and future research needs (Prochaska et al. 2015). More research is needed to understand the effectiveness of TTM across different cultures and the adaptations of the model necessary within specific cultures. Furthermore, more research is needed to enhance the understanding of the stages of change and processes of change across a broad array of behaviors and in diverse populations.

### Theory of Planned Behavior and Theory of Reasoned Action

Both the theory of planned behavior (TPB; Ajzen 1991) and theory of reasoned action (TRA; Ajzen

and Fishbein 1980) posit that subjective norms, attitudes, and perceived control affect behavior intention, which, in turn, affects behaviors. The TRA states that behavioral intention is the most important determinant of behavior. Behavioral intention is directly determined by one's subjective norms related to the behavior and their attitudes toward participating in the behavior. The TPB includes these same constructs and is an extension of TRA that adds perceived control as a direct determinant of intention. An individual's attitudes are determined by their belief about attributes or outcomes of participating in a behavior (or behavioral beliefs). Individual subjective norms are determined by their normative beliefs or whether or not referent people approve or disapprove of participating in the behavior. Perceived control is determined by control beliefs (*the availability of facilitators and barriers to performing a behavior*) and weight by perceived power (*impact of each control factor to serve as a facilitator or barrier to the behavior*). The TRA and the TPB have been applied to explain variance in intention and to predict behaviors related to a variety of health behaviors such as smoking, exercises, and nutritional choices (Montaño and Kasprzyk 2015). For example, the TPB has been applied to understand factors that influence participation in strength training among older adults. In a study with older individuals living in seniors' centers in Ontario, Canada, researchers found that subjective norm and perceived behavioral control were the strongest predictors of intention to engage in strength-training behavior (Dean et al. 2007). Attitude, however, was not significantly related to intention. The results of the study also showed intention to be a significant predictor of strength-training behavior (Dean et al. 2007). While there is evidence that supports the effectiveness of TRA and TPB in explaining changes in intention and behaviors, there are limitations to these two theories. Currently, these theories do not specify relevant beliefs about normative referents, control beliefs, and behavior outcomes that should be measured. These beliefs should be differentiated for each group and behavior and likely vary across populations.

### Health Belief Model

The Health Belief Model (HBM) was originally developed in the 1950s by the US Public Health Service to explain the large-scale failure of individuals to participate in disease prevention and detection programs (Hochbaum 1958). Since then, the HBM has been expanded and used to inform health behavior change interventions related to a variety of different behaviors (Skinner et al. 2015). The HBM suggests that an individual is most likely to engage in a behavior under the following conditions: (1) they believe they are susceptible to the disease, (2) they perceive the consequences of disease to be serious, (3) they believe they will benefit from taking action, and (4) they believe the barriers to taking action are outweighed by the benefits. There are six key concepts within HBM, which include perceived susceptibility (*beliefs about the likelihood of contracting a condition*), perceived severity (*beliefs about the seriousness of contracting a condition*), perceived benefits (*beliefs about the positive outcomes of taking action*), perceived barriers (*obstacles to taking action*), cues to actions (*external or internal factors that could trigger a behavior*), and self-efficacy (*one's confidence in their ability to perform a behavior*) (Skinner et al. 2015). According to a recent literature review, the HBM is one of the most commonly used theoretical models for predicting colorectal cancer screening in older adults (Beydoun and Beydoun 2008). Perceived barriers, such as no recommendation from a physician, lack of knowledge, fear, and embarrassment, have consistently been shown to significantly influence colorectal cancer screening behaviors in the elderly (Beydoun and Beydoun 2008). Other constructs, such as perceived susceptibility (e.g., family history), have also been used for predicting colorectal cancer screening behavior (Beydoun and Beydoun 2008). Although the HBM has been used for more than half a century and has been shown to be useful in predicting certain behaviors (e.g., cancer screening), more research is needed to understand the relationships among the HBM constructs. Studies are also needed to understand the factors that moderate the effect of HBM constructs on behaviors.

### Evidence-Based Practice and Research in Health Promotion

Evidence-based practice and research in health promotion are essential for developing effective health promotion interventions and programs, and the concept of evidence-based public health (EBPH) is critical to this process. EBPH combines science-based interventions with community preferences to enhance population health (Brownson et al. 2015). Jacobs and colleagues summarize six key elements of evidence-based public health practice: (1) engaging the community during assessment and decision-making process, (2) systematically utilizing data and information systems, (3) making decisions based on available peer-reviewed quantitative and qualitative evidence, (4) using program planning frameworks, (5) conducting sound evaluation, and (6) disseminating lesson learned (Jacobs et al. 2012). There are many barriers to implementing EBPH, such as limited funding, lack of time and cultural and managerial support, inconsistency in the definition of evidence, and perceived lack of priority for EBPH in institutions (Brownson et al. 2015). Despite these barriers, there are many free, online resources available that can be used to facilitate EBPH. One such resource is the Guide to Community Preventive Services, which was developed by the Centers for Disease Control and Prevention and is overseen by the Community Preventive Services Task Force. The Guide to Community Preventive Services ([www.thecommunityguide.org](http://www.thecommunityguide.org)) consists of a panel of independent, unpaid experts in preventive services, public health, health promotion, and disease. The task force provides evidence-based findings and recommendations regarding preventive services, programs, and policies to improve community health. The official collection of recommendations and reviews from this task force is housed on the Community Guide website. The Community Guide provides credible information, obtained through a scientific systematic review process, on the current evidence for specific types of interventions within particular populations. Topics span a wide range, including alcohol consumption, asthma, cancer, cardiovascular disease, diabetes, mental health, obesity, and many more.

Other organizations and websites provide resources and recommendations for facilitating EBPH in the aging population. The Evidence-Based Leadership Council (EBLC) is a collaboration of individuals representing 11 health programs and 4 organizations committed to increasing the use of evidence-based programs for older adults (Haynes et al. 2014). EBLC's website provides a centralized resource for selecting, implementing, and evaluating health programs ([Evidence-Based Leadership Council n.d.](#)). Similarly, the National Council on Aging (NCOA), a nonprofit advocacy organization for older adults, has a website that includes information for planning, implementing, evaluating, and sustaining evidence-based programs ([National Council on Aging n.d.](#)). EvidenceToPrograms.com is web-based toolkit that guides users through the process of building, evaluating, and sustaining a health promotion program for healthy aging (Stevens et al. 2015). Finally, the journal, *Frontiers in Public Health*, has a research topic dedicated to EBPH for older adults. This research topic, which is available online, features research on proven health promotion programs and the factors that impact the reach, implementation, and sustainability of these programs (Ory and Smith 2015).

The Austrian Red Cross also has published recommendations for evidence-based health promotion specifically for older adults (Lis et al. 2008). These guidelines share many similarities with general evidence-based recommendations for health promotion research and practice. These guidelines include tailoring health promotion programs to the needs and resource of the population of interest while understanding the diversity of different groups (cultural competency, health literacy, sociodemographic characteristics). Moreover, the guidelines recommend involving multiple stakeholders throughout the process and utilizing individual and community empowerment strategies, as well as developing multilevel, comprehensive interventions. The application of mixed-method approaches and use of an interdisciplinary team of researchers and professionals are also recommended for ensuring accessibility and sustainability of health promotion programs for older adults.

## Planning Models in Health Promotion

Proper application of a planning model will ensure that all key elements of EBPH are addressed during the development, implementation, and evaluation of a health promotion program. Two well-developed planning models often applied in health promotion are the PRECEDE-PROCEED Model and Intervention Mapping (Bartholomew et al. 2015). Both models use a comprehensive approach to addressing a health issue and allow for integration of multiple theoretical frameworks. These models allow practitioners and researchers to develop evidence- and theory-based interventions using logic models. Logic models are diagrams that depict plausible causal relationship among variables associated with a health issue and their solutions. The PRECEDE-PROCEED Model, an eight-phase, population-based planning framework with an ecological perspective, has been applied to hundreds of programs (Bartholomew et al. 2015). The first three phases in the model assist the planner in developing a logic model of the problem, where planners examine the causes of health problems using an ecological perspective. These phases include Phase (1) social assessment; Phase (2) epidemiological, behavioral, and environmental assessment; and Phase (3) educational and ecological assessment. These three phrases focus on the determinants of health-related behavior and environment and the interrelationships among individuals and their psychological, biological, and behavioral characteristics and their environment. In Phase 4, administrative and policy assessment and intervention alignment, the planner determines what program components and interventions are required and what administrative, policy, and organizational resources exist to develop the program. In this particular phase, the concept of intervention matching, mapping, pooling, and patching is applied. More specifically, this phase requires (1) matching program components to the ecological levels; (2) mapping interventions to particular predisposing, enabling, and reinforcing factors; (3) pooling from previous interventions and work; and (4) patching interventions to address gaps in evidence-based practices. In Phase 5, the planner prepares for

implementation by using data collected from the previous four phases to develop materials and resources to facilitate program delivery. In the final three phases, the planner develops plans for data collection in order to conduct process, impact, and outcome evaluations. Process evaluation determines the extent to which a program was implemented as intended, while impact evaluation examines changes in predisposing, reinforcing, and enabling factors, as well as behavioral and environmental factors. Outcome evaluation assesses the impact of the program on health and quality-of-life indicators.

Intervention Mapping (IM) consists of six steps that are complementary to the PRECEDE-PROCEED Model's planning phrases (Bartholomew et al. 2015). This framework expands on the logic model of the problem outlined in the PRECEDE-PROCEED Model by focusing on the defining determinants of behavioral and environmental change and matching theory-based methods to these determinants. In Step 1, the planner conducts a needs assessment in order to develop a logic model of the problem. In Step 2, the planner uses theory and previous evidence to develop a logic model of change. The logic model of change describes the hypothesized casual pathways from the intervention through the determinants of behavior to the health-promoting behaviors and environmental change agents to the ultimate changes in health outcomes. In Step 3 (*program planning*) and Step 4 (*program production*), the planner uses the model of change developed in Step 2 to understand, design, and develop the intervention. In Step 5, the planner applies theory and evidence to develop an implementation plan for the intervention. In the final phase, the planner outlines methods for conducting process and outcome evaluations.

## Conclusion

As older individuals continue to represent more of the population, proportionally, the need for effective strategies to prevent and manage chronic diseases and disabilities becomes ever more critical. Health promotion for older adults builds on the

foundational principles of health promotion for all ages. Successful health promotion for older adults requires tailoring to the needs, resources, and unique problems experienced by this particular population. The theories and evidence-based practices described in this article are broadly depicted and should be used in combination with assessment of the intended population (Bartholomew et al. 2015).

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## Health, Work, and Retirement Longitudinal Study

Andy Towers<sup>1</sup>, Brendan Stevenson<sup>1</sup>,  
Mary Breheny<sup>1</sup> and Joanne Allen<sup>2</sup>

<sup>1</sup>School of Public Health, Massey University,  
Palmerston North, New Zealand

<sup>2</sup>School of Psychology, Massey University,  
Palmerston North, New Zealand

### Synonyms

New Zealand Longitudinal Study of Aging

### Definition

The Health, Work, and Retirement (HWR) longitudinal study is a nationally representative cohort study that has been following a sample of middle-aged and young-old New Zealanders (aged 55–70) across multiple data collection waves since 2006. The broad aim of the HWR study is to determine the factors that promote health and independence of older New Zealanders in the transition from work to retirement, with a particular focus on successful aging in older Māori (the indigenous people of New Zealand).

## Description of the HWR

The HWR study is New Zealand's only nationally representative government-funded longitudinal study designed to understand the factors that determine health and independence in older adults. Government funding for the HWR study was provided amid growing concern in New Zealand about the future viability of the country's universal health and pension provision (New Zealand Treasury 2009). Historically, New Zealand has low rates of personal retirement savings (Scobie et al. 2004). In addition, there is a lack of knowledge of how chronic inequities in health, wealth, and well-being which develop in midlife between Māori and non-Māori (Dixon and Maré 2007; Ajwani et al. 2003; Robson 2004) impact their capacity for successful aging. In Wave 1 in 2006, the HWR study sampled a cross section of community-dwelling New Zealanders aged 55–70 to assess their current health, wealth, social, working, and demographic status. Those completing the Wave 1 cross-sectional study were subsequently invited to participate in the longitudinal study. The HWR study has followed this sample on a biennial basis with data waves in 2008, 2010, 2012, and 2014. A supplementary data collection wave in 2013 was funded specifically to investigate older adults' levels of interconnectedness and social support. Further government funding has resulted in two further data collection waves planned for 2016 and 2018. The inception of the HWR study was timed such that the fiscal and social impact of key policies and initiatives aimed at addressing aging-related issues in New Zealand could be monitored closely and long-term outcomes comprehensively assessed. For example, the HWR study can examine the outcomes associated with the establishment and maintenance of KiwiSaver accounts (a 2007 employer-based contributory superannuation scheme) in a representative sample of New Zealand's young-old population, as the scheme began operation between the first and second waves of data collection. The HWR study is designed to be comparable to international longitudinal studies of aging, such as the *Health and Retirement Study* (HRS), the *English*

*Longitudinal Study of Ageing* (ELSA), and the *Survey of Health, Ageing and Retirement in Europe* (SHARE).

## Research Design

*Characteristics of the sample:* In 2006 equal probability random sampling procedures were used to select a study sample from the 55–70-year-old population registered on the New Zealand electoral roll. Registration on the electoral roll is mandatory for all New Zealanders eligible to vote in government elections. A total of 5,260 adults aged 55–70 (including Māori and non-Māori) were selected from the electoral roll to represent the 55–70-year-old general population. From those remaining on the electoral roll, a further sample of 7,780 Māori aged 55–70 were then randomly selected using the Māori descent indicator on the roll to increase the Māori subsample. Māori oversampling was undertaken to combat the historically low research participation rates found internationally in older ethnic minority populations (Moreno-John et al. 2004). A combined total of 13,040 New Zealanders received an HWR study questionnaire in 2006. Subsequently, 551 (210 from the general subsample and 341 from the Māori subsample) were excluded from participation due to ineligibility (e.g., deceased, institutionalized, or unable to be contacted), thus lowering the participant pool to 12,489. Of this revised total, 6,657 (53%) participants returned surveys in 2006 (henceforth “Wave 1”). Of this, 3,104 (61% response rate) were from the general subsample, and 3,553 (48% response rate) were from the Māori subsample. Following completion of the 2006 survey, all participants were asked whether they would complete a follow-up survey in 2008 (Wave 2). Those indicating willingness to join the longitudinal study (approximately 3,200) were approached for the 2008 data collection wave, and subsequent HWR study data collection waves target prior wave completers.

Table 1 compares the characteristics of the HWR study sample across all current waves (2006–2014) with the characteristics of New

**Health, Work, and Retirement Longitudinal Study, Table 1** Comparison of the Māori and non-Māori HWR study participants across all waves with New Zealand's 50+ general population as at baseline (unweighted)

	NZ aged 50+ (2006)	Wave 1 (2006)	Wave 2 (2008)	Wave 3 (2010)	Wave 4 (2012)	Wave 5 <sup>a</sup> (2013)	Wave 6 <sup>b</sup> (2014)	Refresh
<b>Total N<sup>c</sup></b>		3 127	2 470	1 836	1 734	1 329	1 687	773
Māori descent	93,381	1,712	1,283	882	811	550	758	147
Non-Māori	9 19,503	1,415	1,187	954	923	779	929	626
<b>Deceased during study</b> (Cumulative)		–	53	114	192	244	275	
<b>Mean age (SD)</b>								
Māori descent	–	60.8 <sup>(4.6)</sup>	63.1 <sup>(4.6)</sup>	65.4 <sup>(4.6)</sup>	67.3 <sup>(4.6)</sup>	68.2 <sup>(4.5)</sup>	69.4 <sup>(4.4)</sup>	59.8 <sup>(3.0)</sup>
Non-Māori	–	61.1 <sup>(4.5)</sup>	63.3 <sup>(4.5)</sup>	65.5 <sup>(4.5)</sup>	67.6 <sup>(4.5)</sup>	68.8 <sup>(4.5)</sup>	69.8 <sup>(4.5)</sup>	60.1 <sup>(3.0)</sup>
<b>Females</b>								
Māori descent	53%	54%	55%	54%	54%	57%	56%	51%
Non-Māori	53%	50%	51%	53%	53%	53%	52%	58%
<b>Partnered (married/de facto)</b>								
Māori descent	53%	64%	67%	67%	68%	64%	65%	66%
Non-Māori	64%	76%	77%	79%	78%	77%	77%	79%
<b>Working (full and part time)</b>								
Māori descent	77%	63%	58%	51%	44%	37%	35%	59%
Non-Māori	63%	68%	60%	51%	42%	36%	32%	71%
<b>Lives in urban center (30,000+)</b>								
Māori descent	58%	78%	79%	79%	79%	81%	–	–
Non-Māori	69%	82%	81%	81%	81%	82%	–	–
<b>Educational qualifications</b>								
Māori descent	56%	44%	40%	35%	31%	29%	29%	30%
Secondary	22%	21%	23%	19%	18%	17%	19%	32%
Post-secondary	17%	27%	15%	21%	24%	26%	26%	24%
Tertiary	5%	9%	22%	25%	27%	28%	26%	14%

(continued)

Health, Work, and Retirement Longitudinal Study, Table 1 (continued)

	NZ aged 50+ (2006)	Wave 1 (2006)	Wave 2 (2008)	Wave 3 (2010)	Wave 4 (2012)	Wave 5 <sup>a</sup> (2013)	Wave 6 <sup>b</sup> (2014)	
							HWR06	Refresh
Non-Māori	No secondary	26%	23%	20%	19%	18%	18%	14%
	Secondary	22%	28%	24%	22%	22%	21%	24%
	Post-secondary	21%	18%	23%	24%	28%	29%	35%
	Tertiary	11%	32%	34%	35%	32%	33%	27%
<b>Personal income (after tax)</b>		<i>n</i> = 2204	<i>n</i> = 2031	<i>n</i> = 1760	<i>n</i> = 1677	<i>n</i> = 1271	<i>n</i> = 1310	<i>n</i> = 633
Māori descent	0–20,000	56%	41%	41%	45%	46%	47%	23%
	20,001–35,000	21%	22%	27%	24%	26%	22%	22%
	35,001–70,000	18%	30%	25%	26%	22%	25%	44%
	70,000+	4%	7%	7%	5%	6%	6%	11%
Non-Māori	0–20,000	53%	35%	36%	41%	43%	37%	18%
	20,001–35,000	21%	20%	23%	24%	23%	27%	17%
	35,001–70,000	20%	32%	30%	27%	25%	28%	47%
	70,000+	7%	10%	12%	9%	9%	8%	18%

Note: The 2014 data collection is still in the field. Sample N and characteristics for that wave are not available

<sup>a</sup>Wave 5 reflects a supplementary wave not synchronized with the normal biennial data collection and comprises participants who have been part of the study since 2006

<sup>b</sup>Wave 6 is split into the HWR longitudinal cohort and a new “refresh” subsample geared toward a steady-state design. All 2012 participants were recontacted for participation in 2014 (hence the higher participation rate than in 2013). The refresh subsample saw the inclusion of new participants at younger ages, thus increasing sample size and reducing mean age

<sup>c</sup>Participants present in all sampling waves

Zealand's 50+ general population as of 2006 (Statistics New Zealand 2006). As the HWR study sample represents one of the only national-level studies in the world comprising a significant cohort of indigenous older people, the baseline characteristics are displayed for participants with Māori ethnicity and non-Māori ethnicity (e.g., European, Asian, Pacific Island) separately. Although the Wave 1 cross-sectional survey in 2006 which underpins the HWR study cohort comprised 6,657 respondents, Table 1 provides information only on those from Wave 1 who consented to be included in the longitudinal survey.

*Move from cohort-based to steady-state design:* From Wave 1 (2006) to Wave 5 (2013), the HWR study reflected a cohort-based study following an established group of New Zealanders who were aged 55–70 at Wave 1 through to aged 62–77 at Wave 5. From Wave 6 (2014) onward, the HWR study moved from a cohort design to a steady-state design which will make biennial additions of participants aged 55–56 and thereby generate a longitudinal study that is nationally representative of New Zealanders aged between 55 and the oldest age group per wave. In 2015 the same sampling framework outlined for Wave 1 was utilized to add a sample of New Zealanders aged 55–61 to achieve this steady-state design as the youngest HWR study participants were 62 in 2015. Subsequent biennial HWR study waves (e.g., Waves 7 and 8) will each add participants aged 55–56 to ensure that the study sample is continually refreshed every 2 years to maintain the sample as nationally representative of New Zealanders aged over 55 years.

*Data collection and measurement:* The HWR study is based around a biennial postal survey. In addition to these postal surveys, face-to-face interviews of a subsample of participants occurred in 2010 ( $n = 1,001$ ), and this same subsample was interviewed again in 2012 ( $n = 903$ ). Table 2 illustrates the seven broad topic areas measured across all waves in the HWR study and includes assessments utilized in both postal and face-to-face components. In addition to this quantitative data, the HWR study has also included several

qualitative interview studies with participants drawn from the longitudinal sample. In 2006 60 HWR study participants were interviewed about their earlier life to establish pathways from early-life to late-life work and retirement decisions (Pond et al. 2010). Fifty of these participants were reinterviewed in 2008, and 15 partners of these participants were also interviewed. In 2008 48 participants were interviewed about their family life and social connections (Breheny and Stephens 2010). Interview data was combined with survey responses from these participants in a mixed methods approach to discursive analysis. In 2010, a longitudinal qualitative interview study with HWR study participants examined the importance of practices such as gifting and passing on objects to maintaining identity in later life. Undertaking in-depth qualitative interview studies with the participants of the longitudinal study provides a unique opportunity. Quantitative data can be used to select and categorize older people into groups for analysis, and quantitative data from the same participants can be used to understand the qualitative findings.

## Research Areas

Data from the HWR study has been used by national and international researchers to explore a diverse range of topics associated with healthy and successful aging. The following domains reflect particular themes under which there is a consistent and growing stream of HWR-related research.

*The determinants of physical and mental health in later life:* The maintenance of good physical and mental health is a key predictor of longevity and successful aging. Since its inception, the HWR study has had a strong focus on exploring the range physical and mental health profiles of older New Zealanders and identifying the primary predictors of health change over time. Work on the Wave 1 data established the psychometric properties and validity of the internationally validated SF36v2 measure of physical and mental health in older New Zealanders (Stephens et al. 2010). Building on this work, research

**Health, Work, and Retirement Longitudinal Study, Table 2** Measures used in HWR study data collection waves: postal survey and face-to-face interviews

	Wave 1 (2006)	Wave 2 (2008)	Wave 3 (2010)		Wave 4 (2012)		Wave 5 (2013)	Wave 6 (2014)
	Postal survey	Postal survey	Postal survey	Face to face	Postal survey	Face to face	Postal survey	Postal survey
<b>Health and well-being</b>								
Physical and mental health	✓	✓	✓	✓	✓	✓	✓	✓
Chronic health conditions	✓	✓	✓	–	✓	✓	✓	✓
Hazardous alcohol use	✓	✓	✓	–	✓	✓	✓	✓
Health service utilization	✓	✓	–	–	✓	–	✓	✓
Tele-health	–	–	–	–	–	–	✓	–
Tobacco use	✓	✓	✓	–	✓	✓	✓	✓
Physical activity	✓	✓	✓	–	✓	–	✓	✓
Nutrition	–	–	–	–	–	–	–	✓
Sensory impairment	–	✓	–	–	✓	–	✓	✓
Prescription drug use	–	✓	–	–	✓	–	–	–
Quality of life	–	✓	✓	–	✓	–	✓	✓
Sexual functioning	–	–	✓	–	✓	–	–	–
Religiosity/faith	–	–	✓	–	✓	–	–	–
Cognitive functioning	–	–	–	✓	–	✓	–	–
Earthquake exposure	–	–	–	–	✓	–	–	✓
<b>Social support and context</b>								
Social support, networks, and interaction	✓	✓	✓	–	✓	–	✓	✓
ICT use							✓	–
Volunteerism and trust	✓	✓	–	–	✓	–	✓	✓
Caregiving (provided/received)	✓	✓	✓	–	✓	–	✓	✓
Caregiving support, burden, and choice	–	–	–	–	–	–	✓	–
Perceived safety/abuse/discrimination	–	–	✓	–	✓	–	–	–
Recreation choices	–	–	✓	–	✓	–	✓	–
Travel and access	–	–	✓	–	✓	–	✓	–
<b>Work and retirement</b>								
Self and partner work status	✓	✓	✓	–	✓	–	✓	✓
Preferred work status	✓	✓	✓	–	✓	–	✓	✓
Current and past work context	✓	✓	✓	–	✓	–	✓	✓
Retirement planning	✓	✓	–	–	✓	–	✓	✓
Retirement reasons and expectations	✓	✓	✓	–	✓	–	✓	✓
Flexible work practices	–	–	–	–	–	–	✓	–
<b>Income and assets</b>								
Personal and household income	✓	✓	✓	✓	✓	–	✓	✓
Sources of income	✓	✓	✓	✓	✓	–	–	–

(continued)

**Health, Work, and Retirement Longitudinal Study, Table 2** (continued)

	Wave 1 (2006)	Wave 2 (2008)	Wave 3 (2010)		Wave 4 (2012)		Wave 5 (2013)	Wave 6 (2014)
	Postal survey	Postal survey	Postal survey	Face to face	Postal survey	Face to face	Postal survey	Postal survey
Key assets and liabilities	✓	✓	✓	✓	✓	–	–	–
Superannuation	✓	✓	✓	✓	✓	–	✓	✓
Economic living standards	✓	✓	✓	–	✓	–	✓	✓
<b>General demographics</b>								
Date of birth, age, and sex	✓	✓	✓	✓	✓	✓	✓	✓
Marital status	✓	✓	✓	✓	✓	–	✓	✓
Education	✓	✓	✓	✓	✓	–	✓	✓
Ethnicity	✓	✓	✓	✓	✓	–	✓	✓
Driving status	–	✓	–	–	✓	–	✓	✓
Household composition	✓	✓	✓	✓	✓	–	✓	✓
House type/ownership	–	–	✓	–	✓	–	✓	✓
Migration	–	✓	✓	–	✓	–	✓	✓
Cultural identification	✓	✓	✓	–	✓	–	✓	✓

undertaken on subsequent HWR study waves has explored the influence of multiple factors on the physical and mental health of older New Zealanders, including social inequalities (Stephens et al. 2011a), social support and loneliness (Stephens et al. 2011b), and the role of caregiving (Alpass et al. 2013). With the addition of cognition assessments in the 2010 and 2012 HWR study face-to-face interview, a further stream of cognitive health research has been initiated. The first published article from this stream established the key differences in cognitive health between HWR study participants and US counterparts in the HRS (Stephens et al. 2015).

*Living standards of older adults:* Living standards are a key aspect of the experience of later life. Within the HWR study, there has been a strong focus both on identifying the primary indicators of living standards for older adults and on how inequalities in such living standards influence the capacity of older adults to age well. Work involving the HWR study data has aided the development of a robust measure of living standards based upon Sen’s capability approach (Breheny et al. in press). This measure was designed to assess living standards in terms of the ability to achieve across six domains valued by older people (health care, social integration,

contribution, enjoyment, security, and restriction). A key aspect of this measure is the way it assesses living standards as varying from constraint to freedom, rather than conventional measures that conceptualize living standards as varying from hardship to comfort. Both qualitative and quantitative research in the HWR study has demonstrated that the living standards of older people have ramifications beyond the material conditions of their lives. Living standards impact upon the ability of older people to contribute to the lives of others, to experience enjoyment, and to be viewed as a person of value as they age (Breheny and Stephens 2010). In examining living standards, the focus is not on individual responsibility for ensuring adequate living standards as people age. Instead, this research aims to reveal enduring structures that limit people’s lives across the life course.

*Older adults’ quality of life:* Quality of life (QOL) in older adulthood is a primary indicator of independence, well-being, and life satisfaction. The HWR study has multiple streams of work on the assessment of QOL and the investigation of factors determining QOL in specific subpopulations. Since Wave 3, the HWR study has included the CASP12 which is an older adult-specific measure of QOL utilized primarily in European



studies such as the ELSA and SHARE. Exploration of the CASP12 factor structure among older Māori and non-Māori indicates that the QOL of both Māori and non-Māori older adult reflects consideration of the same key factors, but that these considerations are slightly different to those expressed in European older adults (Towers et al. 2015). Specifically, shortage of money does not appear to be a primary influencing agent for QOL in New Zealand older adults. Furthermore, three core CASP12 items reflecting feelings of energy and positive future outlook provide a very effective brief indicator of the general QOL of older New Zealanders regardless of ethnic background. A core thread of QOL research within the HWR study has focused on modeling the impact of mobility as a key determinant of QOL in older adults in general and specifically in older adults with vision impairments. Ongoing research utilizing the HWR study data shows that visual impairment is associated with significantly poorer economic, physical, and mental health status, a significant lack of social support, and greater social isolation (La Grow et al. 2009). Furthermore, it is now clear that mobility (i.e., the ability to get around one's environment) is a key factor facilitating QOL in older visually impaired people (Yeung et al. 2015).

*Ethnicity and aging:* The HWR study was specifically designed to understand differences in the experience of aging between Māori and non-Māori and to facilitate an assessment of the experience of aging for other minority group members in New Zealand. From the outset, oversampling of Māori to ensure meaningful ethnic group analyses could be undertaken. The HWR study has confirmed that older Māori have poorer health and lower living standards and are more socially isolated than older non-Māori (Dulin et al. 2011). Ethnicity is entwined with socioeconomic status; differences between ethnic groups are often explained by disparities in access to social and economic resources. To address this, the HWR study data has enabled more detailed analyses of the relationship between ethnicity and experience of later life. For example, older Pacific people in New Zealand have poorer health and lower living standards than either Māori or

non-Māori non-Pacific people. After controlling for multiple health risks, socioeconomic and demographic variables, ethnicity continues to predict lower levels of physical health among Pacific people, suggesting that there are other factors associated with ethnicity which contribute to higher rates of poor health for older Pacific people (Lotoala et al. 2014). As the HWR study matures, further analyses of the longitudinal data will enable an examination of how disparities in health of minority ethnic groups develop over time.

## Cross-References

- ▶ [Aging and Quality of Life](#)
- ▶ [Cognition](#)
- ▶ [Disability and Ageing](#)
- ▶ [Health and Retirement Study, A Longitudinal Data Resource for Psychologists](#)
- ▶ [Loneliness and Social Embeddedness in Old Age](#)
- ▶ [Mental Health and Aging](#)
- ▶ [New England Centenarian Study \(NECS\)](#)
- ▶ [Psychosocial Well-Being](#)
- ▶ [Resilience and Health](#)
- ▶ [Survey of Health, Ageing and Retirement in Europe \(SHARE\)](#)

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## Healthy Aging

Colette J. Browning<sup>1,2,3</sup>, Shane A. Thomas<sup>2,4</sup>, Hal Kendig<sup>5</sup> and Marcia G. Ory<sup>6</sup>

<sup>1</sup>Royal District Nursing Service, St Kilda, VIC, Australia

<sup>2</sup>International Primary Health Care Research Institute, Shenzhen, China

<sup>3</sup>Monash University, Melbourne, VIC, Australia

<sup>4</sup>School of Primary Health Care, Monash University, Melbourne, VIC, Australia

<sup>5</sup>Australian National University, Canberra, ACT, Australia

<sup>6</sup>Health Promotion and Community Health Sciences, Texas A&M Health Science Center and School of Public Health, College Station, TX, USA

## Synonyms

Active aging; Aging well; Positive aging; Productive aging; Successful aging

## Definition

In the last 40 years, there have been many attempts to define healthy aging and its synonyms. The evolution of the definitions of healthy aging and its many synonyms has reflected contemporary thinking and a high level of interest in the health and quality of life of older people.

The WHO now defines healthy aging as:

The process of developing and maintaining the functional ability that enables well being in old age. (World Health Organization 2015, p. 40)

An earlier similar definition was provided by Health Canada as part of a systematic research

program on aging and the maximization of quality of life.

A lifelong process of optimising opportunities for improving and preserving health and physical, social and mental wellness, independence, quality of life and enhancing successful life-course transitions. (Health Canada 2001, p. 1)

The European Union Healthy Ageing Project (Swedish National Institute of Public Health 2006) defined it as “. . . *the process of optimising opportunities for physical, social and mental health to enable older people to take an active part in society without discrimination and to enjoy an independent and good quality of life.*”

Other definitions include:

. . . the development and maintenance of optimal physical, mental and social well-being and function in older adults. It is most likely to be achieved by individuals who live in physical environments and communities that are safe and support the adoption and maintenance of attitudes and behaviors known to promote health and well-being; and the effective use of health services to prevent or minimize the impact of acute and chronic disease on function. (US Health Promotion Research Centre Healthy Aging Research Network)

. . . a process whereby people can achieve or maintain the best possible state of physical, cognitive and mental health and well being, meaningful and positive engagement with people, community and institutions, and a personal sense of security, choice and autonomy, with active adaptation to ageing processes from the individual, familial and societal perspectives. (Browning and Thomas 2007)

## Introduction

While the exact forms of words differ across these definitions, essentially there is a consensus among them that healthy aging involves a process that optimizes health status and quality of life and is determined by a multitude of interacting biological, psychosocial, and environmental factors. These definitions of healthy aging go well beyond narrow survival and physical health criteria and are conceptually derived from the influential WHO definition of health which itself is now over 60 years old. It states: “Health is a state of complex physical, mental and social well-being

and not merely the absence of disease or infirmity” (World Health Organization 1952, p.100). The concept is that health and healthy aging is not an end state in itself but rather a process that occurs across the life course. Moreover, health is widely seen by older people themselves as a resource that enables them to live their lives fully (Kendig and Browning 2010a).

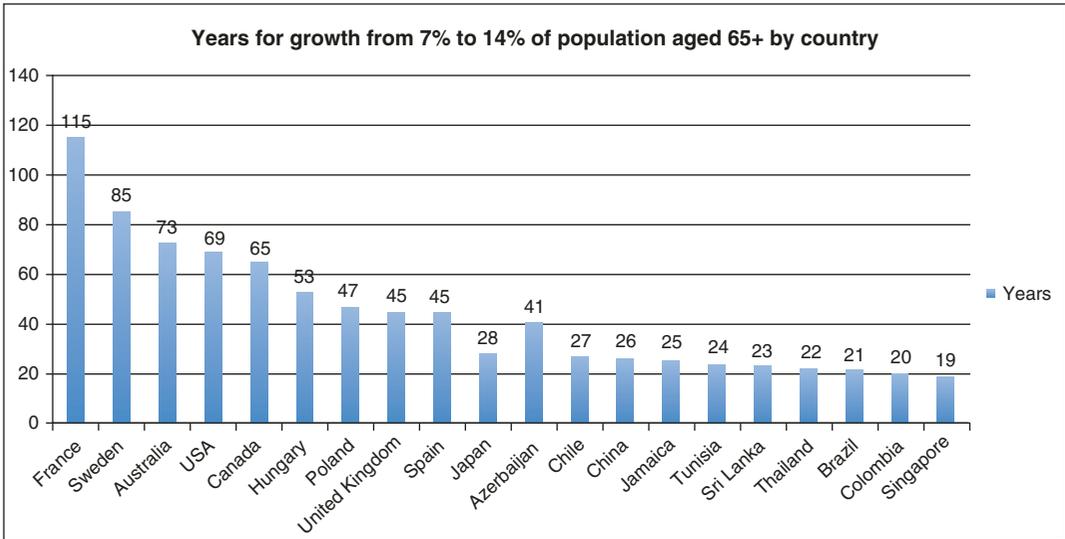
The WHO World Report on Ageing and Health (World Health Organization 2015, pp 40–41) emphasized promoting healthy aging by focusing on functional ability rather than particular disease states, recognizing diversity in aging experiences and outcomes, and understanding the impact of health inequities in old age and across the life course. The WHO definition of healthy aging assumes that older people’s physical and mental capacities and the environment in which they live are not static and that the interactions between these internal and external resources influence the aging trajectory. In this chapter we examine the strategic importance of healthy aging, conceptual and measurement issues, predictors of healthy aging, and programs and services to promote healthy aging.

## The Strategic Importance of Defining Healthy Aging

The concept of healthy aging influences and is influenced by national governmental actions. It is a constructive influence guiding governmental actions that can improve the health, well-being, and productivity of aging people across global communities in the developed and developing world. As reviewed in this paper and elsewhere in this volume, humanity is experiencing rapid demographic changes, markedly increased human longevity, and rapidly changing patterns in health and illness, especially in noncommunicable diseases (NCDs) that are impacted by aging. We now briefly review each of these factors in terms of their association with healthy aging.

### Rapid Demographic Changes

One of the key reasons for the current focus on healthy aging is the rapid demographic change in



**Healthy Aging, Fig. 1** Years for growth from 7% to 14% of population aged 65+ by country

societies in the last 50 years. Kinsella and Phillips (2005) presented seminal demographic data demonstrating that the rapidity of growth from 7% to 14% of the populations aged 65 years and older had changed dramatically in the last century (see Fig. 1).

These data illustrate how the time for the proportion of the population aged 65+ to grow from 7% to 14% has lessened in a range of countries. The changes are remarkable and reflect continuing unprecedented growth in numbers of older people across a wide range of countries and globally. They are, of course, directly related to improvements in life expectancy at older ages, reductions in maternal and child health mortality, and changing migration patterns. Additionally, in some cases such as China, concerted policy measures that restrict population growth have had the consequence of rapidly changing the country’s age pyramid.

**Increased Longevity**

The remarkable changes in longevity have posed the contemporaneous challenges of living better and living longer (“adding life to years”). According to the World Bank Development Indicator Dataset, global life expectancy at birth has grown from 52.5 years in 1960 to 71.2 years in 2013 (World Bank 2015). For China the growth over the same period has been from 43.5 years to

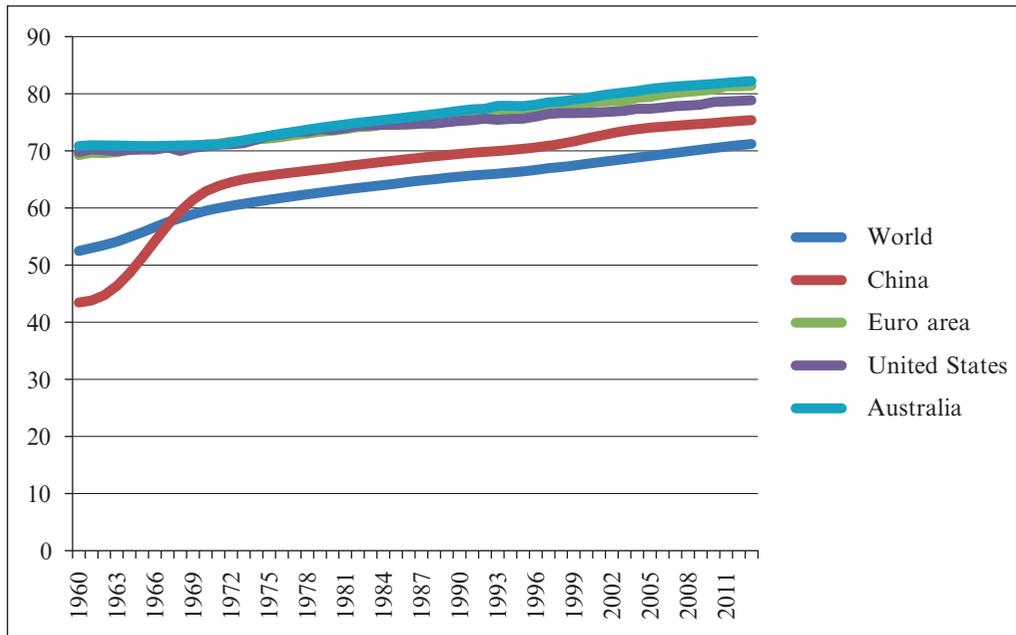
75.4 years, a stunning increase of 32 years in the space of 50 years. Figure 2 shows the trends in increasing longevity for selected countries and regions from the World Bank Development Indicator Dataset.

The US National Institute on Aging (2011) notes that “the dramatic increase in average life expectancy during the twentieth century ranks as one of society’s greatest achievements” (p. 6).

**Aging, Chronic Illness, and Health Costs**

Another key reason for the high level of interest in healthy aging is the robust relationship between aging, prevalence of chronic disease, and health-care costs that follow from rapidly aging populations. In the “Burden of Disease” entry in this encyclopedia, we have noted that the World Economic Forum has reported that NCDs represent 63% of all deaths being “the world’s main killer” (Bloom et al. 2011). The Forum asserted that over the next 20 years, NCDs will cost USD30 trillion (or 48% of 2010 global GDP) and that they will have devastating global economic impacts. Population aging is considered to be a major driver of this.

However, we have argued elsewhere that rhetoric concerning the economic “burden of aging” often verges on ageism. Maximizing health and



**Healthy Aging, Fig. 2** Longevity trends across selected countries and regions

well-being in old age is a basic human right and a response to ageism that challenges the stereotype that declining health is an inevitable consequence of old age (Browning and Kendig 2003). Social determinants that are potentially modifiable, such as income, housing, education, and access to health services, impact on different social groups across the life span potentially leading to the accumulation of disadvantage in health outcomes in old age (Kendig and Browning 2010b). Focusing on disease and its relationship to aging is essential for treatment but can diminish attention to preventative actions and interventions that can improve health and illness trajectories. This complementary preventative approach requires understanding and responding to the impact of social inequalities on healthy aging, as well as the modifiability of behavioral risk factors which impact the onset and progression of multiple chronic conditions.

Wider constituencies globally – including policy makers, service providers, health professionals, researchers, advocates, and the broader public – are increasingly attuned to the impacts of aging upon our communities and societies as

well as economies and service systems. Terms and concepts such as “healthy aging” hold out hope for management of what in global terms is likely to be unprecedented exciting and challenging opportunities for societies and governments. These demographic and social changes are transformational in the space of a generation. It is therefore appropriate that we focus on healthy aging, what it means, and how it can be promoted and maximized for the benefit of all communities.

### Conceptual Issues in Healthy Aging

*WHO Framework for “Adding Life to Years.”* The definitions of healthy aging we have just discussed are predicated upon the assumption that progress for societies should not be judged solely by increased longevity (survival) and the attainment of a narrow definition of physical health but also by the quality of the lives of their older citizens (Glass 2003). While increasing longevity is a cause for celebration globally, the World Health Organization (WHO) has called for “adding life to years,” which is explicit

recognition of the importance of quality of life in addition to longevity for older people (World Health Organization 2015). Policy approaches that promote healthy aging reflect the desire to support older people to remain active, valued, and engaged citizens for as long as possible and, during the last years of their life, to live a comfortable, meaningful life. Such approaches are now strongly advocated globally (Rechel et al. 2013; WHO 2002). Nations such as France and Great Britain and many other European Union countries have invested in major programs of measurement of national well-being (Randall and Corp 2014) across the life span in a systematic attempt to include social capital considerations in policy and performance monitoring for their societies to augment the basic economic indicators.

Similarly, a compendium on the “Successful Aging of Societies” has advanced thinking on social and policy actions that can complement earlier thinking centered on the health and aspirations of individuals (Rowe 2015). Further, comparisons between societies can shed light on the contextual influence of varying policies and socioeconomic developments (Kendig and Nazroo 2016).

Most of the definitions of successful, healthy, active, positive, and productive aging concepts also include broad definitions of aging that are not simply confined to the presence or absence of physical ill health or survival. They include explicit consideration of psychological and social factors as well as the ongoing influence into later life of earlier life experiences as well as transitions through later life (Kendig and Nazroo 2016). We consider that an acceptable and credible definition of healthy aging must incorporate logical extensions of the widely accepted foundation WHO conceptualization and definition of health that has now been in existence for over 60 years. The WHO definition includes the central idea that health is best conceptualized as not just avoiding death or disease and the definitions of successful, healthy, active, positive, and productive aging should similarly be more broadly focused. Definitions of healthy aging and related concepts that are solely biologically focused are not consistent with the wider view proposed by WHO of what being “healthy” should encompass.

*Maslow’s Hierarchy of Needs.* There is also another influential theoretical framework that has contributed to current conceptualizations and definitions of healthy aging and related concepts. This is Maslow’s hierarchy of needs (Maslow 1954). Although Maslow’s work has attracted some critique (Yang 2003), the idea of a hierarchy of needs ranging from basic physical survival to self-actualization and high levels of well-being has an attractive intrinsic simplicity and conceptual robustness. We consider that Maslow’s hierarchy is entirely compatible with the WHO definitions of health and healthy aging. Maslow’s model fits comfortably with most of the current conceptualizations and definitions of healthy aging and related concepts. Maslow’s hierarchy continues to be used by various gerontologists in their research and intervention programs. Its development was an important step in advancing the cause for inclusive definitions of healthy aging.

*Potency of Well-Being as Health Indicator.* The reasoning behind the inclusion of psychosocial factors in the discussion of health and aging is not just ideology or theory. There is considerable evidence that well-being is strongly linked as both a cause and effect of health status across the life span. Diener and Chan’s (2011) comprehensive analysis of these linkages provides a range of evidence to support this proposition. Steptoe et al.’s (2015) article in the *Lancet* is also a very useful resource. The OECD (2010) report on Social Capital, Human Capital and Health also provides a similarly useful analysis of these linkages.

## Measurement Issues in Healthy Aging

*Inventories of Standardized Tools.* Since those early days, a very significant research effort has been implemented in measuring well-being and quality of life. The research literature is replete with tools to measure these concepts. Extensive research has been conducted involving their application to almost every possible condition and social group including older people. Emery et al. (2005) describe the development of the Quality of Life Instruments Database (QOLID)

and the large numbers of measurement tools that are now included within it (see [www.proqolid.org](http://www.proqolid.org)). The database itself includes details of many studies involving the measurement of quality of life in older people. The quality of life and well-being measurement movements are a natural consequence of the adoption of the WHO conceptualization of health. We consider that the inclusion of similar concepts in the widely used definitions of successful, healthy, active, positive, and productive aging is also a direct consequence of the broader focus embraced by the WHO definition and the availability of standardized tools to measure them.

*Operationalization of Key Concepts.* In providing a contemporary of definition of healthy aging, we need to consider its many current synonyms and antecedent definitions as well as its operational definition. Specificity in how a general concept is to be measured is helpful because such matters inform the development of key performance indicators for government and programs. It also assists researchers in terms of measurement of program outcomes so that interventions may be realistically benchmarked against one another. While there is nevertheless still considerable development occurring in the measurement of burden of disease, the existence of mature shared operational definitions of key burden of disease concepts such as disability-adjusted life years and quality-adjusted life years has been very helpful in that field.

*Definition of Active and Healthy Aging.* The time is ripe for greater agreement about the operational measurement of healthy aging. To that end, in October 2014, the European Innovation Partnership on Active and Healthy Ageing met to specify an Operational Definition of Active and Healthy Ageing. Unfortunately, the meeting did not produce a useful consensus concerning how to operationally measure healthy aging. It was acknowledged at this meeting that several key elements of healthy aging cannot currently be adequately measured.

Indeed, the WHO Report on Ageing and Health (Beard et al. 2015) has proposed the priority action

of “Agree on metrics, measures, and analytical approaches for healthy ageing,” and this is a pressing need. Lord Kelvin’s commentary from the early nineteenth century on the need for usable metrics to guide science and policy actions neatly summarizes the importance of good operational definitions to guide policy: “When you can measure what you are speaking about, and express it in numbers, you know something about it; but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meagre and unsatisfactory kind: it may be the beginning of knowledge, but you have scarcely, in your thoughts, advanced to the stage of science.”

This is not to say that there has been no progress in operational definitions for healthy aging, but there are currently many measurement tools with no clear consensus as to which ones are best. The development of a consensus concerning high-quality and practical measures of healthy aging is now recognized as an important global priority by several influential agencies. This development will greatly assist better economic modeling and evaluation of policy initiatives and evidence-based policy formulation.

## **Influences on, and Predictors of, Healthy Aging**

A substantial knowledge base concerning risk and protective factors for various outcomes in old age is now available based on longitudinal investigations. A difficulty is that varying study purposes has led to the use of varying outcome measures that often are not comparable. Further, they often do not incorporate healthy aging concepts into their measurement suite while including a preponderance of measures of physical decline. We now illustrate some of the findings in the relevant extant literature.

Stuck et al.’s (1999) systematic review found that the most significant risk factors for functional decline were cognitive impairment, depression, disease burden, under- or overweight, lower limb functional limitation, low social activity, low

physical activity, poor self-perceived health, no alcohol use, smoking, and vision impairment. Many studies and reviews have confirmed the role of behavioral and social factors such as not smoking, physical activity, normal weight, moderate alcohol use, and social integration in physical functioning, cognitive functioning, and mortality in older people (Depp and Jeste 2006; Lee et al. 2010; Peel et al. 2005). Lantz et al. (2010) in their 19-year prospective study of mortality among people in the United States aged 25 years and older found that low physical activity and smoking were significant predictive factors. A 17-year follow-up of the Whitehall II study (Britton et al. 2008) found that successful aging – as indicated by cognitive capacities, absence of disease, and good functional health – was predicted by socioeconomic factors in midlife and a range of key health behaviors earlier in life, including diet and exercise, as well as work support for men. Research from the English Longitudinal Study of Ageing (ELSA) (McMunn et al. 2009) has identified substantial social class inequalities in the onset of illness and survival of older people. An analysis of threats to aging well in Melbourne, Australia, over a 12-year period (Kendig et al. 2014) found major gender differences: major threats for women included being under weight, low physical activity, and urinary incontinence, while for men, these threats included being a current smoker, low strain, and perceived inadequacy of physical activity

Thus, there is a body of longitudinal research examining the associations between older people's characteristics and behaviors and their subsequent experiences in terms of various measures of healthy aging. The usefulness of the research has been limited by difficulties distinguishing between causal influences and outcomes as the same measures are sometimes used as both independent and dependent variables (Glatt et al. 2007). In addition examination of single outcomes and/or single risk or protective factors may be confounded by other factors not included in the analyses. Physical and mental/

emotional health components of aging well are rarely examined together as a multidimensional healthy aging outcome. Finally, many of the studies do not provide subgroup analyses to examine the impact of gender and other social subgroups.

### **Programs and Services to Promote Healthy Aging**

In line with the underlying principle that aging processes are modifiable, over the past 30 years, there has been development and evaluation of different interventions for improving the health and quality of life of aging individuals and their caregivers. As an example, in the United States alone, there are now several inventories of evidence-based interventions associated with a variety of health and well-being enhancements across the life course (see <http://www.wsipp.wa.gov>). One of the most successful programs, the Stanford Chronic Disease Self-Management Program (Lorig 2015), has reached hundreds of thousands of older adults.

There are broad-based evidence-based programs focused on modifying healthy lifestyles and environments (e.g., increasing physical activity and healthy eating) and other more specific ones for addressing major geriatric problems such as risks for falls and other injuries or enhancing mood and cognition in later life (Ory and Smith 2015). While many interventions have traditionally been based on theories about the important influence of social cognitive processes, more recent interventions are building on socio-ecological models that stress the importance of providing supportive built environments or policies designed to make the right lifestyle choice the easy one.

The evidence is now overwhelming that such evidence-based programs can help meet the triple aims of health reform including better health, better health care, and better value (Ory et al. 2013). The research questions have changed from “what works” to “how can we implement

what is known to work” to “how do we sustain such efforts for long-term health effects?”

The growing intervention research base is built upon our conceptualization of healthy aging as possible as well as our understanding that the best interventions are multilevel and address the multiple clinical, psychosocial, and environmental risk factors. An advance in recent years is the adoption of common planning and evaluation frameworks such as the RE-AIM framework (Gaglio et al. 2013) as well as pragmatic research instruments for rapidly assessing intervention impacts in a variety of home, health care, and community settings.

## Conclusion

Healthy aging is a topic of central interest to communities, societies, and governments. It has been argued that this interest stems from a variety of sources including rapid demographic changes, markedly increased human longevity, and rapidly changing patterns in health and illness especially in non-communicable diseases that are impacted by aging. The recent efforts to define healthy aging including the WHO’s most recent 2015 definition “The process of developing and maintaining the functional ability that enables well being in old age” now incorporate well-being and psychosocial factors and these are welcome and appropriate additions. Further work is underway on developing societal and policy-focused directions in healthy aging. The complexity of the field and the varied applications of healthy aging make it difficult to achieve consensus on measurement, but further development would strengthen the knowledge base and applications to economic modeling and the evaluation of policy initiatives and evidence-based policy formulation. Programs that are designed to promote healthy aging now have a substantial evidence base, so with appropriate investment, many of the challenges posed by our aging societies can be addressed.

## Cross-References

- ▶ [Active Aging](#)
- ▶ [Burden of Disease and Aging](#)

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## Heidelberg Centenarian Studies

Christoph Rott<sup>1</sup>, Daniela S. Jopp<sup>2,3</sup> and Kathrin Boerner<sup>4</sup>

<sup>1</sup>Institute of Gerontology, Heidelberg University, Heidelberg, Germany

<sup>2</sup>Institute of Psychology, University of Lausanne, Lausanne, Switzerland

<sup>3</sup>Swiss Centre of Competence in Research LIVES, Overcoming Vulnerability: Life Course Perspectives, Lausanne, Switzerland

<sup>4</sup>Department of Gerontology, John W. McCormack Graduate School of Policy and Global Studies, University of Massachusetts Boston, Boston, MA, USA

### Synonyms

100-year-old; People having reached the age of 100 years; Studies of centenarian people

### Definition

The Heidelberg Centenarian Studies are two population-based investigations conducted 11 years apart. They inform about physical and cognitive functioning, health, need for care, and well-being at the age of 100 years in Germany. Cohort differences between individuals born around 1900 and around 1911 are assessed in central domains of functioning and care.

### Early Research on Longevity and Centenarians in Germany

The Heidelberg Centenarian Studies have their roots in earlier centenarian research conducted in Germany. In the 1960s, German scientists started to investigate extraordinary longevity and to conduct studies with centenarians (Franke 1985; Lehr 1982). These studies were characterized by a broad interdisciplinary perspective and tried to provide comprehensive answers on longevity issues instead of focusing on disciplinary

specific research questions. Biological, medical, psychological, and social factors were equally considered. Ursula Lehr, a German developmental psychologist, proposed a longevity model that attracted worldwide attention. Length of life and quality of life were the two equally important outcome dimensions in her model (Lehr 1982).

Hans Franke, a physician, was the first German researcher who systematically investigated individuals at the age of 100 years and older (Franke 1985). He was aware of the rapid increase of the number of centenarians and highlighted the importance of age validation in this age group. Between 1965 and 1983, his team contacted and examined 575 centenarians. While a detailed description of the exact sampling strategy is not available, it is known that Franke contacted all centenarians whom he could identify via newspaper announcements and word of mouth, regardless of their physical and mental status. Interestingly, his main conclusions resulted in two insights: that cumulative disability and multimorbidity were highly prevalent and that centenarians showed tremendous interindividual differences. In order to characterize the centenarians better, he grouped his sample into three levels of vitality. The first group consisted of active and well-functioning centenarians (“Rüstige,” 29%), the second group were frail and rather sick individuals who were limited in everyday activities (“Kränkelnde,” 48%), and the third group had advanced disease and total dependence and was often bedridden (“Sieche,” 23%). Based on his observations and in line with Lehr’s longevity model, Franke raised the question whether life was still worth living at the age of 100 years and beyond.

Stimulated by Franke’s work, Lehr initiated a centenarian study in the Bonn-Cologne area (Lehr 1991) with a focus on coping behavior. This meant that centenarians had to be rather cognitively intact and able to participate in a comprehensive interview. Although the participants were therefore clearly positively selected, the interindividual differences prevailed as one of the key findings. Furthermore, findings indicated that the coping behavior played a central role for an active life and social integration, even in the

face of functional limitations and disease burden (Rott 1999). Most of the centenarians felt that they were actively shaping their life and were striving to make the best of their situation.

### The First Heidelberg Centenarian Study (HD100-I)

Although these two early German centenarian studies provided valuable insights into very long lives, they bear at least two major limitations. First, it was unclear to what degree study findings were representative of the centenarian population in Germany. Given the lack of well-described sampling procedures, this is unclear for Franke's study, and the Bonn-Cologne study was clearly not population based. Secondly, the data were not collected with standardized instruments but rather with qualitative interviews. Thus, it is difficult to compare the results with those from other centenarian studies being now conducted around the world. A major impetus for a new German centenarian study came from the Georgia Centenarian Study (Poon et al. 1992), not only with respect to sampling and instruments but also with respect to research questions. Building on experiences and results from the Georgia Centenarian Study, the aims of the First Heidelberg Centenarian Study were to assess objective and subjective quality of life and their interrelations, addressing three main domains: (1) cognitive functioning, (2) functional health and care, and (3) subjective well-being. To be comparable with other studies, internationally established instruments were administered (e.g., to assess autonomy and everyday functioning: ADL and IADL scales by Fillenbaum 1988) and a population-based sampling strategy was applied (Rott et al. 2001). There were no exclusion criteria. Within a clearly defined geographical area about 60 km around Heidelberg, 172 cities and communities provided names and addresses of 281 eligible persons (age 100 years at the time of assessment). Of these, a substantial number, namely 125 persons (44.5%), could not be verified: Either they died in the interim (that is, between nomination and the first contact with the family: 93 centenarians), could not be found

in spite of intensive inquiry (22 persons), or their age was wrong (younger than stated; 10 persons). A direct contact was established with 156 persons or their relatives. In 65 cases, participation in a face-to-face interview was refused for various reasons. However, some basic demographic and health information could be obtained via telephone from 42 centenarians of the refusal group. Full study participants were 91 centenarians who were visited in their place of residence (i.e., apartment or care institution). Of these, 56 provided reliable information about themselves. In addition, 86 primary contacts (i.e., proxies) provided information on the centenarian, complementing the centenarian as information source (for 95% of the centenarian sample). These proxies were mostly children or other relatives in close contact with the centenarian; the remaining 5% of the centenarians did not want their proxies to be contacted or did not have any close contacts. The interviews were conducted in the years 2000 and 2001. After 18 months, a subgroup of individuals ( $n = 36$ ) was again assessed with a subset of the baseline measures. Moreover, centenarians were followed by contacting their proxies every 6 months until they died. The last of the HD100-I participants died in 2009.

The mean age of the participants was 100.2 years ( $SD = 0.41$ ). Eighty-five percent of the centenarians were women, most of them (78%) were widowed, and about three-quarter (72%) had an elementary school degree. Thirty percent lived in an own apartment, 20% lived with relatives, and half of them resided in institutions.

Replicating prior findings, interindividual differences played a major role in all areas. Domain-specific results can be summarized as follows:

#### Cognitive Status

Cognitive functioning was evaluated with a shortened version of the MMSE (i.e., items sensitive to visual, dexterity, or literacy deficits were removed, as proposed by Holtsberg et al. 1995) and the Global Deterioration Scale (GDS; Reisberg et al. 1982). Not surprisingly, results revealed that centenarians differed significantly from each other with respect to their cognitive

capacities (Kliegel et al. 2004a). A key finding was that dementia was less prevalent than expected: While about half of the population (52%) showed moderate to severe cognitive impairment, one quarter was found to be cognitively well intact. In a second step, MMSE and the GDS scores were combined to evaluate whether the centenarians had sufficient cognitive capacity to live independently. This was the case for almost half of them (46%; Becker et al. 2003). On the other hand, cognitive functioning of one-quarter of the sample was so severely restricted that continuous monitoring and care was necessary.

Analyzing cognitive change of survivors ( $n = 36$ ) over a period of 1.5 years revealed distinct patterns of intraindividual change (Kliegel et al. 2004a). Five centenarians (14%) were characterized by reliable improvement, 22 centenarians (61%) showed stability (some on the bottom level), and 9 centenarians (25%) revealed decline which was often a rather radical drop to the bottom level of functioning. Further reflecting substantial individual differences in terms of functioning, centenarians were found to remain stable at low as well as high levels of functioning. Specifically, those centenarians who had an MMSE score of 0 had already reached this status about 2 years (730 days) before death. In contrast, there were also centenarians who maintained intact cognitive functions until they died.

Additional noteworthy findings were related to the extent to which distal influences such as education as well as prior life style determined cognitive functioning at age 100. Analyzing the influence of early education, occupational status, and intellectual activities on cognitive status in very late life revealed independent, significant, and strong influences of both formal school education and intellectual activities on the cognitive status, even after controlling for occupational status (Kliegel et al. 2004b).

### Functional Health and Care

The instrument to evaluate levels of activities of daily living (ADL) was taken from the OARS (Fillenbaum 1988). We prioritized the proxy information because it was evident that the

self-reports of the centenarians represented an overestimation of functioning (Schönemann-Gieck et al. 2003). Results demonstrated a severe loss of independence. Whereas about two-third of the centenarians could eat by themselves, the degree of independence in most other activities was between 30% and 40% only. Bathing as the most complex basic activity of daily living could be performed independently by 13% (Becker et al. 2003).

In 1995, the German Long-Term Care Insurance Program was implemented with the goal of providing financial means to individuals in need of care to pay for professional services or to reimburse care provided by the family. However, care needs were assessed only on the basis of physical functioning, and cognitive restrictions were not considered, ignoring the levels of dependency caused, for example, by dementia. As a reaction to this, Becker and colleagues developed a category system including physical and cognitive limitations to analyze the HD100-I data, to allow for a more comprehensive evaluation of independence and care need. Specifically, ADL functioning was combined with cognitive performance, and this more complex measure was categorized into four levels analogous to the German Long-term Care Insurance (Becker et al. 2003). Level 0 indicated sufficient physical and cognitive capacity to live independently, level 1 required nursing care once a day, level 2 three times a day, and level 3 made continuous care 24 h a day necessary. Level 0 was present in 9% of the centenarians, indicating physical and cognitive independence (functional competence), a level that was similar to the results of the Danish Centenarian Study (Andersen-Ranberg et al. 2001). Thirteen percent of the centenarians needed care once a day (level 1), 45% three times a day (level 2), and one-third (33%) was fully dependent (level 3). A comparison of these alternative criteria to determine care need with those used by the German Long-term Care Insurance suggested that existing care needs were often not addressed adequately. Almost half (44%) of the HD100-I centenarians were categorized at a lower level of care compared to our categorization of independence and care need (Becker et al. 2003).

### Subjective Well-Being

HD100-I centenarians reported better well-being than one would expect given the obvious constraints in health and cognition, as well as the extensive care needs. Specifically, we considered two well-being constructs, valuation of life, and happiness. Valuation of life (VOL; Lawton et al. 1999b) refers to an individual's feeling of being attached to his/her life and to experiencing life as worth living. In contrast, happiness as an aspect of emotional well-being refers to the immediate experience of positive feelings, which should be influenced by the centenarians' daily struggle with loss and restriction. Comparing VOL levels of the HD100-I centenarians with the septuagenarians interviewed by Lawton and colleagues (1999a), findings indicated that centenarians had significantly lower VOL levels, yet the difference was rather small (HD100-I:  $M = 48.1$ , vs. 70s:  $M = 50.2$ ). Considering predictors of VOL in the centenarians, the strongest predictor was extraversion, followed by IADL competence. Other objective factors such as health or cognition did not account for any interindividual differences in VOL (Rott et al. 2006).

Regarding happiness, centenarians felt at least as happy as middle-aged and older individuals, when compared with participants of the ILSE Study, a study representative for German middle-aged and older adults (Jopp and Rott 2006). Thus, it appears that centenarians do not experience reduced subjective well-being when considering more emotional aspects such as happiness, relative to younger individuals. Underscoring the findings on VOL, health was not found to be among the predictors of happiness, which suggests that centenarians are able to experience happiness even in the face of objective negative conditions such as their deteriorating health status. Other basic personal resources, such as education (job training), cognition, social network, and extraversion, were associated with happiness, but when considering self-efficacy and optimistic outlook as mediators, some of the effects became nonsignificant or had only indirect effect via the mediators. The strongest predictor of happiness were self-efficacy and optimistic outlook, indicating that beliefs about one's capacity

and more general attitudes towards one's life are more important for feeling happy at very advanced age relative to basic resources such as health (Jopp and Rott 2006).

### Conclusions from the First Study

The First Heidelberg Centenarian Study confirmed the impression from prior, more unsystematic German centenarian studies that interindividual variability in central domains clearly existed. In addition, differences in intraindividual change in cognition could be observed even in close proximity to death. While nearly all of the centenarians were physically frail and about 90% needed nursing care, the proportion of individuals with poor cognitive functioning was much lower. Thus, it seemed that cognition was better maintained than physical functioning in these very old persons. Those who could give reliable self-reports seemed remarkably robust psychologically and in most cases evaluated their life as worth living. Attitudes towards life seemed to be more important for well-being than objective conditions such as health.

### The Second Heidelberg Centenarian Study (HD100-II)

Inspired by promising results from a cohort study in Denmark demonstrating that later born female centenarians were better off regarding mobility and ADL functioning (Engberg et al. 2008) and being aware of limitations of the first investigation, the Second Heidelberg Centenarian Study (HD100-II) was launched in 2011. One aim was to examine cohort differences in cognition and physical functioning/care between centenarians born approximately 10 years apart. Other objectives were to take a closer look at social networks and care arrangements, a more comprehensive assessment of health and diseases and to investigate the interplay of psychological strengths and well-being.

The same sampling procedures as in the first study were used. For recruitment, we requested contact information of all individuals born in

1911/1912 from the same city registries (in and up to 60 km around Heidelberg, Germany). To ensure the greatest possible degree of representativeness, no exclusion criteria were applied. Of the 485 eligible individuals, 298 centenarians either died between nomination and first contact, refused any participation, or no contact could be established. Seven centenarians and 73 primary contacts provided only basic information via telephone. Reasons for refusing full study participation were cognitive restrictions/dementia (43%), concern the interview would be too exhausting (28%), no interest (16%), poor physical health (9%), and other reasons (4%). We could enlist 107 centenarians or their primary contact to participate in a face-to-face interview. Five additional centenarians nominated themselves after having heard of the study. These participants are not considered for cohort comparisons. In total, 112 centenarians were interviewed at their residence (private home or elder care facility). When the centenarian was no longer able to answer reliably (e.g., due to cognitive impairment), the primary contact served as the only information source ( $n = 18$ ).

Data were collected in the years 2011 and 2012. The mean age of the participants was 100.5 years ( $SD = 0.47$ ). Most study participants were exactly 100 years old; 5% were 99 and 10% were between 101 and 103 years old. Eighty-nine percent of the centenarians were women and most of them (83%) were widowed. About two-third (61%) had an elementary school degree. A majority (59%) resided in the community, whereas the remaining 41% lived in an elder care facility.

### **Better Cognitive Status of Later Born Cohort**

Cognitive functioning was evaluated in both studies with the Global Deterioration Scale (Reisberg et al. 1982). The participants of the second study revealed a significantly better cognitive status compared to those from the first study. Specifically, the proportion of centenarians with no or only little limitations had increased from 41% to 52%, while the percentage of individuals with strong limitations had decreased from 28% to 22% (Jopp et al. 2013).

### **Improved Functional Health But Same Amount of Care**

Activities of daily living (ADL) were evaluated in the same way as in the first study. The instrument was taken from the OARS (Fillenbaum 1988), and we prioritized the proxy information. The proportion of independent functioning significantly increased in three out of seven activities of daily living (Jopp et al. 2013). While in the first study 63% could eat by themselves, 83% were able to do so in the second study. The rate of independence in getting in and out of the bed without assistance rose from 34% to 53%; and 51% were able to take care of their own appearance in the second study compared to 32% in the first study. In spite of these improvements, the rate of dependency was still very high. About only one-third of the centenarians in both studies were able to walk without assistance, a requirement for independent living and social participation. Taking a bath or shower independently, representing the most complex activity of daily living, stagnated at a rate of 13%. Thus, that the more recent cohort of centenarians showed improvements in some activities of daily living compared to those individuals who were 100 years old about 11 years ago did not reduce the amount of care granted by the German Long-Term Care Insurance.

### **Similarities and Differences in Social Networks and Care Arrangements**

Comparative analyses were conducted for all social network and care arrangement indicators that were available in both studies to identify cohort differences. Interestingly, most of the social network indicators did not differ between the first and the second study. Centenarians were very similar with regard to marital status (80% widowed, 12% never married, 4% married, and  $\leq 4\%$  divorced), having a living child (71%), spending time with people they do not live with, in the past week (2–6 times per week, on average), seeing family as often as they want (46–54%), and having anyone to confide in (94–96%). There was only one marginal difference, for number of children, with centenarians in the second study having slightly fewer children on

average compared to the first study ( $M = 2.1$  vs.  $M = 2.6$ ).

Whereas these basic indicators showed mainly similarities, noteworthy differences emerged with regard to living arrangements (living alone, with at least one person in household, or in an eldercare facility), use of professional help (community-dwelling centenarians only), and perceptions of loneliness. Centenarians of the second study were significantly more likely to live alone (29% vs. 13%). They were also more likely to utilize professional help to address low or high intensity needs (16% vs. 6% for help with house cleaning, and 16% vs. 4% for help in multiple care domains). Group differences were not significant for moderate care needs (11% vs. 8% for help in one care domain). Finally, centenarians of the second study were significantly less likely to report loneliness. Thus, findings suggested that the recent cohort of centenarians from the second study stay in the community and live independently longer, get more professional help, and experience less loneliness. What may have contributed to less experienced loneliness in the recent cohort is an interesting question that our data cannot fully answer. However, correlational analyses indicated that more time spent with others not living in the same household was significantly associated with less loneliness. It is possible that reports of time spent with others included professional helpers and that thus an increased use of professional help contributed to preventing or reducing experiences of loneliness in centenarians. The increased use of professional help is also reassuring, given that in the wake of dramatic increases in the very old population (Christensen et al. 2009), combined with low birth rates and, in some cases, increasing childlessness (Statistisches Bundesamt 2013), the primary reliance on children as support providers does not seem like a realistic prospect for many future centenarians (Boerner et al. 2016).

### Better Understanding of Health and Disease

The Second Heidelberg Centenarian Study offered also a more detailed insight regarding health conditions in centenarians. Specifically, drawing on information from centenarians and

proxy informants, the Heidelberg centenarians were found to have on average about five recent and chronic health conditions, indicating substantial comorbidity (Jopp et al. *in press*). No centenarian without a health problem was found, 4% had only one, 12% had two, and 9% had three conditions. The health conditions most often reported were vision and/or hearing impairments (94%), mobility problems (72%; e.g., falls, difficulty with balance/walking), and musculoskeletal conditions (60%; e.g., arthritis, osteoporosis). Heart conditions (57%; e.g., high blood pressure, heart diseases) and problems with the urinary system (55%) had similar prevalence rates (Jopp et al. *in press*).

In spite of a notable comorbidity, the overall number of diseases with high mortality risk was rather low. Considering the three most common lethal illnesses, heart diseases, stroke, and non-skin cancer, not one of the centenarians was found who was affected by all three of them. One-third of the centenarians had only one, and only 10% had two of them. Another noteworthy finding came from reports on pain. Specifically, 30% of the centenarians reported frequent pain (19% indicated often, and 11% indicated always). Of those reporting any pain, the largest group said their pain was bearable (57%). Yet, a total of 36% of the centenarians reported pain stronger than bearable (Jopp et al. *in press*). In sum, patterns of health issues are dominated by sensory and mobility impairment and not by specific diseases.

### High Level of Subjective Well-Being and Pronounced Psychological Strengths

Subjective well-being was assessed with different self-report measures to which those centenarians answered who were cognitively able to provide reliable responses. The single item asking whether they would laugh easily, as well as the question whether they would be as happy as at younger ages received affirmative responses from over half of the sample. Both questions were answered in the negative way by about one-tenth. That the remainder of the sample, namely about one-third of the centenarians, had difficulty to decide between yes or no despite sufficient cognitive

capacity, may suggest that questions about quality of life are not easy to be answered in very old age. Still, comparing the more recent cohort of centenarians with those of the first Heidelberg Centenarian Study suggests that today's centenarians felt more often as happy as when they were younger (Jopp et al. 2013). Using the Life Satisfaction Scale by Pavot and Diener (1993), a substantial majority of the sample, namely over 80%, indicated that they were satisfied with their lives. Comparing levels of life satisfaction between the HD100-II centenarians and young-old and old-old control groups revealed that the centenarians were on average as satisfied with their lives as the young-old and old-old controls (Jopp et al. 2013).

Among the demographic, health, social, and psychological variables, psychological strengths including self-efficacy, optimistic outlook, meaning in life, and will to life showed the strongest links to life satisfaction. Optimistic outlook was the strongest significant predictor of individual differences in life satisfaction. Thus, psychological strengths are, in comparison with health and various objective conditions, very important for experiencing life as satisfying at age 100 (Jopp et al. 2013), a finding that replicates and extends prior analysis from HD100-I.

## Conclusions from Both Studies

The Heidelberg Centenarian Studies revealed that substantial interindividual differences exist at the end of the human life span confirming the hypothesis that even extremely long living individuals do not age in the same way. Intraindividual variability was observed between domains (physical functioning, cognition, and well-being) and within one area (cognitive functioning). Noteworthy are cohort differences favoring the later born, they are less physically frail and to a larger extent cognitively intact. In spite of these improvements in physical and cognitive functioning, the high need for care is unchanged. This result raises the question what can be done to increase capacity levels to maintain autonomy and reduce care need.

Regarding health, the pattern of findings seems to highlight that centenarians are protected from lethal diseases, maybe due to their genetic dispositions. Sensory and mobility impairments are the dominating health problems. Emerging health profiles further indicate that even in very advanced age, quality of life may be improved by enhanced diagnostics and optimal disease management as well as preventive measures and interventions. Care arrangements of the very old will be different in the future with more professional help and less family support, which calls for the adjustment of current service models and related policy to account for the unique needs of this growing population.

Although living at the age of 100 is in many cases characterized by strong limitations, substantial health problems, and the risk of reduced social networks, both cohorts coped remarkably well with these challenges. The psychological makeup of centenarians seems to be more adequate for a very long life than the physical architecture.

## Cross-References

- ▶ [Health in Centenarians](#)
- ▶ [Well-being in Centenarians](#)

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## History of Biomarkers in Geropsychology

Christiane A. Hoppmann and Victoria

Michalowski

Department of Psychology, University of British Columbia, Vancouver, BC, Canada

## Synonyms

Allostatic load; Bioindicator; Stress

## Definition

A biomarker is an indicator that reflects both normative and pathological biological processes.

## Historical Origins

It is always difficult to date the birth of a new approach without disregarding the important contributions of many scholars that paved the way long before its emergence. However, it seems safe to say that the late 1940s created a unique breeding ground for aging research to combine both psychological and medical perspectives, which subsequently led to a proliferation of new theoretical models and empirical evidence on how psychological and biological factors interact to shape aging outcomes (Birren and Schroots 2000). An increased recognition of demographic changes as well as altered disease patterns during this period launched the founding of a new multidisciplinary society for the study of aging that continues to foster the cross-fertilization of psychosocial and biomedical science perspectives (Gerontological Society of America in 1945), the development of an aging unit within the National Institutes of Health in the United States of America (1946), and the World Health Organization's definition of health which explicitly recognizes the important role of not just biomedical but also psychosocial factors in shaping health and well-being across the lifespan (Birren 1961; World Health Organization 1948). Today, many prominent theories of lifespan development and aging explicitly call for an examination of the complex interplay between psychosocial and biomedical factors (Baltes et al. 2006; Finch and Seeman 1999; Schaie 2001). The purpose of this entry is to provide a theoretical backdrop for the kinds of questions that can be addressed when including biomarkers in psychological aging research, to highlight recent advances in the field, and to foreshadow avenues for future research involving biomarkers.

## Aging Research at the Intersection of Psychology and the Medical Sciences

Contemporary psychological and biological aging theories both call for an interdisciplinary approach to the study of adult development and aging (Baltes et al. 2006; Finch and Seeman 1999). For example, a central tenet of lifespan psychology is the inherently incomplete architecture of human ontogeny according to which biological make-up and psychological, social, and material resources influence each other in systematic ways from conception to very old age. In this context, development is characterized by three factors: (a) an age-related decrease in biological plasticity across the lifespan; (b) an increased need for psychosocial, material, and knowledge-based resources (culture); and (c) an age-related reduction in the efficiency of psychosocial, material, and knowledge-based resources in counteracting biological losses. Despite the interdisciplinary anchoring of this perspective, the ultimate goal of lifespan psychology remains to delineate the specific psychological mechanisms, such as selective optimization with compensation, that promote successful aging (Baltes et al. 2006). Stress theories of aging also embrace a uniquely interdisciplinary perspective by explicitly taking into account the role of social and environmental factors when trying to better understand individual differences in biological wear and tear and how it is associated with age-related pathologies. Notwithstanding this clear interdisciplinary orientation, the main focus of this perspective consists of identifying the specific biological mechanisms underlying age-related losses in resiliency as well as increases in disease risk (Finch and Seeman 1999). The high value that is placed on interdisciplinary approaches and the explicit recognition that a better understanding of the multi-directionality and dimensionality of aging requires a coordination of efforts between different disciplines has not only resulted in the launch of a substantial number of highly influential aging studies (Schaie and Hofer 2001); it has also created a platform for the

generation and communication of findings that matter across traditional disciplinary boundaries.

## **Advantages and Challenges of Using Biomarkers in Geropsychology**

Geropsychologists profit from recent advances in the biomedical sciences which provide the field with a historically unprecedented large repertoire of biomarkers reflecting different biological processes that can be utilized to better understand how psychosocial factors influence health with aging (Miller et al. 2009; Piazza et al. 2010). Commonly used biomarkers indexing sympathetic-adrenal-medullary and hypothalamic-pituitary-adrenal activity as well as immune functioning have been summarized by Piazza and colleagues (Piazza et al. 2010) along with a brief definition, their specific functions, any age-related changes, and their association with specific diseases. Importantly, this tremendous opportunity comes with the challenge to be crystal clear about which biomarkers may be best suited to address a specific question under investigation. For example, there is a certain appeal to including biomarkers such as salivary cortisol in psychological studies because they are easy to collect. However, salivary cortisol is but one biomarker that may be worth considering. There is in fact a whole array of established neuroendocrine, cardiovascular, immune, or metabolic markers targeting different biological systems that can be collected using specimens such as saliva or blood or by taking electronic readings (Piazza et al. 2010). Furthermore, depending on the research question, it may make sense to specifically target one biomarker, for example, cortisol, or to sample multiple markers that may provide answers to systematic interactions between different biological systems (e.g., cortisol to index hypothalamic-pituitary-adrenal activity, alpha amylase for sympathetic-adrenal-medullary activity, and proinflammatory cytokines as immune system markers; (Nater et al. 2013a)). Finally, different biomarkers capture processes that occur on vastly different timescales and that involve different system

levels. For example, a psychologist interested in psychosocial predictors of hypothalamic-pituitary-adrenal activity has to make a priori decisions about whether to sample cortisol in saliva which fluctuates on an order of minutes, whether to collect cortisol in hair which changes on an order of months, or whether to target DNA methylation patterns in glucocorticoid receptor genes that may reflect relatively long-lasting early-life experiences (Miller et al. 2009; Nater et al. 2013a). Taken together, the tremendous array of different biomarkers that is available today has the potential to truly propel psychological aging research forward, but it also comes with the need to be mindful about which biological mechanism(s) to target and what time course to select to meaningfully interpret respective findings.

## **Biomarkers in Geropsychology: The Sample Case of Research on Social Relationships**

The following sections introduce a small subset of studies on social relationships and health that have been conducted over the past decades to illustrate a number of different research approaches that have significantly added to the current knowledge on the mechanisms linking social factors and health with aging. In doing so we point to the different methodological approaches that have been taken and highlight the role of biomarkers in identifying different pieces of the larger overall puzzle.

In the late 1970s, the Alameda County study provided groundbreaking evidence that an individual's number of social ties predict all-cause mortality over and above the important role of age, gender, socio-economic status, body mass, health behaviors, health care utilization, and self-reported health (Berkman and Syme 1979). This landmark finding has been replicated across several long-term longitudinal studies (House et al. 1988) and put social relationships on the map of health psychological and aging research, stimulating a broad array of subsequent research

aimed at better understanding underlying psychological mechanisms and biological pathways.

One such approach that has been pursued since the 1990s, for example, in the context of the MacArthur Studies of Successful Aging, combines different biomarkers into an allostatic load index (Seeman and Gruenewald 2006). The model of allostatic load is based on the idea that a repeated or chronic activation of various bodily systems that are activated in response to different stressors can lead to bodily wear and tear and a loss of resiliency that increase the risk for a broad spectrum of negative aging outcomes including but not limited to accelerated cognitive decline, chronic disease, and early mortality (Seeman and Gruenewald 2006). Allostatic load has been operationalized as a cumulative index that quantifies the number of biomarkers across multiple biological systems (cardiovascular system, hypothalamic-pituitary-adrenal axis, sympathetic nervous system, metabolic and inflammatory markers, lung and renal function) for which an individual scores in the highest risk quartile (Seeman and Gruenewald 2006). Long-term longitudinal research using this biomarker-based index of allostatic load filled the gap between previous evidence on the association between one's number of social ties and mortality by demonstrating that individuals with high-quality social relationships showed reduced stress-related wear and tear in midlife and old age (e.g., Seeman et al. 2002). One core strength of this approach is the comprehensive assessment of biomarkers across multiple biological systems, which has significantly increased our understanding of how not just the quantity but also the quality of social relationships get "under the skin" to shape health with aging.

Another more recent line of research has targeted processes that occur on much shorter timescales, such as hours or days, using combinations of repeated daily life assessments and concurrent assessments of biomarkers in saliva (Piazza et al. 2010; Hoppmann and Riediger 2009; Stawski et al. 2013). For example, research from the National Study of Daily Experiences has shown that the occurrence of daily life stressors such as arguments with others or work overload is

associated with an increased overall secretion of cortisol on that day (Stawski et al. 2013). In another study, it has further been shown that positive social exchanges such as intimacy with one's partner buffered the negative effect of chronic stress on daily cortisol outputs (Ditzen et al. 2008). To date, salivary cortisol is probably the most frequently used biomarker in studies using daily life assessments (Piazza et al. 2010). Despite its popularity and ease of use, salivary cortisol is only one biomarker that can be fruitfully implemented to delineate the mechanisms underlying social relationship-stress links. More recent work has also targeted other salivary biomarkers related to the hypothalamus-pituitary-adrenal axis, such as dehydroxyepiandrosterone-sulfate (DHEA-s), demonstrating that family members providing care to individuals with dementia display elevated daily DHEA-s outputs on days after using adult day service programs and when experiencing increased positive mood (Zarit et al. 2014). Furthermore, daily life assessments have included markers of sympathetic-adrenal-medullary activity such as salivary alpha-amylase (Nater et al. 2013b). A particular strength of study designs combining daily life assessments and biomarkers in aging research is their ability to capture life as it is lived. However, repeated daily life assessments also involve unique requirements regarding procedures for the assessment of biomarkers, for example, regarding ease of use and nonintrusiveness.

Finally, there is a large body of experimental research using biomarkers that has led to a much better understanding of the role of social relationships in modulating biological stress responses. For example, the introduction of the Trier Social Stress Test (TSST) has led to a proliferation of research searching for psychosocial moderators of the well-documented association between social-evaluative threat and hormonal as well as cardiovascular stress responses (Dickerson and Kemeny 2004; Kirschbaum et al. 1993). Of note, recent research using this experimental paradigm has started to integrate biomarkers at different system levels. For example, a recent study demonstrates that being supported by a close social other is associated with reductions in TSST-induced

cortisol responses but that such reductions depend on the presence of specific oxytocin receptor gene polymorphisms (Chen et al. 2011). This little snippet of the much larger experimental literature on social relationships and health showcases the value of taking the rich findings that have been generated by long-term longitudinal aging studies as well as studies using daily life assessments back into the lab to pinpoint the psychological mechanisms and biological pathways that link social relationships with aging outcomes under controlled laboratory conditions.

The selection of studies on social relationships and health described above illustrates the potential of implementing biomarkers into psychological aging research. However, they only represent a small segment of research in this area. Similar arguments could have been made regarding the role of other psychological factors for aging outcomes such as cognition, personality, or emotions and the use of different indices (e.g., cardiovascular reactivity, health behaviors).

## Future Directions

Biomarkers have a tremendous potential to enrich psychological aging research. In the next section we highlight several issues that demand further attention and that should be tackled to move the field forward.

Biomarkers clearly are a “hot” topic in geropsychology. However, they have to be taken for what they are – markers that reflect biological processes in a specific system of the body. Something that is sometimes overlooked but nevertheless important is that any given biomarker is influenced by a multitude of different factors including psychological, biological, and environmental processes which have to be taken into account in order to make sense of the generated findings. For example, there is a proliferation of psychological aging research looking at salivary cortisol as a biomarker of stress. Yet, this biomarker captures far more than just the psychological origins of stress that may be of core interest to a given researcher. In fact, biological and environmental factors with documented influence on

salivary cortisol include age, sex, body mass, menstrual cycle, certain neurological disorders, infections, time of day, medication and substance use, and physical activity just to name a few (Kudielka et al. 2012) which have to be considered as well when aiming to draw conclusions about the association between psychological stressors and hypothalamic-pituitary-adrenal reactivity. Salivary cortisol consequently should not be mistaken as an “objective” measure of psychological stress but rather as an additional indicator that may be fruitfully used to complement self-reported measures of psychological stress or negative affect because it provides an additional perspective.

Lifespan psychologists have long called for an integration of processes that occur along different timescales (Gerstorf et al. 2014; Nesselrode 1991). For example, combining repeated daily life assessments that capture processes that unfold on a timescale of hours or days with assessments of long-term longitudinal change that occur over years or even decades represents a quantum leap in aging research because it helps address such key questions as how daily life experiences may accumulate over time to shape long-term health outcomes. For example, recent evidence shows that affective reactivity to daily life stressors is associated with an increased risk of reporting chronic health problems 10 years later (Piazza et al. 2013). In addition, there is merit to combining the strengths of experimental and long-term longitudinal approaches. For example, recent evidence from the Whitehall II cohort shows that individuals responding with more pronounced cortisol secretion to a lab stressor had an increased risk of having hypertension 3 years later (Hamer and Steptoe 2012).

Finally, much has been said about the merit of interdisciplinary endeavors, but a lot less is typically mentioned about the challenges that go along with it. Cultivating interdisciplinarity while at the same time making sure that each researcher contributes the unique insights of their specific discipline probably requires a rethinking of academic training to better prepare the next generation of aging researchers for navigating complex interdisciplinary endeavors and

adding value to them based on their discipline-specific expertise. Consequently, new training programs have emerged that are situated at the intersection of psychology and the medical sciences including health psychology and gerontology programs, whose graduates will take psychological aging research that uses biomarkers to the next level. Graduate programs that focus on specialized topics, such as human development in a changing world, integrate an even richer array of psychological, biological, sociological, educational, and anthropological perspectives.

## Cross-References

- ▶ [Berlin Aging Studies \(BASE and BASE-II\)](#)
- ▶ [Canadian Longitudinal Study on Aging, A Platform for Psychogeriatric Research](#)
- ▶ [Health and Retirement Study, A Longitudinal Data Resource for Psychologists](#)
- ▶ [Plasticity of Aging](#)
- ▶ [Psychological Theories of Successful Aging](#)
- ▶ [Psychological Theories on Health and Aging](#)
- ▶ [Resilience and Aging](#)
- ▶ [Selection, Optimization, and Compensation at Work in Relation to Age](#)
- ▶ [Social Support and Aging, Theories of](#)
- ▶ [Training Psychologists in Aging](#)

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## History of Clinical Geropsychology, Professional Practice Informed by the Science of Psychology and Aging

Nancy A. Pachana<sup>1</sup> and Michele J. Karel<sup>2</sup>

<sup>1</sup>School of Psychology, The University of Queensland, Brisbane, QLD, Australia

<sup>2</sup>Mental Health Services, Department of Veterans Affairs Central Office, Washington, DC, USA

### Synonyms

History of clinical psychology of aging

### Definition

History of applying the knowledge and methods of psychology to understanding and helping older

persons and their families to maintain well-being, overcome problems, and achieve maximum potential during later life.

## Introduction

The second half of the twentieth century witnessed the emergence of the scientific study of aging for many medical as well as social science disciplines. Psychological research on cognition, emotions, and psychopathology in later life gained momentum in the 1950s and 1960s, first through cross-sectional studies and eventually progressing to longitudinal and sequential research paradigms. In the 1970s and 1980s, practice and training in clinical geropsychology took root, with the application of the science of the psychology of aging to improving the lives of older adults, their families, and the communities wherein they reside. In the 1990s, progress in neuroscience methods and findings contributed greatly to a richer understanding of biological processes of aging and their influence on psychological functioning. From 2000 onward, a greater emphasis on positive psychology in general, and its application to later life specifically, has again broadened the understanding of the experience of aging. Alongside these scientific gains are challenges for meeting the mental health needs of growing numbers of older adults in both the developed and the developing world. Clinical geropsychology – through research, practice, training, and advocacy – continues to contribute to meeting these growing needs and, as a profession, seeks to increase its ranks to meet the demographic challenges of the coming decades.

In this entry, we have four principal aims. First, we describe how the theory and science of geropsychology – in domains of theory of adult development, cognition and intelligence, emotional and personality, and sociocultural contexts – inform clinical geropsychology as a professional field of practice. Second, we review findings in the growing science of clinical geropsychology in domains of psychopathology, assessment, intervention, and integrated care. Third, we provide an overview of growing

resources for the field of clinical psychology in terms of professional organizations, journal, and books. Finally, we share developments in the growth of clinical geropsychology as an area of professional practice and training in the United States and globally, including areas of challenge and opportunity.

## Clinical Geropsychology Defined

Clinical geropsychology refers to the application of the knowledge and methods of clinical psychology to meet the behavioral and mental health needs of older adults and families. Older adults are generally defined as those persons over the age of 65, with the decades after 65 usually denoted as “young-old” (65–75), “old-old” (75–85), and “oldest old” (85+). Changing demographics globally mean that, in both the developed and the developing world, the proportion of people over 65 continues to grow, with the greatest growth seen in those over age 85.

According to the American Psychological Association definition of the specialty of geropsychology, this field works toward “understanding and helping older persons and their families to maintain well-being, overcome problems and achieve maximum potential during later life. Professional geropsychology appreciates the wide diversity among older adults, the complex ethical issues that can arise in geriatric practice and the importance of interdisciplinary models of care.” (See <http://www.apa.org/ed/graduate/specialize/gero.aspx> for more details.)

## Historical Trends in Geropsychological Science: Implications for Clinical Geropsychology Practice

The science of psychology and aging has grown tremendously in the past few decades. Growing understanding of cognitive, emotional, and social aspects of aging are critical for informing geropsychology practice. Several areas of geropsychology theory research that have implications for clinical practice are highlighted here.

*Theories of adult development.* Theoretical frameworks in geropsychology have evolved over time. In speaking about aging processes, Birren and Renner (1977) acknowledged that persons can experience incremental as well as decremental changes over time, and later Birren and Cunningham (1985) commented on geropsychology’s interest in differences and changes in behavior which occur with age, but also its interest in “patterns of behavior shown by persons of different ages in different periods of time” (pg. 18). Earlier theories focused more so on decremental changes over time. For example, disengagement theory (Cumming and Henry 1961) posited that later life was characterized by physical, psychological, and social disengagement, viewed as a response to declines in functioning and an increased interest in turning inward, away from active engagement in the world. In contrast, more recent conceptual frameworks emphasize adaptive strategies by older adults with agency to pursue active and successful late-life trajectories. For example, Selection, Optimization, and Compensation (SOC) theory (Baltes and Baltes 1990) proposed a framework to understand successful development and aging, by the individual’s active use of strategies involving selecting goals, optimizing means to achieve said goals, and utilizing compensatory strategies as required in the face of diminished resources or other constraints. Similarly, Carstensen’s (1992) theory of socioemotional selectivity posits that, later in life, individuals are aware of diminishing time left to them and so actively pursue a strategy of focusing on a more selective network of socially fulfilling relationships.

These theoretical perspectives are critical for informing hopeful attitudes about change in late life, for both practicing psychologists and their older adult patients. For too long, and still, there have been common beliefs that older adults could not change longstanding habits nor benefit from psychotherapy. While this has been disproven by research evidence, stereotypes can be difficult to challenge. Clinical geropsychologists understand that older adults have many strengths and strategies for adapting to difficult problems in late life.

*Cognition/intelligence.* When first studied in earnest, cognitive functioning in general and intelligence in particular were presumed to decrease in the face of increasing age. The cross-sectional cognitive studies of the 1940s and 1950s, which compared younger and older cohorts, appeared to support this view of steep and inevitable declines in intelligence with aging. However, data from longitudinal studies of cognitive functioning, such as the Seattle Longitudinal Study (Schaie 2005), have largely discredited this view. In fact, research supports a more nuanced view of cognitive functioning in later life, with some aspects of cognitive functioning holding steady into even advanced old age. For example, crystallized intelligence (learning from past experiences or prior learning) generally declines minimally later in life compared to fluid intelligence (Christensen 2001). Verbal abilities, particularly vocabulary and language usage, also have minimal declines in later life (Anstey et al. 2003). In contrast, speed of cognitive processing, some aspects of executive functioning such as performance on tasks requiring divided attention, and memory, particularly episodic memory, reflect aspects of cognition that not only decline with increasing age, but also may have a relatively accelerated rate of decline at more advanced ages (Anstey et al. 2003; Verhaeghen 2011).

Geropsychologists must understand and adapt psychological interventions to the cognitive strengths and challenges of older adults with whom they work, on an individualized basis. It is important not to assume cognitive decline nor to ignore possible cognitive changes that may need to inform a treatment plan. Most older adults maintain some (if not many) cognitive strengths and these can be optimized. Likewise, interventions can be adapted for slower processing speed (e.g., slow the pace and ensure points are being understood), possible changes in executive functioning (e.g., provide structure for sessions), and memory (e.g., keep a therapy notebook to track lessons being learned). As needed, family or team members can be engaged to support psychological interventions.

*Emotion and personality.* Like cognitive functioning, in contrast to assumptions, stereotypes,

and early theories of emotion and personality in late life, aging does not generally bring negativity, depression, declines in well-being, nor disengagement from relationships. Research over the past few decades has painted a complex and nuanced picture of emotional life in old age. In general, aging is associated with lower negative affect, stable positive affect, higher positive versus negative affect, and increased subjective well-being (Charles and Carstensen 2010). The maintenance of well-being in the context of frequent physical and interpersonal losses in late life has a number of elegant theoretical explanations related to increased capacity for emotional regulation and/or self-management in late life, including SOC, socioemotional selectivity theory, strength and vulnerability integration (Charles 2010), and self-management of well-being (Steverink et al. 2005). Many empirical studies have supported the basic tenets of these theories, with increasing attention over time to understanding individual and cultural differences (e.g., Fung et al. 2008). Likewise, the study of personality and aging has been characterized by diverse approaches for understanding nuances of inter- and intraindividual stability and change in traits over time and strategies for maintaining one's sense of self and identity (Ruth and Coleman 1996). In contrast to simple ideas regarding the impact of aging on personality, personality is increasingly viewed as both shaping and being shaped by one's experiences across the life span (Griffin et al. 2015).

This nuanced view of emotional functioning in late life is critical for geropsychology practice, again, for confronting ageist assumptions of both patients and clinicians. Patients who state "of course I'm depressed. . . I'm old" can be educated that depression is not a normative part of aging. Or, those who believe "you can't teach an old dog new tricks" can be taught about plasticity and adaptation across the life span and that behaving differently can help us to feel differently. Clinical geropsychologists can turn to these elegant theories of emotional adaptation in late life to help their patients with problem-solving, including the importance of optimizing strengths, identifying compensatory strategies, and emphasizing

positive life experiences (“pleasant events”) for optimizing positive affect.

*Social/cultural/environmental contexts.* Increasingly, the aging individual’s adaptation is viewed in social, environmental, and cultural contexts. Social relationships – positive and/or negative, with family, friends, and others – and their changes over the life course are critical determinants of health and well-being, in complex ways. Theoretical and methodological developments have helped to sort out some of these complexities (Antonucci et al. 2014). Early work by anthropologists studying aging highlighted the importance of sociocultural context on individual experiences of aging (Perkinson and Solimeo 2014). Older adults are tremendously diverse – in regards to gender, ethnicity, sexual orientation, religion, socioeconomic status, countries/regions of origin, and otherwise; experiences of aging interact with these multiple other components of diversity. These individual differences influence health beliefs, access to health care, family constellations and patterns of formal and informal caregiving, and health and mental health outcomes. Likewise, early work on the importance of fit between the individual’s abilities and environmental demands in influencing individual affect and behavior (Lawton and Nahemow 1973) have informed a growing field of design of living and work environments for older adults (e.g., Gitlin 2003).

Understanding and respecting diversity among older adults is a core component of competency-based geropsychology practice (APA 2014; Knight et al. 2009; Pachana 2015). Geropsychologists continually question assumptions and get to know the individual elder, allowing him/her to share his/her unique life experience, informed by the historical and cultural context in which he/she has lived. Likewise, geropsychologists ensure that their assessments include consideration of social and environmental factors that may be affecting the older adult’s functioning. These factors should inform development of a treatment plan. In many cases, intervening at the family system, health-care team, or residential community level may have a greater impact than intervening at the individual level

(especially in the case of older adults with significant cognitive impairment).

## A Growing Science of Clinical Geropsychology

*Psychopathology in late life.* Research over the past several decades has helped to inform perspectives on the epidemiology, phenomenology, and etiology of mental illness across the life span. Psychopathology in late life is often characterized by complex comorbidities between medical, neurocognitive, and psychiatric conditions (Knight and Pachana 2015). For example, comorbidity between anxiety and depression in later life is high. In a study by Beekman and colleagues (2000), nearly 50% of those with major depressive disorder also met criteria for anxiety disorders, and just over a quarter of those with anxiety disorders also met criteria for major depressive disorder. There are extensive data about the negative reciprocal relationship between depression and medical illnesses in later life (Katon 2003) and a growing body of research about the similar reciprocal effects of comorbid anxiety and medical illnesses (Culpepper 2004). Increasing research has focused on suicidality in older persons as a serious mental health issue, both in terms of assessment and treatment. The evidence suggests that older adults who die by suicide are more likely than those at younger ages who die by suicide to be depressed and socially isolated, are more likely to use a firearm, are less likely to have substance abuse problems or to have made previous suicide attempts, and are more likely to have physical illnesses or functional impairments (Conwell and Thompson 2008).

There is also an increased literature on protective factors with respect to psychopathology and associated adverse outcomes. For example, with respect to risk of suicide, research has demonstrated that older adults with more psychological well-being and meaning in life (Heisel and Flett 2008), with a greater future orientation (Hirsch et al. 2006) and more positive affect (Hirsch et al. 2007), and with more reasons for continuing living (Britton et al. 2008) generally tend to have

lower levels of suicidal ideation. Current behavioral treatments for those at risk for suicide also make use of such data on protective factors (O'Riley et al. 2015). Similarly, protective factors for anxiety in later life include high levels of perceived social support, regular exercise, and higher levels of education (Vink et al. 2008).

Late-life anxiety and depression are also commonly expressed later in life in subthreshold presentations (Cassidy et al. 2005). Nevertheless, subclinical symptoms that do not meet formal diagnostic criteria for a mental disorder – e.g., minor depression – can affect functioning and health outcomes in older adults and are important targets for clinical intervention. An important issue is whether the criteria that define mental disorders (cite DSM-5) are always wholly appropriate for older adults, with risks of either over- or underdiagnosis of clinical problems.

*Psychological assessment with older adults.* The clinical interview is probably the most important part of assessment in general, and particularly with older adults, who may present with complex medical and psychosocial histories. Structured or semi-structured interviews hold distinct advantages over unstructured interviews with respect to reliability and validity (Edelstein and Semenchuk 1996) and are superior in assessing the presence and severity of psychiatric disorders and in monitoring change in symptoms over time, as compared with self-report instruments (Dennis et al. 2007). In terms of assessment tools, an increasing number of instruments have been developed specifically for older adults, focused on psychiatric symptoms, specific disorders, functionality, quality of life, and so forth, with more published every year. Also, normative data for mainstream tests, such as standardized batteries of intelligence, cognition, and personality, have improved normative databases for use with older persons. Although both assessment and intervention strategies have a paucity of data on their use in the oldest old populations, the proliferation globally of longitudinal aging studies and particularly centenarian and super-centenarian studies are both providing data as well as spurring increased research on this population.

Some interesting trends in the assessment of older adults are tests designed for particular cultural populations (e.g., the Kimberley Indigenous Cognitive Assessment tool, or KICA, by LoGiudice and colleagues, 2006), and online tests are increasingly used for diagnosis of dementia and related disorders (e.g., the Cambridge Neuropsychological Test Automated Battery, or CANTAB, by Sahakian and colleagues (1988)). Psychologists are also strengthening their visibility in several assessment domains including competence and decision-making capacity assessments (Lichtenberg et al. 2015b; Moye et al. 2013), and elder abuse and neglect (Mosqueda and Olsen 2015).

*Geropsychological intervention.* In the health and mental health-care arena, out-dated ideas that older adults are rigid and unlikely to change in later life have been countered by growing research demonstrating that older adults are just as likely as younger adults to benefit from psychological interventions to address problems including depression, anxiety, sleep difficulties, pain, sexual dysfunction, diet, and exercise (Lichtenberg et al. 2015b; Perkinson and Solimeo 2014; Scogin and Shah 2012). Over the past 20–30 years, research is demonstrating that older adults can benefit from behavioral, cognitive-behavioral, interpersonal, problem-solving, and a range of other psychotherapy approaches, with similar efficiency and efficacy rates to younger populations (Cuijpers et al. 2014; Pinquart et al. 2006, 2007). Further, studies of real-world effectiveness of evidence-based psychotherapies in the Veterans Health Administration are demonstrating that older Veterans benefit from these interventions as much as do younger Veterans (Karlin et al. 2013; Karlin et al. 2015a, b). In recent years, adaptations to psychotherapeutic approaches are being made to meet the needs of older adults with mild to moderate cognitive impairment (e.g., Kiosses et al. 2015; Simon et al. 2015). Likewise, research has grown demonstrating effectiveness of psychological interventions for addressing aging-specific concerns including non-pharmacological management of behavioral concerns among people with dementia (Logsdon et al. 2007), stress/distress among caregivers of

older adults (Gallagher-Thompson and Coon 2007), and cognitive training to improve cognitive abilities and everyday functioning (Willis et al. 2006).

*Integrated care models.* Most older adults access mental health services through primary care, or other medical care, settings rather than through specialty mental health services. Research over the past decade increasingly supports integrated models of care, wherein collaborative, care management, and stepped care models allow for recognition, treatment, monitoring of treatment response, and referral to specialty care as needed. Such integrated care models have research support for the management of late-life depression (Hunkeler et al. 2006), suicidality (Alexopoulos et al. 2009), serious mental illness (Mueser et al. 2010), and alcohol abuse (Oslin et al. 2006). Ongoing research on clinical outcomes and cost-effectiveness will hopefully inform policy that supports funding for psychological practice in primary and other integrated care settings.

### **Growth of a Field: Professional Organizations, Training, and Publications**

*Professional organizations.* Within psychology in the United States, the American Psychological Association's Division of Adult Development and Aging (Division 20) was established in 1946, originally called "The Division on Maturity and Old Age." This Division focuses broadly on the study of psychological development and change throughout the adult years, rather than specifically on clinical practice, but counts among its members many clinical geropsychologists. Psychologists in Long-Term Care (PLTC) was established in 1981. PLTC is "a network of psychologists and other professional dedicated to the enhancement of mental health and quality of life for those involved in long-term care through practice, research and advocacy" (from [www.pltcweb.org](http://www.pltcweb.org)). In 1993, "Section 2," that is, the section of clinical geropsychology, of APA's Division of Clinical Psychology was established.

That section, now called the Society of Clinical Geropsychology, states its vision as follows: "to foster the mental health and wellness of older adults and wellness of older adults through science, practice, education and advocacy and to advance the field of professional geropsychology" (from [www.geropsychology.org](http://www.geropsychology.org)). The APA Committee on Aging (CONA) was established in 1998, with the mission to ensure that older adults receive the attention of APA governance, in activities related to science, practice, policy, education, public interest, and public affairs. The APA Office on Aging was established to coordinate APA activities related to aging and geropsychology (see [www.apa.org/pi/aging/](http://www.apa.org/pi/aging/)). As described further below, the past decade has seen multiple initiatives to advance the profession of geropsychology in the United States, including publication of the APA's *Guidelines for Psychological Practice with Older Adults* (APA 2004, 2014) and establishment of the Council of Professional Geropsychology Training Programs (CoPGTP).

The past several decades have seen the growth of a range of professional organizations outside of the United States with either a focus on, or inclusive of, geropsychology. The multidisciplinary International Psychogeriatric Association (IPA) is concerned with promoting better mental health for older people (<http://www.ipa-online.net/>). IPA hosts annual conferences and has a particular focus on cross-national information sharing with respect to mental health, particularly with respect to the developing world. IPA has also developed a well-respected set of resources on behavioral and psychological symptoms of dementia – the *IPA Complete Guides to Behavioral and Psychological Symptoms of Dementia (BPSD)*. Various national psychological associations have sections devoted to geropsychology (e.g., the Faculty for the Psychology of Older People (FPOP), within the Division of Clinical Psychology of the British Psychological Society, and the Psychology and Ageing Interest Group (PAIG) of the Australian Psychological Society (APS)). There are also free-standing geropsychology groups in many countries (e.g., the New Zealand Psychologists of Older People (NZPOPs) group).

*Journals.* In recent decades, there has been an explosion of peer-reviewed geropsychology

research published in the field, in both journals devoted to psychological issues of aging as well as general psychology/mental health and/or gerontology/geriatric journals that increasingly include geropsychology topics. Common outlets for research on geropsychology more broadly include the APA's *Psychology and Aging* and the GSA's *Journals of Gerontology: Psychological Sciences*. Others more specifically aimed at clinical research, including clinical geropsychology, include *Aging and Mental Health*, *Clinical Gerontologist*, and *International Psychogeriatrics*.

**Books.** The earliest scholarly books on psychology and aging were published in the late 1950s through early 1970s as the science was developing at that time (e.g., Birren 1959). The late 1970s through to early 2000s saw increasing numbers of books published on adult development and aging, cognitive aging, and the clinical psychology of aging (e.g., Hersen and Van Hasselt 1998; Edelstein 2001). Over time, handbooks in geropsychology have provided scholarly updates in the field. One of the most widely known of these resources, *Handbook of the Psychology of Aging*, is in its 7th edition (Schaie and Willis 2011), initially published in 1977 (Birren and Schaie 1977); clinical geropsychology perspectives have always been prominent in this series. In the clinical geropsychology arena specifically, such handbooks provide scholarly updates of wide-ranging late-life behavioral and mental health concerns, and their assessment and treatment. Recent examples include *Handbook of Assessment in Clinical Gerontology, Second edition* (Lichtenberg 2010), *APA Handbook of Clinical Geropsychology* (Lichtenberg et al. 2015a), and *Oxford Handbook of Clinical Geropsychology* (Pachana and Laidlaw 2014), the latter with a more international focus. Textbooks on adult development and aging, psychology and aging, and mental health and aging abound, in comparison to very few such resources just four to five decades ago.

## Developments in Clinical Geropsychology Practice and Training

*Geriatric health and mental health care.* Psychology as a field was relatively slow to join other

health-care professionals that were developing specialized practices regarding care of older adults. The interdisciplinary geriatric health-care team for decades has included physicians, nurses, social workers, pharmacists, and others but only more recently, in some care systems, psychologists (e.g., Karlin and Zeiss 2010). Across professions, however, there is a geriatric health-care workforce crisis (Institute of Medicine 2008). The global geriatric health and mental health workforce will fall far short of the health-care needs of older adults going forward, in all countries of the developed and the developing world (National Institute on Aging and World Health Organization 2011). The projected estimated needs for mental health specialists in general and geropsychologists in particular has been a concern for many years (Institute of Medicine 2012; Karel et al. 2012). Given demographic trends, this situation is of growing concern internationally (Laidlaw and Pachana 2009).

A historical perspective on mental health and aging in the United States over the past 4–5 decades is presented in a series of papers by Margaret Gatz and Michael Smyer (Gatz et al. 1980; Gatz and Smyer 1992; Gatz and Smyer 2001; Karel et al. 2012). They track epidemiological, societal, policy, health system, and professional factors that have influenced mental health care for older adults. The 1970s and 1980s saw very little systematic or coordinated attention to the mental health needs of older Americans, although 1989 did see expansion of Medicare, the primary health-care insurer of older adults, to cover services by psychologists. The 1990s saw some progress in higher profile recognition of the issue (e.g., Surgeon General's report and White House Conference on Aging resolutions on mental health and aging), early advocacy for integrated care models, expanded publication of practice guidelines related to geriatric mental health conditions, and growing evidence base regarding the efficacy of psychotherapy with older adults (despite emphasis on medication treatments). The early 2000s saw ongoing development and policy support for integrated care models, move toward parity of Medicare funding for mental health services, national attention to the geriatric

workforce crisis, a growing evidence base to inform geropsychology practice, and delineation of a competency-based geropsychology training model. Ongoing challenges include funding for geriatric mental health practice, training, and research, and the need to prepare a health-care work force to meet the health and mental health needs of an aging population.

*Clinical geropsychology in the United States.* In the United States, a series of conferences dedicated to clinical geropsychology training have supported the development of training models, resources, and programs over time. The 1981 *Conference on Training Psychologists for Work in Aging* was held in Boulder, Colorado, and thus dubbed the “Older Boulder” conference, after the historic 1949 Boulder Conference that established the scientist-practitioner model of clinical psychology training in the United States. The 1981 conference focused on graduate education curriculum development, continuing education and retraining, recruitment and retention, services and settings, psychosocial knowledge base, and biopsychological knowledge base for geropsychology training (Santos & VandenBos 1982). However, despite a constructive vision of training in the field, many barriers existed for implementation of conference recommendations (Hinrichsen *in press*). In 1992, the “Older Boulder II” conference (held in Washington, DC) was sponsored by the National Institute of Mental Health and the APA; the conference continued to define the knowledge base for clinical geropsychology practice and demarcated three levels of geropsychology training/competence: exposure, experience, and expertise (Knight et al. 1995). Of note, a task force established at that conference drafted a report that was later adopted and published as the APA’s *Guidelines for Psychological Practice with Older Adults* (APA 2004, 2014).

The National Conference on Training in Professional Geropsychology, held in Colorado Springs, CO, in 2006, aimed to delineate attitude, knowledge, and skill competencies for clinical geropsychology training and training models at graduate, internship, fellowship, and post-licensure levels. The conference outcome

was the *Pikes Peak Model for Training in Professional Geropsychology* (Knight et al. 2009), which has helped to inform training program development in recent years. Shortly after the “Pikes Peak conference,” the Council of Professional Geropsychology Training Programs ([www.CoPGTP.org](http://www.CoPGTP.org)) was formed, in order to recognize programs (both within the United States, and more recently, internationally) that provide training consistent with the Pikes Peak model and to share training resources. A CoPGTP Task Force developed the Pikes Peak Geropsychology Knowledge and Skill Assessment Tool ([http://www.copgtp.org/uploads/documents/Pikes\\_Peak\\_Evaluation\\_Tool.pdf](http://www.copgtp.org/uploads/documents/Pikes_Peak_Evaluation_Tool.pdf)), which can be used by trainees and supervisors alike to define training needs in the field. The GeroCentral website (<http://gerocentral.org/>) – a cooperative effort to bring together resources for geropsychology practice, training, policy, and research – offers an online version of this competency self-assessment tool.

These efforts to delineate a training model for the field lead to APA recognition of Geropsychology as a specialty area of psychological practice in 2010. The American Board of Professional Psychology (ABPP) started to provide Board Certification in Geropsychology in 2013 (see [www.abpp.org](http://www.abpp.org)).

*Clinical geropsychology globally.* Europe, as the seat of the World Health Organization (WHO), has been concerned with health practice and policy on a global scale. The European Federation of Psychologists’ Associations (EFPA) set up a task force on geropsychology on the continent, in order to better coordinate its responses to European and global health and policy initiatives concerning aging (EFPA 2005). Data was collected on the state of geropsychology with respect to profiles of research productivity and training goals, to delineate contexts where geropsychologists could contribute their expertise toward improving the well-being of older persons. Countries surveyed (N = 25) included Austria, Belgium, Byelorussia, Bosnia-Herzegovina, the Czech Republic, Denmark, Estonia, Germany, Great Britain, Greece, Hungary, Iceland, Israel, Italy, Lithuania, Macedonia, Netherlands, Norway, Portugal, Serbia, Spain, Sweden,

Switzerland, and Turkey. Some interesting findings from this survey included the relative focus of cognitive and dementia-related research relative to research on intervention and prevention, and the fact that overall more funding for geropsychology research was obtained from foundations as opposed to state/national research funding schemes. With respect to teaching, geropsychology postgraduate programs were available in Austria, the Czech Republic, Denmark, Germany, Greece, Israel, Netherlands, Norway, Switzerland, Sweden, and Spain. Approximately 30% of countries reported geropsychology is a regular topic of postgraduate training in clinical psychology or psychotherapy training programs. One strong recommendation of this task force was to increase publication of aging research within European journals (whether or not in English), and the (at that time) new European Journal on Gerontology was seen as an important step forward (see also Wahl et al. 2013). Since then other new European journals (e.g., *GeroPsych: The Journal of Gerontopsychology and Geriatric Psychiatry*) have been established.

Geropsychology or, more accurately, psychology with older adults has had a shorter history outside of Europe and North America (Pachana 2014). In Australia and New Zealand, societies or interest groups for psychologists interested in older persons have flourished with increasing numbers for the last 25 years. In Asia and South America, geropsychology and its interest in research, clinical practice, and training is more recent but growing swiftly, again driven in part by aging demographics in these countries and partly by the growing visibility of older adults and aging on the global stage (Pachana 2015).

*Areas of challenge.* Health-care costs continue to rise in line with the aging of the population globally and the rising instances of chronic disease and dementia later in life, which impacts on mortality, morbidity, and burden of disease (Lozano et al. 2012; WHO 2014). Despite shrinking research budgets, there are increasing calls in the literature for research on aging and ways to improve health and longevity (Jin et al. 2015). Calls for increased training of a geriatric literate mental health workforce, including psychologists,

have long been argued, but we are no closer to bridging the gap between future need and current workforce (Halpain et al. 1999; IOM 2012; Knight et al. 1995; Robiner 2006). Both training and research in geropsychology need to have an international focus to meet global mental health-care needs (Pachana 2014).

*Areas of opportunity.* Behavioral and mental health care are increasingly being conceptualized as important components of overall health care, in health-care systems around the world. Integrated care, wherein behavioral/mental health services are offered in primary care and other traditionally “medical” care settings, addresses the reality that stress and other behavioral factors contribute significantly to many health conditions and, conversely, that medical illness can contribute to or exacerbate mental health concerns. Expansion of geropsychological services in primary and geriatric health-care settings will allow greater access to these services for older adults. In the United States, these integrated care models are common in the Department of Veterans Affairs Health Care System (e.g., Kearney et al. 2014) and expected to grow given policy facilitators for such addressed in the Affordable Care Act (Rozenky 2014). An APA 2008 Presidential initiative addressed how psychologists can contribute to integrated health care for an aging population (APA 2008). Time will tell whether these promising care models will be widely adapted, and in what countries.

Increasing focus on wellness and adaptation in late life, including the concepts of “successful” or “positive” aging (Bar-Tur and Malkinson 2014; Depp and Jeste 2006; Hill 2011), is likely to see ongoing research and development of self-help, preventive, and clinical interventions. As consumers take increasing investment in health promotion, strategies for optimizing physical, cognitive, and emotional health will continue to grow. Psychologists will contribute to resources for an aging population to plan for positive adaptation in late life. For example, the APA Committee on Aging’s Life Plan for the Life Span provides recommendations for younger, middle-aged, and older adults to address well-being in domains of health and health care, legal and financial matters, work life and retirement,

psychological issues, and social roles and resources (<http://www.apa.org/pi/aging/lifespan.pdf>).

Technology will play an increasing role in health and wellness promotion for aging adults and for geropsychology practice. As the baby boomers are increasingly comfortable with computer technology, they will utilize growing Internet-based and smartphone applications related to health and mental health promotion, including cognitive training (e.g., Christensen et al. 2002) and caregiver interventions (Chi and Demiris 2015). Senior online communities provide expanding opportunities for social connection (Nimrod 2014). Smart home technologies are facilitating aging at home with optimal independence, safety, and quality of life (Demiris and Hensel 2008). At the same time, the use of assistive technologies will continue to raise a number of ethical questions including impact on privacy and autonomy (Zwijnsen et al. 2011). Geropsychology services may become accessible to growing numbers of older adults through tele-mental health technologies (e.g., Gellis et al. 2014; Ramos-Rios et al. 2012) and via expert distance consultation (e.g., Catic et al. 2014).

## Conclusion

M. Powell Lawton, in his autobiographical contribution to *A History of Geropsychology in Autobiography*, concluded in part by saying: “In psychology [of aging] the major conceptual change I have observed is the move from the view of the elder as a pawn of biology and society toward one with overwhelming self-determining capacity” (Lawton 2000, p. 195). This observation provides an excellent summary of the historical trends presented here. The opportunities for plasticity, growth, and enhanced well-being in late life have, in part, driven development of research and practice in geropsychology. Psychologists around the world are able to work with older adults, their families, health-care teams, and communities to provide evidence-based psychological services to address problems, enhance coping, and promote well-being in late life. The opportunities

for “making a difference” in the lives of an aging population are limitless. A critical challenge is encouraging greater number of psychologists to join in this most meaningful and rewarding work, whether in research, teaching, or applied contexts.

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### ► Mental Health and Aging

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have made major contributions to our current state of knowledge.

## Introduction

Mental abilities have long been valued in Western culture as the basis for learning, problem solving, and adjustment. Thus, intelligence and cognitive development quickly became one of the major concerns for the earliest psychologists. Great efforts were made to define intelligence, to measure it, and even to try to increase it. The study of cognition has had a long and often stormy history. Indeed, the controversies are no less stormy today, as perhaps should be expected when dealing with a field of knowledge so highly esteemed.

The questions that we seek to answer are fairly simple, such as “Does intelligence increase or decline with age?” The answers, however, are more complicated; they vary with age, the specific intellectual function we are considering, and even the year in which the individual was born. This latter influence, which comprises a number of “generational” or “cohort” factors, is analyzed in some detail.

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## History of Cognitive Aging Research

K. Warner Schaie and Sherry L. Willis  
 Department of Psychiatry and Behavioral  
 Sciences, University of Washington, Seattle, WA,  
 USA

### Synonyms

Intelligence; Meaningful behavior; Mental abilities; Thoughtful analysis of complex interpersonal interactions and relationships

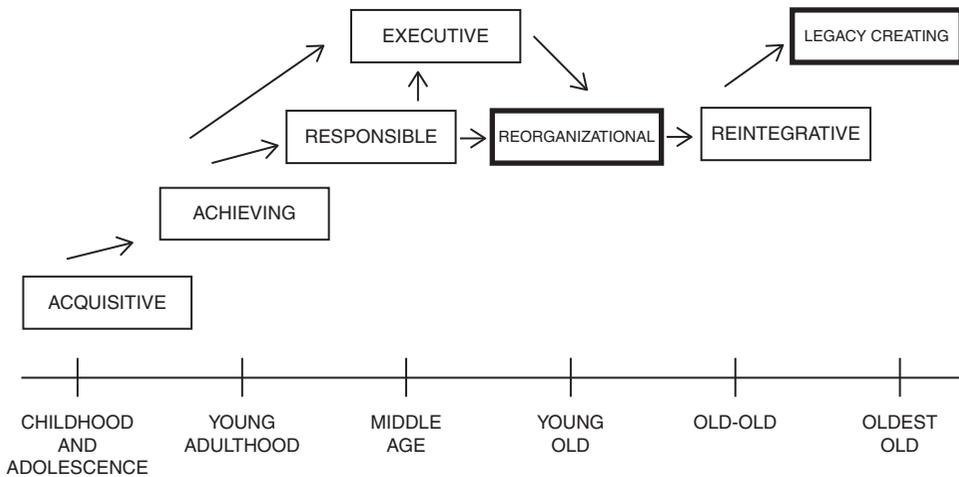
### Definition

Cognitive aging research includes the fields of intelligence and human abilities from young adulthood through advanced old age. It includes the major theoretical and methodological issues of concern in these fields as well as the identification of major findings of those systematic studies that

## Adult Stages of Intellectual Development

What is the nature of intelligence in adults? How is it similar to the intelligence of young persons, and how does it change? If we are going to construct tests that are fair to older people, we must know more about adult cognition; we need to know in what sense people might increase their competence as they grow older.

The famous Swiss psychologist Jean Piaget described the ways in which children's intelligence increases as they develop (Flavell 1963). They learn simple but basic ways of perceiving and reacting to the world. “With the onset of speech, children enter a stage in which they grow primarily in the conceptual-symbolic rather than purely sensory-motor arena” (Flavell 1963, p. 121). This stage, called *preoperational*, is



**History of Cognitive Aging Research, Fig. 1** Schaie's stages of adult cognitive development (Source: Schaie and Willis 2000)

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succeeded around the age of 6 by the stage of *concrete operations*.

In Piaget's theory, operations are the mental routines that transform information in some way, for example, adding two numbers to get a third or categorizing, as in placing all red objects together. The stage of *formal operations* is entered around the age of 12 and is defined by the ability to use mental operations on abstract material. For example, an adolescent can solve a problem such as "If a suitcase can eat four rocks in 1 day, how many can it eat in 2 days?"

Younger children cannot imagine a suitcase that eats rocks, so they will refuse to solve the problem; they cannot disregard the content of the problems (its concrete aspects) and reason in a purely hypothetical way (using the form, or formal aspects, of the problem). Intellectual development, of course, is not complete at the age of 12 when the average child enters the stage of formal operations, but Piaget provides us with little detail on later development.

Although we can assume that there are advances in the use of formal operations, as people progress from "rock-eating suitcases" to elegant mathematical theories of the physical universe, no new Piagetian stages were specified for adulthood (Flavell 1970; Piaget 1972).

Psychologists who focus on adult development find this child-centered approach restrictive and wish to expand it so as to delineate those changes in the quality of intellectual function that they observe in adult study participants. As Erik Erikson and Daniel Levinson expanded the psychoanalytic stages of ego development to the adult years, these psychologists have done the same for Piaget's stages of intellectual development (see Commons et al. 1989, 2014; Commons and Ross 2008; Sinnott 1996).

### A Stage Model of Adult Cognitive Development

K. Warner Schaie and Sherry Willis (Schaie 1977; Schaie and Willis 1999, 2000) have used findings from research on adult intellectual development to formulate six adult stages (Fig. 1). We begin with the observation that Piaget's childhood stages describe increasing efficiency in the acquisition of new information. It is doubtful that adults progress beyond the powerful methods of science (formal operations) in their quest for knowledge. Therefore, if one is to propose adult stages, they should not be further stages of acquisition; instead they should reflect different uses of intellect.

**Application and Achievement.** In young adulthood, for example, people typically switch their

focus from the acquisition to the application and integration of knowledge, as they use what they know to pursue careers and develop their families. This is called the achieving stage. It represents most prominently the application of intelligence in situations that have profound consequences for achieving long-term goals. These situations are not the hypothetical ones posed on IQ tests or encountered in classroom studies, nor are they the problems of childhood, whose solutions are closely monitored by parents and society. Instead, they are problems that the adult must solve for him- or herself, and the solutions must be integrated into a life plan that extends far into the future.

The kind of abilities exhibited in such situations is similar to those employed in educational tasks, except that it requires more careful attention to the possible consequences of the problem-solving process. Attending to the context of problem solving as well as to the problem to be solved may be thought of as being a quality control process like that used in industry when the consequences of a mistake are severe.

**Social Responsibility.** Young adults who have mastered the cognitive skills required for monitoring their own behavior and, as a consequence, have attained a certain degree of personal independence will next move into a stage that requires the application of cognitive skills in situations involving social responsibility. Typically, the responsible stage occurs when a family is established and the needs of partner and offspring must be met. Similar extensions of adult cognitive skills are required as responsibilities for others are acquired on the job and in the community (Hagestad and Neugarten 1985).

**Executive Stage.** Some individuals' responsibilities become exceedingly complex. Such individuals – presidents of business firms, deans of academic institutions, officials of churches, and a number of other positions – need to understand the structure and the dynamic forces of organizations. They must monitor organizational activities not only on a temporal dimension (past, present, and future) but also up and down the hierarchy that defines the organization. They need to know not only the future plans of the organization but

also whether policy decisions are being adequately translated into action at lower levels of responsibility. Attainment of the executive stage, as a variation on the responsibility stage, depends on exposure to opportunities that allow the development and practice of the relevant skills (Smith et al. 1994).

**Reorganization.** In the later years of life, beyond the age of 60 or 65, the need to acquire knowledge declines even more and executive monitoring is less important because frequently the individual has retired from the position that required such an application of intelligence. What, then, is the nature of competence in an elderly adult? As Schaie (1977) puts it, there is a transition from the childhood question “What should I know?” through the adult question “How should I use what I know?” to the question of later life “Why should I know?” This stage, *reintegration*, corresponds in its position in the life course to Erikson's stage of ego integrity. The information that elderly people acquire and the knowledge they apply is, to a greater extent than earlier in life, a function of their interests, attitudes, values, and physical health (Bowen and Staudinger 2013; Diehl et al. 1995; Heidemeier and Staudinger 2015). It requires, in fact, the integration of all of these.

The elderly are less likely to “waste time” on tasks that are meaningless to them. They are unlikely to expend much effort to solve a problem unless that problem is one that they value or that they face frequently in their lives (Berg and Klaczynski 1996; Staudinger and Glueck 2011). This stage also frequently includes a selective reduction of interpersonal networks in the interest of reintegrating one's concern in a more self-directed and supportive manner (Carstensen 1993; English and Carstensen 2014; Scheibe et al. 2013). Such efforts are likely to involve a reduction in information-seeking activities while increasing the importance of emotional regulation involved (Carstensen et al. 1997; Schaie and Carstensen 2006).

The original stages (Schaie 1977) were formulated some 30 years ago. Since that time we have learned a lot about the differentiation of our older population into distinct life stages. In the research

literature distinctions are now commonly made between the young-old, the old-old, and the oldest-old (or very-old). This differentiation is informed by the fact that today's young old are distinguished from the middle-aged primarily by the fact that the vast majority in this life period involves transition from the world of work full time to other pursuits. A major effort is now required to *reorganize* one's life in order to replace the earlier engagement with raising families and job responsibilities with meaningful pursuits for the last part of life (English and Carstensen 2014).

Efforts must also be directed toward planning how one's resources will last for the remaining 15–30 years of postretirement life that are now characteristic for most individuals in industrialized societies. These efforts include active planning for that time when dependence upon others may be required to maintain a high quality of life in the face of increasing frailty. Such efforts may involve changes in one's housing arrangements, or even one's place of residence, as well as making certain of the eventual availability of both familial and extrafamilial support systems. The activities involved in this context include the making of or changing one's will, drawing up advanced medical directives and durable powers of attorney, as well as creating trusts or other financial arrangements that will protect resources for use during the final years of life or for the needs of other family members.

Although some of these activities involve the same cognitive characteristics of the *responsible* stage, we believe that the objectives involved are generally far more centered to current and future needs of the individual rather than the needs of their family or of an organizational entity. Efforts must now be initiated to reorganize one's time and resources to substitute a meaningful environment, often found in leisure activities, volunteerism, and involvement with a larger kinship network. Eventually, however, these are activities also engaged in with the finitude of life in clear view, for the purpose of maximizing the quality of life during the final years and often with the objective of not becoming a burden for the next generation. The unique objective of these demands upon the

individual represents an almost universal process occurring at least in the industrialized societies, and designation of a separate reorganizational stage is therefore warranted.

**Reintegration.** The skills required for the reorganizational stage require the maintenance of high levels of cognitive competence, which is increasingly exercised within the parsimonious principles of selection, optimization, and compensation (cf. Baltes and Carstensen 1996; Baltes 1997; Baltes et al. 1999). In addition, maintenance of flexible cognitive styles is needed to be able to restructure the context and content of life after retirement, to relinquish control of resources to others, and to accept the partial surrender of one's independence (Schaie 1984, 1996).

More and more older persons reach advanced old age in relative comfort and often with a clear mind, albeit a frail body. Once the reintegrative efforts described above have been successfully completed, and perhaps temporally overlapping with them, there is yet one other stage that is frequently observed.

**Legacy creating.** This last stage is concerned with cognitive activities by many of the very old that occur in anticipation of the end of their life. We call this a legacy-creating stage that is part of the cognitive and psychosocial development of many, if not all, older persons. This stage often begins with the self- or therapist-induced effort to conduct a life review (Butler et al. 1991). For the highly literate and those successful in public or professional life this will often include writing or revising an autobiography (Birren and Schroots 2006).

There are also many other more mundane legacies to be left. Women, in particular, often wish to put their remaining effects in order, and often distribute many of their prized possessions to friends and relatives, or create elaborate instructions for distributing them. It is not uncommon for many very old people to make a renewed effort at providing an oral history or to document family pictures and heirloom to the next generation. Last but not least, directions may be given for funeral or memorial arrangements, occasionally including donation of one's body for scientific research, and there may be a final revision of one's will.

An approximate time line for the Schaie stage model is provided in Fig. 1. But it should be stressed that the precise chronological age at which these stages occur may be quite variable in different societies as well as for individuals at different levels of intellectual competence and personal engagement. What is important is the sequential process of these developmental stages.

## Assessment of Cognitive Functions

Psychological tests were developed originally to identify individuals varying in intellectual function. Francis Galton (a half-cousin of Charles Darwin) believed that human intelligence is mostly inherited and, as a result, he urged his country (England) to begin a program of selective breeding. By allowing the most intelligent people to have the most babies, the English population would become smarter and smarter, claimed Galton; it would evolve to even greater heights in Darwin's phylogenetic tree.

### A Test of Intelligence

How could the most intelligent people be identified? A test of intelligence would need to be created. Galton (1883) took on the job and in 1883 published the first intelligence test influenced by British philosophers who considered intelligence to be based on the ability to process sensory information. Galton devised a series of tasks designed to measure how well a person could see, hear, smell, taste, and feel. For example, in one task, the person was asked to lift two weights and say which was the heavier.

Galton's "mental test" (as he called it) was not very successful; it showed only trivial correlations with measures of intellectual competence in the real world, such as scholastic performance (Wissler 1901). Recent investigators, however, have revisited the relation between sensory functions and intelligence showing that Galton's intuitive choice of measures was not as off the wall as some contemporaries thought (cf. Galton 1883).

Almost 20 years later, a French psychologist by the name of Alfred Binet tried again to construct a test of intelligence. Binet did not intend to

better the French genetic stock. He had been given a much more practical problem to solve by the French Ministry of Public Instruction. They needed a test to distinguish students of low ability (mentally retarded) from those of adequate ability but low motivation.

Binet held a more traditional view of intelligence than Galton, believing, for example, that playing chess was a better indicator of intelligence than smelling vinegar. He decided to assess "reasoning, judgment, and imagination" by a series of cognitive problems rather than sensory tasks. Instead of lifting weights, for example, the child was asked to tell the difference between "yesterday" and "tomorrow." Because Binet's miniature tasks were quite similar to those that children experienced in school, scores on his test were highly correlated with scholastic performance. First published in 1905, Binet's test (Li et al. 1999) was quickly translated into other languages, including English. In the United States, his test was translated and revised by Stanford psychologist Lewis Terman in 1916 and became known as the widely employed Stanford-Binet Intelligence Scale.

Terman's first revision of the Stanford-Binet scale introduced the concept of the intelligence quotient, or IQ. Binet had arranged his test in age scales, each consisting of four to eight items, such that children of a certain age should be able to pass. A 6-year-old child who passed all the items for 7-year-olds (but no more) was said to have a "mental age" of 7, even though his or her chronological age was 6.

Terman divided the mental age obtained from the test by the chronological age to get the child's IQ. In our example the child with a mental age of 7 and a chronological age of 6 has an IQ of  $7/6 = 1.17$ , multiplied by 100 to clear the decimal, or 117. An average IQ by these standards is obviously 100, and 117 indicates a somewhat brighter than average youngster.

### The Nature of Intelligence

From the very beginning, there has been a great deal of debate about the nature of intelligence and whether there may be different kinds of intelligence. Is intelligence a single, general ability or

are there several different intellectual abilities? Binet favored the idea of a “general ability” (sometimes called the “g” factor), but later researchers have favored the notion of several factors in intelligence.

Some intelligence tests have a number of subtests covering different content and skills. The Wechsler Adult Intelligence Scale (WAIS – R) is the test most frequently used by neuropsychologists for the individual assessment of adult intelligence (Wechsler 1997). It has 11 subtests. Six of these subtests make up the verbal scale, so named because the tests rely heavily on language. Examples are the vocabulary subtest, in which the study participant is asked the meaning of various words, and the comprehension subtest, in which the study participant is asked to explain items such as proverbs (designed to measure common or cultural knowledge).

Five of the subtests make up the performance scale, so named because the test problems can be solved without recourse to language. In the block design subtest, for example, the participant tries to reproduce a design with colored blocks. Performance tests were first used in World War I to test illiterate draftees and those with English as a second language. Older people generally do not do as well on these performance subtests (Attix and Welsh-Bohmer 2006; Blazer and Steffens 2009).

The fact that there are slightly different subtests on an intelligence test is of course no guarantee that these subtests actually measure different intellectual abilities; they may simply be different ways of measuring a single ability: “general intelligence.” Further exploration has therefore taken the form of factor analysis, a statistical procedure that identifies the number of basic dimensions or factors in a set of data.

In a factor analysis of the WAIS subtests, for example, the major dimension was found to be that of general intelligence, a large factor that accounted for about half of the information contained in the test (Cohen 1957). Three much weaker factors were also identified and labeled “verbal comprehension,” “perceptual organization,” and “memory.” The labels are not important for our purposes. What this analysis means is that

the WAIS can be described fairly well with a single factor. Three other factors appear to be important for some purposes. For example, an individual high in perceptual-organizational abilities might do better on the block design subtest than we would expect from his or her general intelligence alone. One finding of interest in this study is that the memory factor, a relatively weak factor among young study participants, became a major factor for persons over the age of 60. This means that there are wider individual differences in memory among older people, affecting scores on more of the subtests.

With the advent of major survey studies of virtually every issue that might be public policy relevant, there has been an attempt to include short tests of intelligence in major population surveys. These simple scales do not have the reliability and validity of the standard intelligence tests used in laboratory work. These brief tests as measures of cognition are particularly problematic for adults with limited testing experience, and who may have some difficulty in properly understanding questions (Knäuper et al. 1997). We will therefore limit our discussion to data obtained from direct administration of individual or group tests.

### Intelligence as Multiple Abilities

If one’s goal is to map the broad scope of intelligence and not simply that of global intelligence (e.g., the WAIS), many different intellectual tasks must be administered to a large number of people. Factor analysis of a wide variety of intellectual tasks has regularly identified between 6 and 12 primary mental abilities, some of the most prominent of which are listed in Table 1. These abilities have sometimes been described as the “building blocks” or basic elements of intelligence (Thurstone and Thurstone 1941). The “purest” tests of these factors are sometimes administered as tests of the “primary mental abilities.” The most recent adult version of these tests is called the Schaie-Thurstone Adult Mental Abilities Test (STAMAT) (Schaie 1985, 1996, 2013).

**More recent work on intellectual dimensions.** Sternberg suggests that the normal course of intelligent functioning in the everyday world involves adaptation to the environment (Sternberg

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**Table 1** Primary mental abilities discovered through studies using factor analysis

V	Verbal comprehension: The principal factor in such tests as reading comprehension, verbal analogies, disarranged sentences, verbal reasoning, and proverb matching. It is most adequately measured by vocabulary tests
W	Word fluency: Found in such tests as anagrams, rhyming, or naming words in a given category (e.g., boys' names, words beginning with the letter T)
N	Number: Most closely identified with speed and accuracy of simple arithmetic computation
S	Space (or spatial orientation): May represent two distinct factors, one covering perception of fixed spatial or geometric relations, the other manipulatory visualizations, in which changed positions or transformations must be visualized
M	Associative memory: Found principally in tests demanding rote memory for paired associates. There is some evidence to suggest that this factor may reflect the extent to which memory crutches are utilized. The evidence is against the presence of a broader factor through all memory tests. Other restricted memory factors, such as memory for temporal sequences and for spatial position, have been suggested by some investigations
P	Perceptual speed: Quick and accurate grasping of visual details, similarities, and differences
R	General reasoning: Early researchers proposed an inductive and deductive factor. The latter was best measured by tests of syllogistic reasoning and the former by tests requiring the study participant to find a rule, as in a number series completion test. Evidence for the deductive factor, however, was much weaker than for the inductive. Moreover, other investigators suggested a general reasoning factor, best measured by arithmetic reasoning tests

and Lubart 2001). But intelligent persons also tend to select their real-world environments that are relevant to their lives and they shape or adapt to these environments. Intelligent behaviors involve adaptation to novelty, automatization of information processing activities (i.e., performing information processing without conscious awareness of it), or both. A person who automatizes processing efficiently can allocate resources to cope with novel situations; conversely, efficient adaptation to novelty will allow automatization to occur earlier in one's experience of new tasks and situations.

The notion of allocation of intellectual resources is particularly relevant to the study of intellectual aging. Recent data and thinking suggest that the response of older persons to tests is far more selective than that of youngsters, and such allocation is often directed to optimize functions that meet the individual's needs and goals. Baltes further distinguishes between the *mechanics* (or basic processes) of intelligences, the efficiency of which decreases with increasing age, as contrasted to the *pragmatics* (or substantive content) of intelligence, which in many circumstances can increase until very old age (Baltes 1997; Staudinger et al. 1995).

The history of studies of adult intelligence according to Woodruff-Pak (Willis et al. 2006) has also had discernible secular trends in relative emphases on different aspects of adult intelligence that cut across theoretical positions. She identified four stages: In the first, lasting until the mid-1950s, concerns were predominantly with identifying steep and apparently inevitable age-related decline.

The second stage, in the late 1950s to mid-1960s, involved the discovery that there was stability as well as decline. External social and experiential effects influencing cohort differences in ability levels identified during this period led to a third stage, beginning with the mid-1970s. The field was dominated by attempts to alter experience and manipulate age differences via brief interventions or providing aids or supports in the testing situation. In the latest stage, the impact of successful demonstrations of the modifiability of intellectual performance (Willis et al. 2006; Rebok et al. 2013) has led investigators to expand definitions of intelligence and explore new methods of measurement.

### Relevance of Test Instruments to Stages of Intellectual Development

The simple tasks in the traditional IQ tests are well suited to measure progress in the performance of many basic skills through the stages of knowledge acquisition described by Piaget (Binet and Simon 1905). But they are decidedly less adequate for the assessment of adult competence. Even a test that was constructed explicitly for adults, the WAIS, is

deficient in several respects. First, the test was designed with the intent of measuring cognitive dysfunctions in clinically suspect individuals, and second, it was originally normed on young adult samples, those who in our conceptual scheme would be classified as being in the achieving stage, although norms for adults are now available.

### Practical or Everyday Cognition

Some would argue that intelligence in adults should be studied by asking well-functioning people how they go about solving their everyday problems (Sternberg and Lubart 2001). This is what is known as a “naive” theory of intelligence; that is, it is not derived from objective analyses of experts but rather from the collective perceptions of laypersons. Perhaps it is indeed the conceptions of adults about their own competence that ought to be the basis for defining intelligence. But there is the distinct danger that in this process we would confuse intelligence with socially valued or culturally defined behavior. Moreover, the attributes of intelligence obtained in this manner may be characteristic only of the specific group of persons interviewed or may be governed by time-specific and context-specific conceptions. We would be remiss, then, if we were to discard the objective knowledge of mental functioning that is now in hand and is directly applicable to adult intelligence (Schaie and Willis 1999; Willis and Schaie 2006). Instead, we may wish to consider how the basic intellectual processes that are important at all life stages relate to everyday tasks (also see Diehl 1998; Marsiske and Margrett 2006; Wettstein et al. 2014; Yam and Marsiske 2013; Willis and Schaie 1986). The importance of basic processes is also evident in technology-based everyday activities (Taha et al. 2010; Czaja and Lee 2010).

There have been a number of efforts to develop objective measures of people’s abilities to engage in effective problem solving and performance on tasks required for daily living (see Marsiske and Willis 1995; Willis 1996; Willis et al. 1992). For example, the Educational Testing Service (Salthouse 1996) developed a test to assess whether high school graduates had

acquired the necessary information and skills to handle everyday problems in current society; various US states then developed similar measures.

This test includes tasks such as interpreting bus schedules, tax forms, labels on medicine bottles, advertisements in the yellow pages, and understanding instructions for the use of appliances and the meaning of newspaper editorials. The test has been given to large samples of adults ranging in age from the twenties to the nineties (Schaie 1996, 2013). The test correlates with a number of the primary mental abilities; in fact, most of the individual differences on the test can be predicted from knowledge of scores on the basic abilities test.

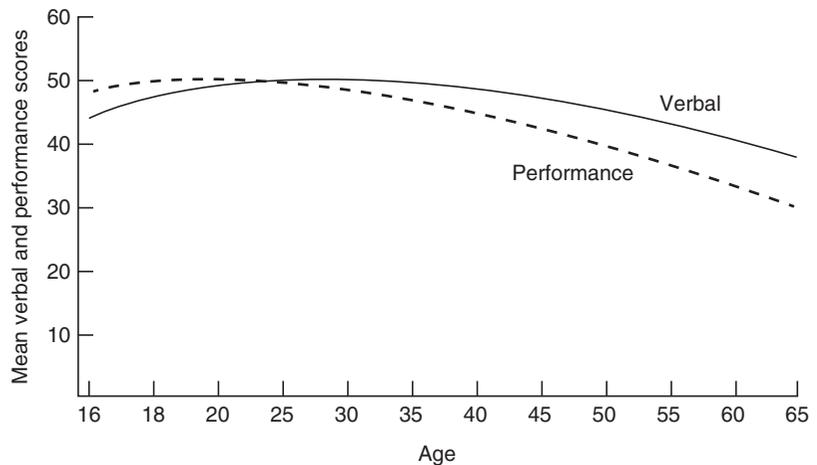
Another effort to measure everyday problem solving was a test constructed for older adults or proxies to rate the skills that old people are thought to need to function independently in the community. These skills, called the instrumental activities of daily living (Schaie 2009), focused on everyday domains such as competence to engage independently in food preparation, housekeeping, medication use, shopping, telephone use, transportation, and financial management activities. Obviously, each of these activities requires the exercise of practical intelligence.

Willis (1997) collected written materials (e.g., medication labels, bus schedules, telephone instructions, mail order forms, appliance instructions, etc.) that are actually used for each of the seven types of activities. She had these items rated as to their relevance by professionals working with older people and then constructed a test that measured proficiency with the information to carry out each activity of daily living independently.

This measure was validated further by observing individuals in their homes actually using these materials to engage in activities such as measuring out medications, using a microwave oven, and so forth (Diehl et al. 1995). Again, approximately half of individual differences on this everyday problems test could be explained by the performance of individuals on the basic ability tests (Schaie 2013; Marsiske and Willis 1995; Willis 1996).

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**Fig. 2** Age Differences in Verbal and Performance Subtest Scores on the WAIS (Source: Adapted from Wechsler, D. (1958). *The measurement and appraisal of adult intelligence* (4th ed., p. 28). Baltimore, MD: Williams & Wilkins, Co. Copyright © 1958 Dr. David Wechsler)



## Cognition and Age

What happens to intelligence with age? This is the key question in this essay, although our previous discussions should alert the reader to the fact that the answers are many and complex. It is argued by some that intelligence enters a process of irreversible decline in the adult years, because the brain becomes less and less efficient, just like the heart and lungs and other physical organs. Others contend that intelligence is relatively stable through the adult years, with the human brain providing more than enough capacity for anything that we would want to contemplate until serious disease and declines in sensory functions set in late in life.

Another view is that intelligence declines in some respects (perceptual speed, for example) and increases in others (in knowledge about life, or wisdom, for example; see (Staudinger and Glueck 2011)). Some argue that individual differences can be explained by compensatory experiences for those who age well, while others place emphasis in the above-average maintenance of physiological and psychological resources for these favored individuals (cf. Salthouse 1996; Schaie 2009).

### Early Cross-Sectional Studies

The interpretation of early cross-sectional studies, examining age differences in cognition, seemed fairly straightforward: An individual's intellectual abilities were thought to decline gradually but

inexorably over the adult years. David Wechsler, creator of the WAIS, believed that the "decline of mental ability with age is part of the general senescent process of the organism as a whole" (Wechsler 1972, p. 30, Wechsler 1997).

Researchers have noted that certain subtests on the WAIS declined less than others. Wechsler (Willis 1997) proposed to use the term "hold subtests" for those subtests on which older adults do about as well as younger adults in contrast to "don't hold" subtests that showed a greater decline. In general, the verbal subtests "hold" and the performance subtests "don't hold" (Fig. 2). It has been shown that there is improvement on the WAIS from 40 to 61 years on the information, comprehension, and vocabulary subtests; mixed change on picture completion (improvement on easy items and decline on difficult items); but decline on the digit symbol and block design subtests (Educational Testing Service 1977; Sands et al. 1989).

Why should some tasks show almost no decline and others show the older persons doing much more poorly than the younger study participants? One possible explanation is that the subtests in which older people do poorly are all highly timed or speeded tests; the scores reflect the time that it takes for the person to solve the problem, or it reflects the number of responses in a given time interval.

One might conclude older people are just slower but not necessarily less able. This type of

research, of course, changes the “problem” from “How long does it take you to solve it?” to “Can you solve it at all?” In fact, those who do not solve the problem at all contribute to the slower average speed of solution among older persons in large part.

### Crystallized and Fluid Intelligence

One of the most prominent theories of “hold” and “don’t hold” tests was formulated by Raymond Cattell and elaborated by John Horn. In factor analyses of cross-sectional studies of several intellectual tasks (not from the WAIS), Cattell and Horn repeatedly found that the tests on which older adults do well compared to younger adults are defined as a factor that they call crystallized intelligence ( $G_c$ ). As represented by tests of general information and vocabulary, crystallized intelligence is said to reflect the mental abilities that depend on culture and experience with one’s world – on education in the broad sense, including both formal schooling and informal learning experiences in everyday life. The “don’t hold” tests were defined by another factor, termed fluid intelligence ( $G_f$ ). Fluid intelligence is more akin to what Wechsler called “native mental ability,” reflecting presumably the quality of one’s brain: how quickly a signal can get in and out, how well organized are the neurons involved in associations, pattern recognition, and memory (Sands et al. 1989; Horn and Hofer 1992).

Adult intellectual development, viewed in terms of the  $G_c$ - $G_f$  theory, implies progressive deterioration in the neural and biological structures underlying intelligence and, thus, systematic decline in fluid intelligence. Crystallized intelligence, as long as we do not require speedy responses or highly abstract reasoning, should not be affected as much; it may even increase as a result of adult educational experiences (Schaie et al. 2005; Schaie 2011; Willis and Schaie 2009). The theory is a popular one, for it more clearly specifies the intellectual tasks that can be used to represent each type of intelligence.

Differential decline of intelligence that supports the  $G_c$ - $G_f$  theory also comes from a variety of longitudinal studies in various Western countries that show greater decline for measures of

fluid abilities (Rott 1993, Germany; Rabbitt 1993, England). However, as will be shown below, in the detailed discussion of a major American longitudinal study (Schaie 1996, 2013), this pattern may not hold for all abilities and in addition may be attenuated in advanced old age, when crystallized abilities also show substantial decline (Bosworth et al. 1999; Gerstorf et al. 2011).

### Longitudinal Studies

Widespread use of intelligence tests among college freshmen began in the United States in the 1920s. By 1950, therefore, it was possible to find a sizable group of 50-year-olds who had taken an IQ test some 30 years earlier. Several psychologists, seeing their chance to run a relatively inexpensive longitudinal study, seized the opportunity by retesting these middle-aged individuals. No one expected results different from those found in cross-sectional studies, which suggested a marked decrease in IQ scores after the age of 25 or 30.

Thus, it came as somewhat of a surprise to find that not only did the longitudinal studies find virtually any decline in IQ by middle age; instead they showed an increase! The average person seemed to have gotten smarter with age, at least up to age 50 (Owens 1966). Later follow-ups showed that the participants in the Owens study actually maintained their intellectual abilities into the sixties (Cunningham and Owens 1983).

One large-scale study combined features of both cross-sectional and longitudinal designs (Schaie 1994, 1996, 2013; Willis and Schaie 2009; Gerstorf et al. 2011; Schaie and Zuo 2001). In 1956, people ranging in age from 22 to 70 were tested in a cross-sectional study. In 1963, as many of the original study participants as could be found and convinced to participate once again were retested. This procedure was repeated a third time in 1970, a fourth in 1977, a fifth in 1984, a sixth in 1991, a seventh time in 1998, and another follow-up of previously tested participants in 2005. Thus, the researchers had seven cross-sectional studies in addition to longitudinal data covering a period of up to 49 years.

The cross-sectional studies showed the typical pattern of intellectual decline in the adult years; the longitudinal data, however, told a quite

different story. Consider, for example, “verbal meaning” (the ability to understand ideas expressed in words), one of the “primary mental abilities” assessed by the investigators. Figures 3 and 4 provide the most dramatic way to represent the difference between cross-sectional data and an estimate of what the longitudinal data would look like if the youngest group of study participants were followed for the rest of their lives (Schaie 2013).

The cross-sectional data (Fig. 3) show a peak between ages 25 and 39, followed by a relatively sharp decline except for verbal and numeric abilities which show negative age differences only by age 60. In striking contrast, the longitudinal data suggest increases in these abilities until 53 or 60, with a small decline thereafter; and even at age 74 the estimated performance is better than at 25 for verbal comprehension (Schaie 2013; Schaie and Willis 1993). Similar comparisons were made with tests of reasoning ability, numerical ability, word fluency, and spatial visualization.

More recently longitudinal data for six mental abilities have been reported at the factor level from the expanded investigation, covering 1956–2005, a period of 49 years (Schaie 2013). Representative findings, shown in Fig. 4, suggest

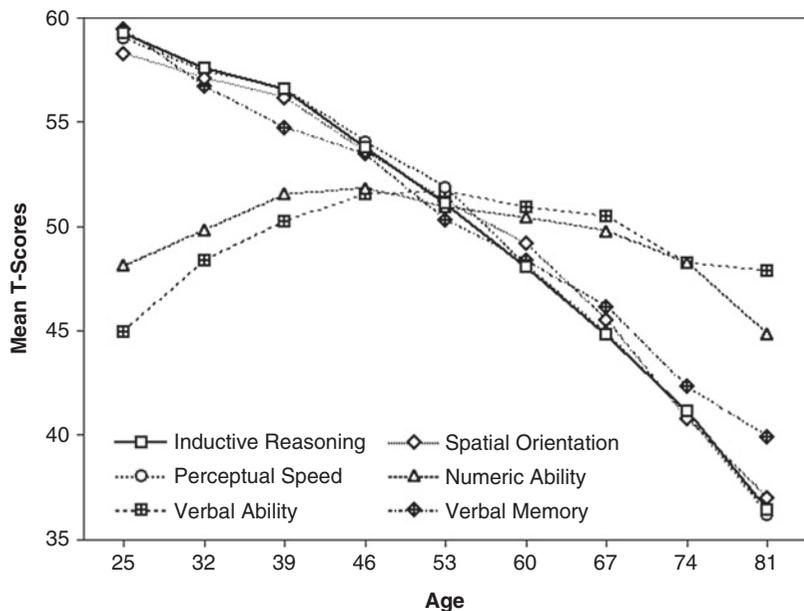
little if any decline, on average, in most abilities until the age of 60; in several instances, increases occur during the adult years, with peaks in mid-life. Even after age 60, average decline is slight until age 74 or 81 in the case of verbal and numeric ability. In fact, for both abilities the 81-year-olds do better than the 25-year-olds (The mental abilities investigated in this study are described in Table 1).

Other investigators also have observed the fact that even in fairly advanced age, change in abilities proceeds quite slowly and in fact is difficult to document in studies that extend only over 2 or 3 years (Hultsch et al. 1992; Zelinski et al. 1993). Once the high eighties and nineties are reached, however, declines become more rapid and extend across most abilities because of the increasing failures of sensory capacities and other physiological infrastructures (Li et al. 1999; Baltes et al. 1999; Salthouse et al. 1998) and there is increasing risk of preclinical decline related to dementia.

The data in Fig. 4 are actually quite conservative because they were adjusted for the various sources that typically confound longitudinal studies. These adjustments take into account experimental mortality (attrition) and reactivity (practice effects), which tend to make unadjusted

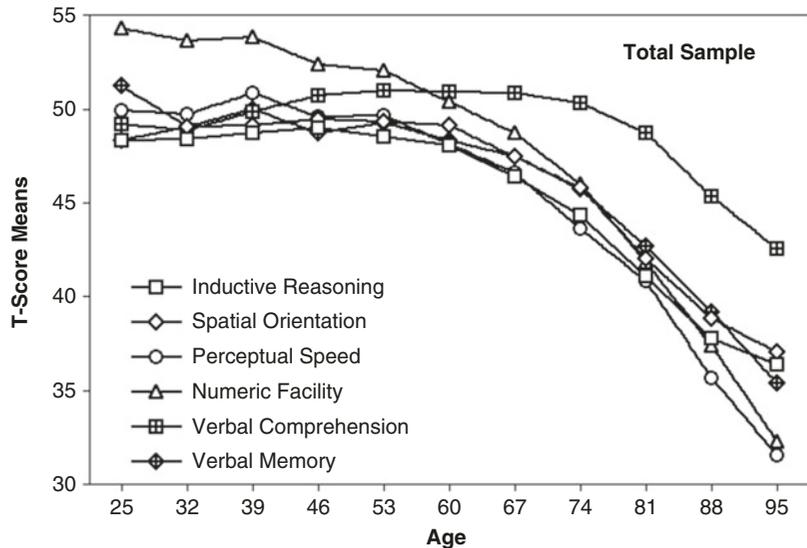
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**Fig. 3** Cross-sectional age difference gradients for six mental abilities (Source: From Schaie (2013), Fig. 4.7. p. 120)



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**Fig. 4** Effects of age on six mental abilities in longitudinal studies (Source: Schaie 2013, Fig. 5.8, p. 164)



longitudinal findings often look unduly optimistic. However, no adjustments were made for the well-documented decline in perceptual speed that puts older people at successively greater disadvantage (Salthouse 1996). Nor were any of the participants removed who were later known to have been in the early stages of dementia, thus perhaps underestimating mean levels for the normal elderly (cf. Sliwinski et al. 1996). In a study by Schaie (1989), the contribution of perceptual speed was removed statistically from the scores of 838 adults ranging in age from the twenties to the eighties. This adjustment removed most of the observed age decrement for highly practiced tasks and markedly reduced aging effects for novel tasks. Findings from a Swedish twin study suggest much of the correlation between cognitive measures and speed may be genetically mediated (Finkel and Pedersen 2000).

### Cohort Differences

What accounts for the difference between the cross-sectional and longitudinal results, with the latter not only showing no decline through midlife and early old age but also, in some cases, clear increases in intellectual abilities? Why do longitudinal studies give us such a different picture from earlier, cross-sectional studies?

The reason longitudinal studies give different results from cross-sectional studies is that

cross-sectional studies compare people of different ages and of different cohorts. Many of the differences that have been attributed to age must, for the most part, be relegated to differences among groups of people differing in year of birth.

Cross-sectional studies make it appear that intelligence declines steeply over the years, but much of this apparent decline is a confound of age and cohort effects. Longitudinal studies suggest generally that each generation is higher functioning than prior cohorts on many but not all abilities (e.g., number); however, there is also some evidence of a slowing of the cohort effects in recent US generations.

The pervasive differences in intellectual performance levels have been studied in young adults for populations in many different countries and are sometimes referred to as the “Flynn effect” (Schaie et al. 2005; Dickens and Flynn 2001; Skirbek et al. 2013). Flynn and colleagues have reported that the largest cohort differences in intellectual functioning were found for what are commonly known as fluid abilities. Smaller cohort gains have been found for acculturated skills acquired through schooling and commonly known as crystallized intelligence. However, these assertions were based almost exclusively on differences found between two particular cohorts differing approximately 30 years in age.

Massive cohort gains are reported for the post-World War II cohort with most data cited being for those born in the 1950s. Although data from a number of developing countries including Japan are cited, the data are largely limited to these two birth cohorts. From a US perspective, it is immediately evident that these cohorts represent the Baby Boomers and their parent generation, sometimes referred to as the Depression cohorts (cf. Schaie et al. 2005; Schaie 2011).

Why is one cohort more advantaged in intelligence than another? Why is it that people born more recently earn higher averages on IQ tests than their parents or grandparents? Various answers are suggested.

Over the last several generations in most countries, years of education have increased and in some cases quality of education has improved. In the United States, among the members of the oldest cohorts now living, the majority may have achieved no more than a high school diploma and relatively few have had college experience. The spectrum of occupations has shifted from manual labor to a majority of jobs requiring a variety of fluid and crystallized skills (Schaie 2011; Schooler and Caplan 2009; Schooler et al. 2004). Nutrition has vastly improved in the last 70 or 80 years, and so has medical care,

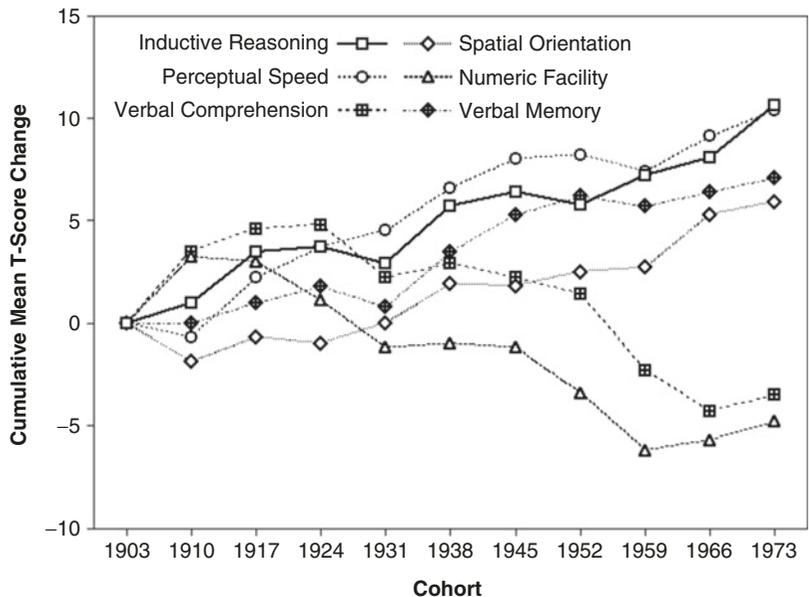
particularly treatment of cardiovascular disease; these improvements in health may be reflected in healthier neural functioning in adulthood. The use of tests like those for IQ has burgeoned, and thus later generations may be better than earlier generations at performing well on such instruments because of the added experience.

Because experiences that may be relevant to differential performance across different cohorts are due to many different influences we still are unsure of the psychological mechanisms involved. Laboratory studies have employed popular recreational activities such as crossword puzzles or jigsaw puzzles to determine whether regular performance on these activities is related to age differences on related abilities. Crossword puzzles have been related to verbal (crystallized) and memory ability and jigsaw puzzles to spatial (fluid) ability (Allard et al. 2014; Pillail et al. 2011).

Cohort differences in intelligence are not uniform across different abilities. Figure 5 shows the change in cohort level in percent of the performance of the earliest cohort for 13 cohorts born from 1889 to 1973. Almost continuous gain occurred for each successive cohort for the primary mental abilities of inductive reasoning, spatial orientation, perceptual speed, and verbal memory. However,

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**Fig. 5** Cumulative cohort differences from oldest to youngest cohort for five mental abilities (Source: Schaie 2013, Fig. 6.3. p. 183)



gain peaked in 1952 for verbal memory. Number ability and verbal comprehension peaked in 1924 and then decreased below the level of the oldest cohort. These differential findings suggest that older cohorts are at a particular disadvantage on the fluid abilities but may have an advantage with respect to number skills (Schaie 1996, 2013; Willis 1989). Interestingly enough a cross-cultural study of cohort differences in number skills comparing young and old Chinese with Americans has shown that the advantage generally shown by current Chinese over American students may be due to positive cohort change in numeric ability in China co-occurring with negative differences in the United States (Geary et al. 1997).

The cohort differences data described above come from the study of unrelated individuals, but generational differences of very similar magnitude have been observed also in studies comparing parents and their adult children when compared at the same ages. This kind of data can, of course, be collected only in studies conducted over long periods of time (Schaie 2008; Schaie et al. 1992).

There is some evidence that the differences between generations have begun to turn in favor of the earlier-born cohorts (e.g., numerical ability). Average test scores on the Scholastic Aptitude Test have been declining since 1962;

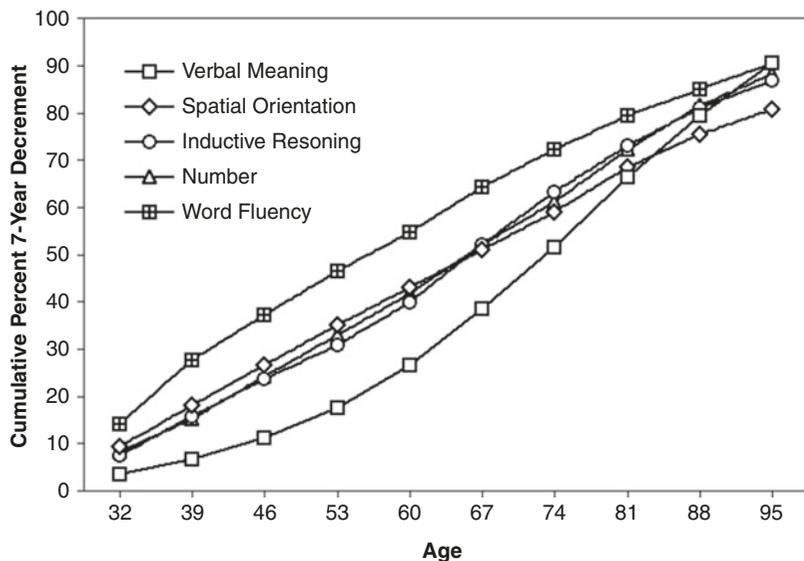
before 1962, averages were stable or increasing. The decline has been blamed on many factors, but chief among them are poorer educational standards in our schools, more students taking the SAT and “the passive pleasure, the thief of time” – television (Hanford 1991). For whatever reason, the youth of today are doing somewhat less well on some cognitive tests than their elders did at the same age, and this fact will eventually be evident in cross-sectional studies of intelligence.

**Frequency of Decline**

In addition to knowing the age at which the average person declines, it is also important to know what proportion of people are likely to decline at a given age. Such knowledge is useful in at least two ways. First, it alerts us to the fact that there may be more stability than change in intellectual aging and that some persons may still grow even at an advanced age. Second, just as longevity tables permit life insurance companies to forecast the odds of someone’s dying, a knowledge of the proportion of those declining at a given age permits us to determine the probability that intellectual changes will have important consequences. Frequency distributions were prepared for several thousand participants in the Seattle Longitudinal Study to determine what proportion had declined



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**Fig. 6** Cumulative hazard rate of significant decrement in different abilities occurring to successive ages from 32 to 95 years (Source: Schaie 2013, Fig. 19.2, p. 459)



significantly over each 7-year age range from 25 to 32, 60 to 67, and so on until age 88 to 95 (Schaie 1989, 2013).

The researchers examined frequencies for the five primary mental abilities: verbal meaning, inductive reasoning, word fluency, numerical ability, and spatial orientation. The proportion of persons who maintained their level of functioning over every 7-year period is shown in Fig. 6. Note that, although abilities varied greatly, in the various abilities tested, by age 60, as many as 50% of those studied declined on Word Fluency while only 25% declined on Verbal Meaning. By age 74, decline was observed for 60% on Word Fluency but only for 35% on Verbal Meaning. However, by age 81, more than 60% of the study participants had declined on all abilities.

## Conclusion

What happens to one's cognitive functions, as one grows older? This has been the primary question in this entry, and we do have a tentative answer based on considerable research (also see Schaie 2016). In addition we also suggested that it may be useful to expand the stage model of development suggested by Jean Piaget by describing additional adult stages which most of us experience as we pass through adulthood.

Average cognitive ability scores were at first thought to indicate a gradual decline after the age of 25. Later studies showed this interpretation to be wrong, to be an artifact of increasing abilities with successive generations.

We now believe that the pure numbers decline only later in life, largely after the age of 60. Although decline occurs for persons at all ability levels (Christensen and Henderson 1991), advantaged groups, such as college graduates, often decline very late and may remain well above the average level of young adults until their eighties and nineties (Marsiske and Margrett 2006; Schaie 1989).

Performance levels for certain tests, those variously called "speeded" or "fluid" or "performance" or whatever, drop somewhat more rapidly, but the reasons for this remain the most

controversial. These may be the basic biological aspects of intellect, as some theories assert (Birren and Fisher 1992). Or these may be the abilities most subject to variations in training, motivation, and historical circumstances (Abeles and Riley 1987). The decline in cognitive test scores after the age of 60 is similarly subject to several interpretations. In addition to notions of inevitable biological decrement, we could attribute intellectual decline to social isolation, decreasing motivation to perform irrelevant intellectual tasks, disease (including disease related to impending death and terminal drop), or some combination of such factors (cf. Fillit et al. 2002; Hülür et al. 2015). Some people decline in intellectual ability; others increase.

Historical events that change patterns of opportunity and exposure to societal resources may result in profound generational differences in performance levels and rate of change (Schaie et al. 2005; Schaie 2011). The patterns of change for different abilities and even different measures of the same ability differ remarkably (Schaie and Willis 1993).

Some abilities seem to be increasing with each new generation; others seem to be decreasing. An environmental event (e.g., the development of television) can change trends for some people and have little effect on others. Thus, the search goes on, but it is a search now for the determinants of change or stability and much less for inevitable and irreversible decrements.

If you keep your health and engage your mind with the problems and activities of the world around you, chances are good that you will experience little decline in intellectual performance in your lifetime. That's the promise of research in the area of adult cognition.

## Cross-References

- ▶ [Age-Related Changes in Abilities](#)
- ▶ [History of Longitudinal Studies of Psychological Aging](#)
- ▶ [Leadership and Aging](#)
- ▶ [Life Span Developmental Psychology](#)
- ▶ [Stage Theories of Personality](#)

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## History of Cognitive Slowing Theory and Research

David Madden<sup>1</sup> and Philip A. Allen<sup>2</sup>

<sup>1</sup>Brain Imaging and Analysis Center, Duke University Medical Center, Durham, NC, USA

<sup>2</sup>Adult Development and Aging Psychology, The University of Akron, Akron, OH, USA

### Synonyms

Complexity hypothesis; General slowing; Processing speed; Process-specific slowing

### Definition

Age-related cognitive slowing refers to the common finding that humans tend to slow down in cognitive processing with increased adult age.

## Individual Differences in Processing Speed

As Birren and Fisher (1995) noted, current research on slowing in cognitive aging is built on the foundation of research on individual differences in the late nineteenth century and early twentieth century, for example, Galton's "anthropometric measurements" obtained at the 1884 International Health Exhibition in London. Related work by Cattell in 1890 and Koga and Morant in 1923 suggested that individual differences in reaction time (RT) in elementary sensory tasks were potentially important measures of cognitive performance. Further, individual differences in the RT measures were not attributable entirely to peripheral, sensory processes but instead appeared to represent basic properties of the central nervous system. Birren (1965) also emphasized that age-related slowing was a central, rather than peripheral, phenomenon and that slowing was related to task complexity. That is, as information processing task complexity increased, older adults showed progressively larger slowing effects. Welford (1977) suggested that slowing was due largely to increased neural noise (i.e., disruptions of the neural networks responsible for cognitive functioning). Following Birren (1965) and Welford (1977), reaction time and related measures of processing speed have emerged to become critical dependent variables in research on age-related differences in cognition and central nervous system functioning (Madden 2001; Salthouse 1996).

### Brinley Plots

Brinley (1965) introduced a method for plotting the differences in RT between younger and older adults, and this has become an influential research method for research on age-related slowing. Brinley introduced this type of analysis as a method for investigating age group differences, but in theory the method can be applied to any two-group comparison. In a Brinley plot, for each of the individual conditions within a behavioral task (e.g., target present vs. target absent, low

vs. high memory load, etc.), the mean performance of the older adults is plotted (on the y-axis) as a function of the mean performance of the younger adults (on the x-axis). Typically, mean reaction time (RT) within each task condition is the measure of interest, but in theory accuracy can also be analyzed in this manner, and Brinley discussed plots of both RT and error rate. Thus, increasing values along the x-axis represent increasing task difficulty, in terms of the mean RT or error rate associated with the individual task conditions, and the more task conditions that are included in the analysis (from either the same or different experiments), the more accurate will be the estimation of the function relating the younger and older adults' data points. In theory, there is no reason for the relation between older and younger adults' performance values to be linear, but Brinley found that plots for both RT and error rate were linear with a slope greater than 1.0. For RT, with 21 data points, he observed a linear slowing function with a slope of 1.68 and an intercept of  $-270$  milliseconds (ms) – and the most surprising outcome was that this linear equation accounted for 99% of the variance! That is, age differences on 12 different task-switching tasks could be precisely described using a single variable – age-related slowing. To characterize the age-related differences in performance, it was not necessary to describe or understand the individual task conditions, only the nature of the overall change in performance across the task conditions.

However, Brinley plots do not always account for 99% of the age-related variance. Processing domain (e.g., lexical vs. nonlexical) or processing stage (e.g., encoding vs. response decisions) can also show domain- or stage-specific age effects. To illustrate how age-related slowing can be affected by processing stage, the Brinley plot method will be applied to data from a word-naming study. In this naming study, two experiments were conducted on 80 younger adults and 80 older adults; there were three other independent variables: case type (consistent lowercase vs. mixed case), phonological condition (exception words, exception controls, regular-inconsistent and regular-inconsistent controls), and word frequency (low vs. high). The data

from these two word-naming experiments, with 32 task conditions (Allen et al. 2011), are illustrated in a Brinley plot in Fig. 1 with 32 data points. Unlike the Brinley (1965) study, however, the linearity of the older-younger RT function accounted for just 69% of the variance. While this is still a large effect size (again, suggesting that perhaps a single variable – processing speed – might account for almost all age-related difference), as will be discussed later on in this entry, a more complex model of age-related slowing will account for more of the model variance. This brings up an important aspect of the processing speed literature as noted by Madden (2001) and others – namely, there are macro and micro perspectives on age-related slowing. The macro perspective has emphasized what common effects in aging occur (e.g., are age-related differences in basic cognitive processes mediated by a common factor?) and tends to be based on a psychometric approach such as structural equation modeling (SEM), whereas the micro perspective has emphasized whether age-related differences in cognitive processes are moderated by other variables and so tends to emphasize an experimental approach (e.g., ANOVA). This entry will begin with micro approaches and then discuss macro approaches to capture the chronological order of this research in the aging literature.

### Generalized Slowing

Early studies using Brinley plots typically found that these functions exhibited a negative intercept value. However, in theory the intercept should be positive, that is, older adults' RT should always be above that of younger adults. This feature suggests that the Brinley plot is not entirely accurate and that a single factor of general slowing does not account for all of the age-related differences observed in RT. Cerella (1985) suggested that the negative intercepts and positive slopes occurred because there were both peripheral (relatively small) and central (relatively large) slowing factors. In his seminal 1985 *Psychological Bulletin* paper, meta-analyzing the response time results from 35 studies using 189 data points, Cerella

suggested that this two-factor linear slowing model could account for a substantial proportion of age-related difference on cognitive tasks.

Salthouse (1985) further elaborated on age-related slowing and proposed six different potential mechanisms from information processing theory that might account for this effect. Of these six, the “cycle-time” hypothesis was favored – the idea that older adults might have slowing processing cycle time (i.e., each processing stage took longer for older adults – this is analogous to the “clock rate” of a digital computer CPU). This is a “hardware” effect rather than a “software” effect. Consequently, if older adults’ clock rate were to be 1.5 times slower than younger adults, then one would expect generalized slowing at the same rate across task complexity. Salthouse also warned about the importance of assessing potential speed-accuracy trade-offs in slowing research. That is, errors must be approximately constant across age, or this could affect the overall performance level, for example, if older adults’ slowing represents greater caution in decision-making.

Myerson et al. (1990) extended the generalized slowing idea to show that nonlinear models could also accurately predict age-related differences in response time performance across a wide variety of cognitive tasks. In their information loss model, they assumed that across functionally serial and discrete information processing stages, information was lost at each successive stage – resulting in a nonlinear “general slowing function.” The information loss model is based on an exponential, rather than linear, relation between younger and older adults’ RTs.

### **Potential Methodological Issues with Brinley Plots**

There are important methodological issues to consider when using Brinley plots. First, this approach assumes that both age groups are using the same processing architecture. If older adults use different strategies than younger adults, then a direct comparison of the two age groups is difficult, because the measurement scale would not be

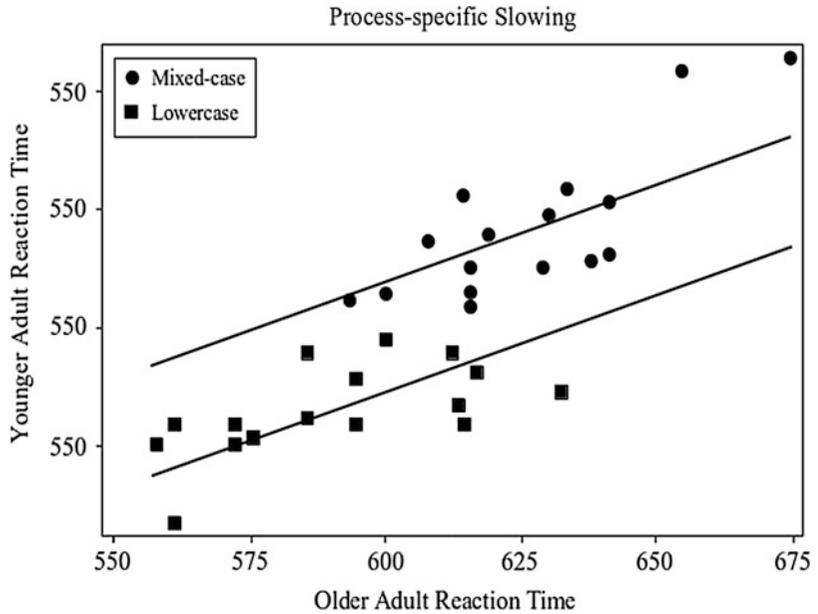
comparable. It appears that there are no studies that have specifically addressed the issue of potentially different measurement scales for younger and older adults. It is assumed that the relationship between levels of an independent variable and the performance (dependent) variable is the same in terms of interval scaling, but this has never been tested. That is, is the magnitude of the difference for any one-unit increase in complexity different across age groups? This issue needs additional consideration.

Another issue in Brinley plot research was noted by Perfect (1994). He noted that different tasks placed on the same Brinley plot frequently show gaps between data points on the plot. When examined as a group, these data points fit nicely on a single regression equation (i.e., a very large *r*-square value). However, these tasks frequently result in an Age  $\times$  Task Type interaction. Thus, when there are regions of dense data points intermixed with wide regions of no data points followed by other regions of data points, this can result in exaggerated *r*-square values compared to separate Brinley plots of the different clusters of data points. Because older adults’ reaction times are almost always higher than younger adults’ response times, this forces a positive correlation – and as the magnitude of the horizontal dispersion increases, *r*-square will increase. This means that the Brinley plot method is biased to show large *r*-square values.

Finally, it is important to note that the Brinley plot is a method for analyzing mean RT. Analyses of mean values as estimates of central tendency assume that the underlying distribution is Gaussian (i.e., normal). However, when the complete distribution of an individual participant’s RTs is examined, that is, all the trials contributing to the mean, the frequency distribution of fastest to slowest RTs is virtually never Gaussian but is instead positively skewed, with more responses at the slower end than on the faster end. Empirically, RT distributions are better characterized by what is termed an ex-Gaussian distribution, which is the convolution of exponential and Gaussian (normal) distributions. Across different task conditions (or groups of participants) the mean of an RT distribution may remain constant even though

### History of Cognitive Slowing Theory and Research, Fig. 1

Process-specific Brinley plot (one slope and two intercepts) of mean RT data from Allen et al. (2011)



the shape of the distribution varies. Distribution analyses of RT use the parameters of different mathematical distributions, most often the ex-Gaussian, to obtain more specific information about the cognitive processes contributing to the response that are not revealed in analyses of mean RT (Balota and Yap 2011).

### Process-Specific and Task-Specific Slowing

Analysis of variance (ANOVA) is commonly used in cognitive aging research. In order to test for age-related differences in cognitive processing, researchers frequently examine whether there is an Age  $\times$  Condition Type interaction. If the interaction is significant, then it is assumed that an age-related difference exists. However, even if significant interactions with age are present in ANOVA, this does not rule out the possibility that such results are still consistent with general slowing. Madden et al. (1992) reported a quantitative transformation of younger adults' latencies that allows the interpretation of interactions with age group using ANOVA. These authors proposed first creating the Brinley plot for the data to be analyzed and then using the regression equation

defined by the Brinley plot as a transform for the younger adults' data. Thus, an Age Group  $\times$  Task Condition ANOVA interaction that remained significant following this transform could be viewed as slowing beyond the level described by the Brinley plot. Faust et al. (1999) described other approaches, including the standardization of individual RT values, for taking age-related slowing into account within the ANOVA framework.

Several other studies provided evidence of domain-specific slowing – in particular, age-related slowing rates for lexical tasks were attenuated relative to nonlexical tasks. In addition, task-specific and/or process-specific effects occurred within the lexical domain. In order to illustrate this observation, the 32 data points illustrated in Fig. 1 will be revisited. As noted earlier, the r-square value for the Brinley plot of these data is relatively low: r-square = .69. In Fig. 1 it is apparent that the data points for the consistent-case conditions lie below the data points for the mixed-case conditions (as illustrated by the two regression equations superimposed over the scatter plot). Indeed, Allen et al. (2011) observed an Age  $\times$  Case Type interaction in both experiments. Even after these data were transformed using the Faust et al. (1999) z-transformation method, the Age Group  $\times$  Case Type interaction persisted

( $p < .001$ ), indicating that a single slowing function could not adequately describe these data. However, when we allow different intercepts for both levels of case type, but a single slowing slope, this model now accounts for 84% of the variance, and this increases to 87% when different intercepts and slopes are used (i.e., much higher than 69%). Consequently, these data from Fig. 1 require two separate slowing functions – one for each case type. These results suggest that age-related differences in visual word encoding are much greater than age-related differences in lexical access or phonological processing, so process-specific slowing can moderate generalized slowing.

### Processing Speed as a Construct

As noted earlier, there are two broad approaches used to examine age-related difference in processing speed – a micro approach typically involving experimental methods to assess whether age-related differences are moderated by generalized slowing (or not) and a macro approach typically involving psychometric methods to assess whether age-related differences in cognitive processing are mediated by a common factor (in particular, processing speed). Perhaps the seminal paper reviewing the evidence for the common-factor account of age-related difference in processing speed was that presented by Salthouse (1996). The key finding in this study is that when processing speed is controlled for, age-related differences in first-order cognitive processes (e.g., perception, attention, memory) tend to be eliminated or at least attenuated. Salthouse then followed up on this research with a series of studies that tested whether age-related differences in a number of cognitive measures were mediated by age-related differences in what he termed processing. As with the Brinley analysis approach, this single common factor of processing speed seemed to account for almost all age-related differences in cognitive performance for fluid tasks. The advantage of using the psychometric approach, though, is that SEM takes into consideration individual differences, and because it uses latent factors, rather than

manifest variables (as are used in path analysis), this method typically estimates error more accurately than regression or path analysis methods.

However, for some time there has been evidence of differential age-related effects in cognitive processes (e.g., Allen et al. 2011; Madden et al. 1992). In SEM terminology, this would mean that indirect paths from age to first-order specific factors (e.g., word encoding, lexical access, and phonological processing) are present in addition to a direct path from age to a higher-level, common factor (what all three of these processes hold in common in describing overall age-related differences). Allen et al. (2001) conducted such an SEM test of process-specific (all age effects are described by first-order cognitive factors), common-factor (all age effects are captured by a single common factor), and hybrid models (both common-factor and process-specific age effects are required). These authors analyzed four SEM data sets from previously published articles to assess whether process-specific age-related differences were present. In three of the four data sets, a hybrid model fit the best, and in the fourth, a process-specific model fit optimally. These results indicated task-specific age-related differences were present, in addition to common-factor age effects.

### Methodological and Conceptual Issues in the Psychometric Approach

Lindenberger and Pötter (1998) provided a note of caution concerning the application of hierarchical regression, path analysis, and SEM psychometric approaches to aging research. The goal of these psychometric approaches is typically to assess whether the relationship between age (the exogenous variable) and a cognitive variable (episodic memory) is unique or whether it is shared with or explained by some other variable (e.g., processing speed). If the relationship between age and episodic memory is statistically significant, but is no longer significant after processing speed is added (total mediation) or at least the relationship is attenuated (partial mediation), then it is assumed that the relationship between age and episodic memory is mediated by processing speed. Lindenberger and Pötter,

however, noted that these methods technically do not test the mediation assumption – instead they provide information on shared and unique sources of variance if the mediation assumption were in fact true. These authors emphasize the importance of theory development and longitudinal methods so that the direction of effects can be determined.

Another methodological issue with the psychometric approach has to do with capitalizing on chance. Whereas the micro approach with its experimental approach emphasizes replication to minimize the chances of a type I error (rejecting a true null hypothesis), the macro psychometric approach typically uses larger sample sizes within a study. In SEM approaches, optimal model fits are frequently obtained with the assistance of modification indexes. Thus, the reported model may reflect chance variation specific to the obtained sample (and not to the total population). A solution to this problem is to collect both validation and holdout samples, develop the model on the validation sample, and then impose this model on the holdout sample to confirm that it fits. In other words, replication across samples is important.

Finally, a conceptual issue with the common-factor models of cognitive aging concerns what is meant by “common.” It is absolutely imperative that researchers be explicit when defining “common” aging factors – if it is actually processing speed, then the same common factor should be used across all studies (not simply using SEM methods to statistically estimate a common factor and then assume that it reflects processing speed). If the common factor is not carefully explained, then it simply becomes a “black box” with no theoretical utility. For example, the potential common factors in cognitive aging research that are often mentioned are processing speed, neural noise, sensory deficits, and inhibitory control deficits. It is imperative that researchers identify their “common cause” in a given study.

### **Cross-Sectional, Longitudinal, and Sequential Designs and Slowing**

The majority of the studies conducted in cognitive aging research are cross-sectional, in the sense of

studying different samples of younger and older adults tested at approximately the same point in time, with data analyses relying on ANOVA, linear regression, or related methods. Sliwinski and Hall (1998), however, proposed that maximum likelihood estimation (MLE) with hierarchical mixed models allowed individual differences to be modeled more precisely and that using mixed model methods resulted in more process-specific age-related difference. Consequently, the greater precision afforded by mixed model designs (in which the individual is modeled using a random effect in addition to the traditional fixed effects) in modeling individual differences in ANOVA designs should be considered when analyzing experimental data because considering individual differences frequently has an impact on generalized vs. process-specific outcomes.

Intuitively, the best method for measuring age-related change would be a longitudinal design, in which the same individuals are tested at different points in time. Purely longitudinal studies are difficult to implement because the time frame needed to characterize change may be on the order of decades. Hofer and Sliwinski (2001) proposed a different approach. They suggested that using Schaie’s (1965) sequential design applied to mixed models would incorporate a longitudinal component into a cross-sectional design, as well as modeling individual differences. In this alternative approach, the sequential design, different age groups (e.g., those in their twenties vs. those in their sixties) are followed longitudinally for a period of time (e.g., several years) to characterize individual-level correlated rates of change. However, both longitudinal and sequential designs have a limitation in that they introduce repeated testing and practice effects that may obscure, to some extent, true age-related change. For example, in a longitudinal analysis of data from 1,616 individuals 18–80 years of age, Salthouse (2010) found that after adjusting for the practice effects, the changes in cognitive performance across approximately 2.5 years were less positive at younger ages and slightly less negative at older ages.

## Cohort Effects in Processing Speed?

The Flynn (1987) effect illustrates the finding that students from a 1980 cohort scored significantly higher on standardized scores of fluid reasoning than did students of the same age from a 1950 cohort. Because processing speed is a major indicator for fluid reasoning performance, an important question is whether the Flynn effect generalizes to aging. That is, do more recent cohorts of older adults show increased processing speed relative to earlier cohorts of older adults? There is some evidence that older adults from the present age cohort are showing increases in processing speed relative to earlier cohorts of older adults. For example, in their Long Beach Longitudinal Study of Aging, Zelinski and Kennison (2007) found that fluid abilities of reasoning for their Cohort 2 ( $n = 456$ ; born between 1908 and 1940) were significantly higher at the same age than they were for their Cohort 1 ( $n = 482$ ; born between 1893 and 1923). Overall across multiple processing domains, their Cohort 2 at age 74 showed equivalent performance to Cohort 1 at age 62. Consequently, there is accumulating evidence that processing speed/fluid reasoning for older adults is improving with each successive birth cohort.

## Neuroimaging Measures of Age-Related Slowing

As Birren (1965) emphasized, RT measures are indicators of age-related effects at a central rather than peripheral level. Modern brain imaging techniques are beginning to provide new information regarding the properties of brain structure and function that are relevant for age-related slowing, but definitive conclusions are not yet available. It is likely that measures of both gray and white matter volume and integrity, as well as measures of both task-related and resting-state brain function, will be relevant. It appears that age-related differences in the brain are multifactorial and interactive in their relation to speed. Currently, many neuroimaging studies use a *disconnection model* of cognitive aging to interpret age-related

differences in brain structure and function. From this perspective, age-related decline in cortical volume or microstructural integrity of white matter is viewed as contributing to the decreased efficiency of the connections among the neural networks mediating cognitive function.

For example, Kievit et al. (2014) combined gray matter volume measures of prefrontal regions with measures of white matter tracts connecting those regions, in a large, population-based sample of 567 individuals with both behavioral and imaging data. An SEM analysis of two related measures of executive function, fluid intelligence and multitasking ability, indicated that the paths of statistical influence between the neuroimaging and behavioral variables differed for the two behavioral domains. Both regional gray matter volume (Brodmann area 10) and white matter integrity (genu of the corpus callosum) were significant mediators of the age-related decline in fluid intelligence, whereas integrity of the anterior thalamic radiations (frontostriatal tract) mediated multitasking ability. Thus, as a general principle, aging may represent a form of gradual disconnection of the neural networks responsible for elementary perceptual speed, and ultimately, more complex forms of cognition. The influence of disconnection, however, may vary across behavioral domains and may interact with changes in regional volume.

## Neuroplasticity and Age-Related Slowing

With the advent of cognitive training software (e.g., Posit Science and Lumosity), another issue pertinent to the present discussion of cognitive slowing in increased adult age is whether cognitive training can affect cognitive performance. That is, can the older adult brain benefit from training in a manner that would suggest some level of neuroplasticity – even in older adults? While this is a very complicated research issue, Mitchell et al. (2012) provided both positive and negative evidence for neuroplasticity in aging. First, in an analysis of four different longitudinal studies, these authors found that a change in cognitive activity was associated with an increase in cognitive

performance (e.g., learning to play the violin at 70 improved overall cognitive performance). However, the amount of baseline cognitive activity at an earlier age was not correlated with later cognitive performance – although the general amount of time spent on cognitive activities tended to decline with increased adult age in three of the four longitudinal studies included in the Mitchell et al. study. Therefore, the amount of baseline cognitive activity may not be significantly correlated with later cognitive performance because of older adults' typically decreasing time spent on cognitive activities. Alternatively, cognitive training may provide just a relatively brief cognitive performance benefit.

## Conclusion

Processing speed tends to decrease with increased adult age, and very early in the history of cognitive aging research, investigators recognized that this age-related effect is a property of the central nervous system rather than a peripheral, sensory-motor effect. Age-related slowing is evident across a variety of task conditions and expresses a general effect of task complexity – as hypothesized by Birren (1965). A number of studies also suggest, however, that age-related differences in processing speed are moderated (or mediated) by specific cognitive processes or processing domains – as hypothesized by Welford (1977). Thus, researchers continue to develop more fine-grained analyses of the relative contribution of general and task-specific slowing to the age-related differences in RT. Different methods including RT distribution analyses and variations on longitudinal vs. cross-sectional testing continue to be explored. As these different perspectives become combined with methods from neuroscience and neuroimaging, it is hoped that a more complete account of age-related slowing will emerge.

## Cross-References

- ▶ [Age-Related Slowing in Response Times, Causes and Consequences](#)
- ▶ [Cognitive and Brain Plasticity in Old Age](#)

- ▶ [Common Cause Theory in Aging](#)
- ▶ [History of Cognitive Aging Research](#)

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## History of Longitudinal Statistical Analyses

Manuel C. Voelkle<sup>1,2</sup> and Janne Adolf<sup>2</sup>

<sup>1</sup>Institute of Psychology, Humboldt University Berlin, Berlin, Germany

<sup>2</sup>Max Planck Institute for Human Development, Berlin, Germany

## Synonyms

Longitudinal data; Longitudinal data analysis; Longitudinal research; Longitudinal studies; Repeated measures

## (Re)Constructing the History of Longitudinal Statistical Analysis

Longitudinal statistical analysis has a long past but a short history. In fact, until very recently, longitudinal statistical analysis did not exist as a subject, but was inextricably tied to substantive research in different disciplines. Even today, most publications on longitudinal statistical analysis are written from the perspective of a certain discipline and focus on a specific research design and data structure. Examples include pertinent work on large sample panel data (Hsiao 2014) and single-subject time series data (Lütkepohl 2005) in economics, crossover experimental designs in medical and pharmaceutical research (Jones and Kenward 2014), and the typical applications in the social sciences, often involving multiple individuals and a moderate number of repeated measurement occasions (Singer and Willett 2003). Depending on the field of research and the focus on a specific design or data structure, the history of longitudinal statistical analysis may thus be construed quite differently. This encyclopedia entry is primarily devoted to the history of longitudinal statistical analysis in relation to geropsychology and developmental psychology. As a field, however, modern geropsychology is highly interdisciplinary and thus subject to various influences. As the influences of neighboring disciplines wax and wane, so does the importance of their historical backgrounds. For this reason a description of the history of longitudinal data analysis remains always preliminary, reflecting our present-day view on the most important trends and influences that have shaped the field up to now. As the field changes, the perception of its history may change as well. Taking on today's notion of the main rationales of longitudinal research and the best way to address them, this encyclopedia entry will sketch the development of the most prominent approaches to longitudinal statistical analysis in geropsychology. Thereby, the focus lies on identifying relevant historical trends rather than presenting a chronology of discrete events. Specific dates mentioned in the following are thus best understood as exemplary milestones of more general developments.

## Early Origins of Longitudinal Research

“The study of change became the business of science” (p. 7) ever since Galileo’s law of inertia overthrew Aristotle’s conception of a stable and harmonic universe (Gottman 1995), thus turning the analysis of things into the analysis of *change* of things. Other protagonists in this conceptual revolution were Copernicus who preceded Galileo and argued for the heliocentric model and planetary motion as well as Newton, whose refinement of Galileo’s work led to the laws of motion. The subsequent development of differential and integral calculus by Newton and Leibniz in the seventeenth century did not only feature in the emergence of classical mechanics in physics, but the according concepts and formulations also lie at the heart of many modern approaches to longitudinal statistical analysis. However, it took well over two and a half centuries until they gained ground in the social sciences.

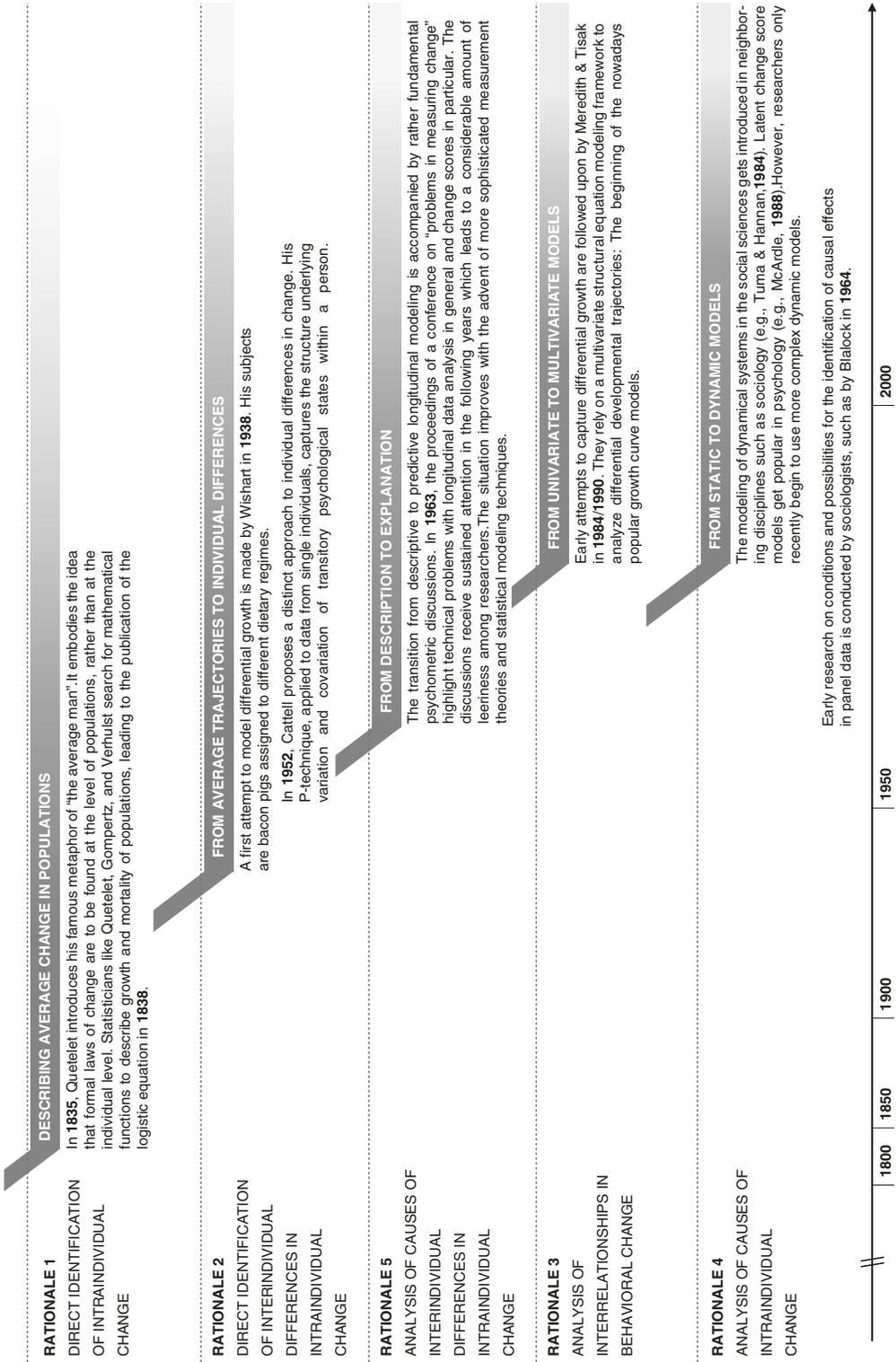
## Longitudinal Research in Developmental Psychology and Geropsychology

Similarly, the origins of geropsychology can be traced back to the old Greco-Roman philosophers and beyond. It was not until about the mid-twentieth century, however, that geropsychology emerged as an organized field of research and education (Birren and Schroots 2000). Although the preceding historical developments were somewhat different in Europe and North America (Lindenberger 2007), geropsychology was always closely tied to developmental psychology (and vice versa) and, especially in the North American tradition, characterized by the quantitative empirical study of growth and decline. Accordingly, it is probably no coincidence that the birth of geropsychology as a field falls into the same time as the first attempts to explicate and resolve the conceptual and technical difficulties in the statistical analysis of change. A seminal 3-day conference on *problems in measuring change* in the year 1962, which brought together some of the most eminent

psychometricians in the field, is prototypical for these attempts (Harris 1963). The debates at that time were by no means confined to technical subtleties, but brought up rather fundamental psychometric issues, culminating a few years later in the well-known advice of the former president of the American Psychological Association Lee Cronbach that “investigators who ask questions regarding gain scores would ordinarily be better advised to frame their questions differently” (p. 80) (Cronbach and Furby 1970). Fortunately, most researchers did not follow this advice, and in subsequent years, measurement theories and statistical techniques got more refined and the rationales for longitudinal research were more clearly spelled out. Particularly influential in the field of geropsychology became the formulation of five different rationales for longitudinal research by Baltes and Nesselroade (1979), who distinguished between (1) *the direct identification of intraindividual change*, (2) *the direct identification of interindividual differences in intraindividual change*, (3) *the analysis of interrelationships in behavioral change*, (4) *the analysis of causes of intraindividual change*, and (5) *the analyses of causes of interindividual differences of intraindividual change*. Until today, this distinction has not only proven to be a useful taxonomy, but also reflects major trends in the history of longitudinal statistical analysis. For this reason, the remainder of this encyclopedia entry presents the attempt to reconstruct the history of longitudinal statistical analysis in developmental psychology and geropsychology along the lines of these five rationales. Figure 1 provides a graphical overview of the major trends in the history of longitudinal statistical analysis identified in this chapter and how they relate to the five rationales put forward by Baltes and Nesselroade (1979). The figure thus also serves as an outline of the encyclopedia entry.

## Describing Average Change in Populations During the Nineteenth Century

Most writers date the beginning of the history of longitudinal statistical analysis to the early nineteenth century. For geropsychology, these early years were characterized by the pioneering work



**History of Longitudinal Statistical Analyses, Fig. 1** Major trends in the history of longitudinal statistical analysis in geropsychology and their relation to the five rationales for longitudinal research put forward by Baltes and Nesselroade (1979)

of the Belgian scientist Adolphe Quetelet, who not only followed earlier work by Johannes Nikolaus Tetens in extending the scientific investigation of human development to the entire life span (“L’homme naît, se développe, et meurt d’après certains lois qui n’ont jamais été étudiées dans leur ensemble ne dans le mode de leurs réactions mutuelles”; p. 1, Quetelet 1835), but also made important contributions to longitudinal statistical analysis, such as the identification of research strategies that correspond to today’s schemes of cross-sectional and longitudinal research. At around the same time Quetelet studied the physical and social growth and decline in humans, his fellow countryman Pierre François Verhulst published the famous logistic equation in 1838. The equation was developed out of an attempt to better describe the growth of a population and after realizing that populations could not grow geometrically over a long period of time but that any increase is “limited by the size and the fertility of the country [. . . such that] the population gets closer and closer to a steady state” (p. 36) (Bacaër 2011). Finally, these early developments are closely associated with the name of Benjamin Gompertz, a British mathematician and actuary, who studied the laws of human mortality and proposed a sigmoid function to describe the mortality of a group of individuals which later became known as the Gompertz curve. The work by Gompertz, Quetelet, and Verhulst influenced (and was in part rediscovered by) renowned scientists in the early twentieth century, such as the biostatisticians Lowell Jacob Reed or Raymond Pearl, one of the founders of the new field of biogerontology. Indeed, the functional forms used to describe growth and predict mortality in the nineteenth century were quite sophisticated, even according to current standards, and continue to be used today. Inspired by developments in natural sciences, much work of this early period of longitudinal statistical analysis was concerned with detecting “natural laws” of human development or in the words of Baltes and Nesselrode with *the direct identification of intraindividual change* (rationale 1). Individual differences were acknowledged as early as the late 18th century, in the work of Tetens. However, such differences

were not incorporated in longitudinal statistical models as they were conceived of as either unpredictable or even erroneous. The latter view was taken to an extreme by Quetelet, who applied Gaussian error theory as developed for the quantification and control of observational error in astronomy to variations among humans. Rather than pertaining to confounding effects during the measurement process, his conception of error comprised what Quetelet considered inordinate and intractable idiosyncrasies and even deviations from physical and “moral” and eventually divine perfection (Porter 1986). This led to the metaphor of “the average man” (“l’homme moyen”) (Stigler 2002) which can, despite its somewhat ideological connotations, be considered programmatic for a period in which scientific effort to formalize and cast change in terms of mathematical laws centered around the population as the primary unit of analysis. As Porter (1986) notes: “The doctrine that order is to be found in large numbers is the leitmotif of nineteenth-century statistical thinking” (p. 6).

### From Average Trajectories to Individual Differences During the First Half of the Twentieth Century

Following Quetelet’s venture into the analysis of genuine human variation, the interest in interindividual differences began to complement the interest in aggregate characteristics of populations. Francis Galton’s and Karl Pearson’s work on systematic covariation among members of the same population regarding, for instance, physiological appearance, are exemplary in this regard (Porter 1986). With respect to the study of change, John Wishart’s publication on “growth-rate determinations in nutrition studies with the bacon pig, and their analysis” in 1938 marked an explicit transition from merely describing the functional form of average trajectories towards quantifying individual differences in these trajectories (Bollen 2007). In this article, Wishart reanalyzed data from a total of 30 bacon pigs whose weights had been measured across 16 weeks and who had been exposed to three different levels of protein content in the food ration. After having plotted and manually fitted a

second degree parabola to each pig's growth curve, he studied the effect of the experimental conditions on individual differences in growth curve parameters by means of ANOVA and ANCOVA. As noted by Bollen and Curran (2006), this study is remarkable, because it was probably the first attempt at *the direct identification of interindividual differences in intraindividual change*, Baltes' and Nesselroade's second rationale for longitudinal research. The use of factor analysis for fitting longitudinal data and the resulting work on generalized learning curves by Tucker (1958, 1966), but also Rao (1958), followed in this tradition. The nowadays popular linear mixed effects and latent growth curve models for the analysis of interindividual differences in intraindividual change can be traced back to these early attempts.

A precursor for a complementary approach to differential longitudinal modeling may be seen in Raymond B. Cattell's (1952) proposal to analyze variation and covariation among psychological variables within single individuals by means of P-technique factor analysis. In contrast to standard (R-technique) factor analysis, Cattell's P-technique analyzes the relationship between variables intraindividually, over many time points. It thus targets instantiations of change as they can be expected for more transient psychological states that are likely to (co)fluctuate in a reversible manner over time. Requiring many repeated measurements per person, the modeling approach comes with a strong person-oriented flavor, a perspective that only in recent years received increasing attention in geropsychological research (Molenaar 2004). Although Cattell developed P-technique primarily to reduce a larger set of observed variables to an underlying structure of person-specific common latent variables, it clearly influenced later developments of longitudinal statistical models at the individual level that may subsequently be used to study interindividual differences in intraindividual (co)variation.

### From Description to Explanation During the 1960s and 1970s

Once the interest in describing interindividual differences in intraindividual change was raised,

the desire to explain these differences came naturally. Already Wishart did not limit himself to identifying the best fitting trajectory for each individual pig, but was interested in the causes of interindividual differences of intraindividual change (Rationale 5). In this regard, the 1960s and 1970s can be considered a transition period. On the one hand, researchers got increasingly interested in longitudinal data analysis and the statistical techniques to carry out such analyses became more refined and more widely known. On the other hand, there was still a considerable amount of leeringness, with longitudinal studies often not only being considered inordinately expensive but also suffering from the image of being a "womb-to-tomb research plan, replete with inadequate design, inexact instruments of measurement, and low research product" (p. 987) (Sontag 1971). Furthermore, more advanced linear mixed effects models were not yet developed, and the by then popular methods of repeated measures ANOVA and MANOVA bound to several assumptions, such as sphericity, which were often not met in practice (Fitzmaurice and Molenberghs 2009). Even the conceptualization and operationalization of change itself were subject to discussions, which revolved around keywords such as "gain" or "change scores," "raw change," "true change," "base-free," or "residual change." Clearly, this time period was characterized by the most fundamental and controversial debates on longitudinal data analysis in (gero)psychological research. Exemplary for these were the proceedings of the above-mentioned conference on *problems in measuring change*, which were published in 1963 (Harris 1963). One focus of the conference was on problems that arise with certain measures of change, especially with fallible observed change scores. Bereiter's (1963) elaboration on "some persisting dilemmas in the measurement of change" – also the opening chapter of the book – is probably most prominent in this regard. This work influenced many researchers in subsequent years including David Rogosa's pointed chapter on "myths about longitudinal research" over 20 years later, which eventually demystified several beliefs about longitudinal statistical analysis that were formed

during those earlier years. Interestingly, the gradual shift from the pure description of change to the explanation of change manifested itself somewhat differently across disciplines. In the emerging field of geropsychology, the focus laid primarily on Rationale 5, that is, *the analyses of causes of interindividual differences of intraindividual change*, with the term “causes” being better replaced by the more neutral term predictors. Much of the interest was on how people differ in developmental trajectories and what characteristics such differences may be related to. True causation, that is, the study of causes of intraindividual change (Rationale 4), was not yet high on the agenda. This was different in sociology, where researchers increasingly realized the potential of panel data to infer cause-effect relationships, with the influential work by Blalock (1964) and Duncan (1969) being exemplary for these attempts. Also in this period falls the seminal work of sociologist James Coleman on the mathematical study of change (Coleman 1968). His distinction between change as a function of time, immanent change, and exogenously driven change, along with his considerations regarding multivariate dynamical systems, foreshadowed much of the later developments in longitudinal statistical analysis in the field of developmental psychology and geropsychology.

#### **From Univariate to Multivariate Models During the Close of the Twentieth Century**

The interest in longitudinal research continued, some of the earlier confusion was resolved as “myths” were separated apart from facts (Rogosa 1988), and longitudinal statistical analysis gained momentum in the 1980s. This was fueled by two closely related developments. On the one hand, there was the advancement of earlier mixed modeling approaches. The proposition of a flexible class of *random-effects models for longitudinal data* by Laird and Ware in 1982 (Laird and Ware 1982) is a citation classic and the basis of most current approaches to longitudinal data analysis in geropsychology. On the other hand, the earlier work on the use of factor analysis for longitudinal data continued. At that time, confirmatory factor analysis – as part of more general

structural equation models (SEM) – had become a powerful and increasingly popular approach to the analysis of cross-sectional data. This was facilitated by the availability of easily accessible software (Jöreskog and Thiilo 1972). Drawing upon earlier work by Rao and Tucker mentioned above, it was Meredith and Tisak who presented a paper on “*Tuckerizing*” curves at the annual meeting of the Psychometric Society in 1984 in which they showed how to implement the analysis of trajectories by factor analysis within a structural equation modeling framework. Because this opened up completely new modeling possibilities, the year 1984 can be considered another milestone in the history of longitudinal statistical analysis, even though the actual paper was not published until 1990 (Meredith and Tisak 1990). Most importantly, the embedding of longitudinal data analysis within an inherently multivariate SEM framework allowed the field to move beyond simple univariate models, toward the analysis of interrelationships in behavioral change (Rationale 3). Being an immanently multivariate field with multiple determinants and multiple outcomes, this development was particularly important for geropsychology, and the field saw a number of influential studies, for example on the differentiation-dedifferentiation of cognitive abilities, in the following years (Baltes et al. 1980; Schaie et al. 1998).

#### **From Static to Dynamic Models During the Close of the Twentieth Century**

Paralleling the trend from primarily univariate to multivariate models was an increasing reorientation from primarily static models to dynamic models. With better techniques for multivariate data analysis at hand, researchers got increasingly interested in not only describing interrelationships in behavioral change, but also in capturing the actual dynamics underlying such relationships. With the introduction of SEM-based latent change scores, it was primarily McArdle and colleagues who advanced the field in this direction, resulting in a number of important publications in geropsychology (McArdle 1988, 2001). Interestingly, the somewhat parallel trend in the development of longitudinal statistical analysis between otherwise closely related

disciplines continued during this time. For instance, the work by Tuma and Hannan (1984) on *social dynamics* was highly influential in sociology and can be considered a precursor of much of the most recent work on dynamical systems in (gero)psychology. The publication of the corresponding book in 1984 is another reason why this year can be regarded a milestone in the history of longitudinal statistical analysis. In contrast to the considerable degree of dispute and confusion that characterized the 1960s and 1970s, developments during the 1980s and 1990s were influenced by the insight that there simply is “no *best* way to study change” (p. 3) (Burr and Nesselroade 1990). In consequence, researchers became more and more aware of the freedom but also the responsibility they have when choosing from the methods “toolbox” of longitudinal statistical analysis.

### **Current Trends in Longitudinal Statistical Analysis in the New Millennium**

Clearly, the history of longitudinal statistical analysis has not come to an end. Quite the opposite, with the beginning of the New Millennium, research activities involving longitudinal statistical analyses have increased tremendously. Unlike in the last century, today the need for longitudinal data and the value of longitudinal statistical analysis for psychological research are beyond dispute. Rather, with ever more longitudinal studies and an increasing number of different types of longitudinal data available, the discussion has taken a pragmatic turn, with most of today’s research focusing on different ways to improve the design and analysis of longitudinal studies. In this regard, the five historical trends associated with the five rationales for longitudinal research continue to exist, although the relative emphasis in their development may have changed over time.

#### **Descriptive Models Accounting for Differential Change Are Well Established**

Finding the best fitting function for a developmental process (Rationale 1) is still of core interest to

geropsychological research and may be best exemplified by the work on “the rise and fall in information processing rates over the life span” (Cerella and Hale 1994) and related research on intellectual development (Li et al. 2004), to give just one example. Being aware of the complex and multidetermined nature of human development, however, geropsychologists have largely dismissed the idea of reducing human development to a definite set of deterministic “natural laws” straightforwardly expressible in mathematical equations. Instead, the study of individual differences in change (Rationale 2) has become a major goal in geropsychology and so did the study of the determinants of such differences (Rationale 5). The search for predictors of the enormous interindividual differences in what may be generally called “successful aging” – best evidenced by the impressive behavioral and brain plasticity observed in recent years (Lindenberger 2014) – is in fact one of the most important goals in modern geropsychology. To this end, the application of methods of differential psychology to repeated measures, as called upon by John Nesselroade in his 2000 Presidential Address to the Society of Multivariate Experimental Psychology (Nesselroade 2002), has proven particularly useful and will likely continue to do so in the future. The numerous articles, chapters, and textbooks on SEM-based latent growth curve/multilevel modeling document this trend. With respect to the description of intraindividual change, the description of interindividual differences in intraindividual change, and their prediction, hence Rationales 1, 2, and 5, the field of longitudinal data analysis has clearly matured. Today, there will be few graduate students or researchers in geropsychology who have never been exposed to any variant of growth curve models.

#### **Models of “Psychological Mechanics” Are Needed**

In terms of multivariate causal models and thus in terms of Rationales 3 and 4, however, longitudinal statistical analysis in geropsychology is still in its infancy. Although there have been calls for taking holistic, experimental approaches to life span and

geropsychology as early as 40 years ago (Baltes and Nesselroade 1973), the number of studies that use multivariate longitudinal data with the explicit goal to identify cause-effect relationships in nonexperimental settings is limited and so is methodological research targeted on improving longitudinal (causal) analysis in gerontology. In recent years, however, there have been some exciting developments in neighboring disciplines, which may eventually spill over to geropsychology and accelerate the representation of multivariate change in conjunction with the investigation of (intraindividual) causes of change: first, the development and increasing use of dynamic causal modeling to analyze effective connectivity in functional neuroimaging data, which explicitly aims at a better understanding of the behavior of a dynamical multivariate system (i.e., Rationales 3 and 4) (Friston et al. 2003); second, the increasing use and continuing refinement of methods for panel data analysis in sociology and econometrics, with the goal of better identifying cause-effect relationships in non-experimental data (Rationale) (Halaby 2004); and, finally, a better theoretical understanding of causality and the conditions for its inference based on recent work in statistics and computer science (Rationale 4) (Pearl 2009; Rubin 2005).

### Enriched and Ecologically Valid Intense Longitudinal Data

Another development that (gero)psychology has witnessed in recent years concerns the increasingly different types of longitudinal data (physiological, behavioral, experiential), which may be obtained at different timescales ranging from milliseconds to several decades – or even combinations of all of these timescales. This is a trend that is likely to continue, with studies that combine, for example, a real-time assessment of physiological functioning as part of a multiday measurement burst, within the context of a large-scale panel study with annual assessment waves, becoming less the exception but increasingly common. Obviously this not only permits completely new insights into geropsychological processes, but also poses new methodological challenges. In light of these developments – and

despite its long past – the actual history of longitudinal statistical analysis may only just be starting.

### Cross-References

- ▶ [Berlin Aging Studies \(BASE and BASE-II\)](#)
- ▶ [Cognitive and Brain Plasticity in Old Age](#)
- ▶ [Health and Retirement Study, A Longitudinal Data Resource for Psychologists](#)
- ▶ [History of Longitudinal Studies of Psychological Aging](#)
- ▶ [Individual Differences in Adult Cognition and Cognitive Development](#)
- ▶ [Plasticity of Aging](#)
- ▶ [Psychological Theories of Successful Aging](#)

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## History of Longitudinal Studies of Psychological Aging

Andrea M. Piccinin and Jamie E. Knight  
Department of Psychology, University of  
Victoria, Victoria, BC, Canada

### Definition

In a longitudinal study, the same individuals and characteristics are repeatedly measured sometimes over long periods of time. This type of design is used to study developmental trends across the lifespan, and because the same people are compared against themselves, the differences observed are less likely to be the result of generational differences. As a result, longitudinal studies can more accurately assess change and development than can cross-sectional studies, where individuals of different ages are compared against one another.

### Early Longitudinal Studies

Longitudinal data collection can be traced back to the irregular collection of Israeli census data, circa 1491 BC. However, data collection with regular intervals is not seen until 1665 in New France (Canada) (Statistics Canada 2006). King Louis XIV was ahead of his time in recognizing the importance of collecting reliable population information with which to measure the growth and development of his colonies. Economic development and self-sufficiency were easily quantified from information gathered on age, sex, marital status, trade, and occupation as well as from livestock and cultivated land. These statistics were used to monitor the health and taxation of the growing colonies. One example of the utility of these early census data was identification of the nearly two to one male–female ratio within the young colony. This discovery prompted efforts to send more women, which led directly to an increased and more stable population due to the ensuing marriages and births. While these

repeated measurements did not make use of the within-person change information that differentiates longitudinal data from cross-sectional and is emphasized today, they did provide useful population level evidence.

Early longitudinal studies focused primarily on childhood growth: physical, cognitive, and emotional. The oldest reported longitudinal growth record is attributed to Count Philibert Gueneau de Montbeillard, who measured his son every 6 months (from 1759 to 1777) and published it in Buffon's *Histoire Naturelle* (Tanner 1989). A subset of more recent studies of child development are of particular interest with respect to aging. These have developed into studies of aging, either through data collection continuing for long enough or through new researchers re-contacting original participants so that measurement has continued into adulthood and old age.

The Terman Study of the Gifted is generally recognized as one of the first studies initiated in childhood that has continued throughout the participants' lives. Terman started recruiting children from schools in 1921. The initial average participant age was ten; however, the inclusion of siblings resulted in a sample with birth years ranging from 1900 to 1925 and an initial age range of 3–28. By 1928, the sample size had reached 1,528 and recruitment ended. By 2003, 200 participants remained.

The Berkeley Growth and Berkeley Guidance studies (initiated at birth in 1928–1929) and the Oakland Growth study (initiated 1932 from 1920 to 1921 birth cohort) were either continued or later re-contacted at several points in their lifespan and now proceed with consolidated data collection as the Intergenerational Studies of the Institute of Human Development. Similarly, the Harvard Growth Study (1922 school-aged) and the Harvard Cohort (graduates from 1939 to 1944) and Inner-City (“Glueck”) Cohort have also been extended from their original focus on child and young adulthood.

A series of birth cohort studies in the United Kingdom – Hertfordshire Aging (1920–1930 birth cohorts) and Hertfordshire Cohort (1931–1939 cohorts) Studies, National Study of

Health and Development (1946), National Child Development Study (1958), and the Boyd Orr study of families (1937–1939) – have also developed into studies of aging, by nature of their long follow-ups. These formed a formal collaboration as the Healthy Ageing across the Life course (cyon) Network in 2008, and several now interact with younger British cohort studies through the CLOSER initiative to promote excellence in longitudinal research.

Finally, several studies of aging have reached back in time to include administrative data. For example, the Aberdeen and Lothian 1921 and 1936 studies were begun between 1997 and 2004 when investigators contacted individuals who had completed national educational assessments at age 11 and followed them up starting in old age. In other words, the baseline data collected in these studies were initially one-time measurements not intended for research or longitudinal analysis, but have formed the basis of studies of aging that include information about childhood achievement.

### History of Aging-Focused Research

Of studies with first measurements in adulthood, the Iowa State Study most closely mirrors the administrative baseline studies described above. While formally begun in 1950, the Iowa State Study sampled from men who had 1919 entrance exam scores, effectively extending the measurement of cognition to three occasions (the third in 1961) over 42 years from young to late adulthood. In 1946, the New York State Psychiatric Institute Study of Aging Twins began its long-term investigation of hereditary aspects of aging and longevity, following participants' cognitive performance for 30 years. The 1950s and 1960s saw a marked increase in studies focused on aging in the United States. The Duke Studies of Normal Aging (I, 1955, and II, 1968), AT&T longitudinal study of managers (1956), Baltimore Longitudinal Study of Aging (1958), and Seattle Longitudinal Study (1956) all followed closely in time the first American National Conference on Aging (1950) and development of the Federal Council on Aging

(1956). These are all described by Schaie (Schaie 1983). In Germany, the Bonn Longitudinal Study of Aging (1965) followed two 5-year birth cohorts for 15–19 years.

In contrast to cross-sectional research on aging, these large-scale longitudinal studies are often highly multidisciplinary – collecting observational data on psychological (cognition, personality, perceived stress, locus of control, self-concept, life event, etc.), psychiatric, medical, sociological, and other characteristics. Some, such as the Seattle Longitudinal Study, in which data collection for K. Warner Schaie's dissertation evolved into a pioneering career, developed from what was initially a cross-sectional study. While Seattle involved recruitment of specific cohorts of new participants at each wave, as part of Schaie's innovative cohort-sequential design, other studies used either a single recruitment period (e.g., Duke) or continuous enrolment (Baltimore).

Early reports from these longitudinal studies were not analyzed in the same ways as modern studies, since current methods had not yet been developed, but generally, results agreed with cross-sectional work regarding the finding of greater decline in fluid than in crystallized abilities. On the other hand, however, evidence was accumulating that, relative to cross-sectional findings, declines started later and, for most people, proceeded more slowly. This led to some very animated and contentious debates in the 1970s as well as great motivation to meet the challenges of studying development in later adulthood.

### Debates and Challenges

Conventional and scientific observations going back centuries have consistently described age-related declines in cognitive function, beginning as early as the third decade of life. With the advent of longitudinal studies of aging in the 1950s and 1960s, new evidence surfaced suggesting that declines began four decades later than previously thought. This striking mismatch led to a great deal of thought about its source and prompted Schaie (Schaie and Strother 1968) to develop and implement a cross-sequential design

for the Seattle Longitudinal Study in order to try to separate the influence of age from the impact of generational or “birth cohort” differences (Kuhlen 1940). While this was a creative strategy and an excellent step forward, it did not fully resolve the fact that once any two of age, cohort, and time are known, the third is determined. As stated by Donaldson and Horn (Donaldson and Horn 1992), “You have to know the answer to get the answer.” Research, conducted because the answer is not known, must proceed by assuming that at least one of the three influences has no impact. There is good evidence that the debate over practice effects is at least in part associated with the age-cohort-time dilemma, as recent work has shown that differences in model assumptions can provide evidence for practice or cohort effects in the same data (Hoffman et al. 2011). Renewed interest in the age-cohort-time problem has led to a resurgence of work and publications in this area, but it appears that solutions still require making strong assumptions and placing constraints on one of the dimensions.

A concrete example of the impact of cohort differences (Schaie et al. 2005) can be seen in the work initiated by James Flynn. What is now known as the “Flynn” effect is the observation that like-aged and similarly sampled individuals (e.g., army recruits, elementary school children) in more recently born generations obtain higher scores on the same IQ tests than individuals in earlier generations. Often attributed to changes in the education system, though with specific causes not known, the existence of this consistent pattern requires careful consideration of cohort differences in research on aging.

Additional sources of variance that are likely to magnify differences in the conclusions drawn from cross-sectional versus longitudinal studies of aging are retest or practice effects, attrition, and mortality. While both cross-sectional and longitudinal samples are influenced by selection effects – for example, only the individuals from a particular generation who are still alive at the time of sampling can be included – only longitudinal studies include information regarding whom from a measured sample subsequently drops out or dies. Generally seen as a challenge of

longitudinal studies, it could equally be viewed as a strength – providing essential information about how the “population” changes with age and in time. While those who drop out or die tend to be individuals who are older, less healthy, and less educated, there is good evidence that once part of a longitudinal study, individuals of failing health and advancing age will be more likely to return for repeated assessment than they would be to agree to enter a study for the first time. In other words, the selection due to attrition is often smaller than that due to initial selection. Particularly in the oldest samples, therefore, faster declines may be seen in the longitudinal age changes than in the cross-sectional age differences (Desrosiers et al. 1998).

While retest effects have likely been most of concern in research on cognitive development, they appear in other psychological domains as well (e.g., mood, personality, mental health). Retest has been addressed by use of parallel forms or alternate measures at different occasions of measurement, but such extreme solutions undermine the longitudinal nature of the design and eliminate the ability to assess change at the within-individual level. Given (1) that practice is unlikely to occur equally in different individuals; (2) that it is operating at the same time as, for example, a dementing process in a subset of any sample; and (3) that learning and adapting is an essential characteristic of life, the assumptions required to implement the many approaches that attempt to “correct” for practice effects may introduce confounds that, again, confuse longitudinal changes with cross-sectional differences.

## Methodology

The many challenges associated with analyzing and drawing inferences from longitudinal data require development of new methods for the analysis of change. Following an era of crisis, in which some asked “How we should measure “change” –or should we?” (Cronbach and Furby 1970), methods dealing with change have moved beyond struggles with change scores to comprehensive methods such as mixed effects models

(aka multilevel models, latent growth curve models) making use of multiple occasions, unbalanced designs, and a focus on individual “trajectories” rather than group occasion averages. Plenty of challenges remain for the stouthearted, however, as well as continued lack of consensus regarding how best to address them.

Particularly in studies of aging, there is a tendency to recruit age-heterogeneous samples – often ranging in age from 50 or 60 to 90 or higher. These 30- or 40-year age ranges are an attempt to capture the (potentially) long portion of the lifespan labeled “late life” as well, often, as the transition from middle age into this period. These samples, which would also be appropriate for a cross-sectional analysis, are then often followed for ten or so years. Given the age range for the cross-sectional (e.g., 40 years) relative to the longitudinal (e.g., 10 years) information, it is essential that the statistical models employed to analyze this type of data differentiate clearly between the two sources of variance. If longitudinal data are being collected, at great time and expense, because they are believed to contain superior developmental information, then the utmost diligence must be applied to ensure that results and conclusions are based on the longitudinal aspects of the data. Current priorities continue to include the hotly debated issues described above (Hofer and Piccinin 2010).

No doubt related to the challenges of mounting longitudinal studies and also to a system that rewards publication of new findings over subsequent supporting evidence and may initially ignore subsequent null findings (Pashler and Wagenmakers 2012), the longitudinal aging literature can be idiosyncratic and difficult to compare. It has not been uncommon for authors planning a meta-analysis to instead present a narrative review. The stated reasons for this change of plan have included the great variability in design and analysis features in longitudinal studies relative to cross-sectional research in general and relative to experimental research in particular. Indeed, if we are to combine or contrast results from longitudinal and cross-sectional designs, we must first acknowledge the fundamental differences between the meaning of (a) variance in the

changes that occur within individuals over time and (b) variance in the differences that exist between individuals of different ages at any one point in time. It is also essential to explicitly address whether each report from a longitudinal study made use of cross-sectional (e.g., baseline or other individual waves) or longitudinal (i.e., repeated measures) data. If longitudinal analysis, by definition, requires the analysis of repeatedly measured characteristics, then some of what has been called “longitudinal” in the past has not, technically, been longitudinal.

### The Modern Era

The dark days regarding measurement of change were accompanied by some apparent reluctance to fund research specifically focused on aging. Initial bills met with resistance to the concept of separating aging from the biomedical purview to which it had belonged. In 1973, a bill was vetoed by US President Nixon based presumably in part on the sentiment expressed in a memo from the Office of Management and Budget claiming that it “could raise false expectations that the aging process can somehow be controlled and managed through biomedical research” (Lockett 1983). The bill was eventually passed in 1974 when Nixon signed legislation creating the National Institute on Aging (NIA) shortly before his resignation.

The late 1980s saw the beginning of a virtual explosion of new longitudinal studies of aging around the globe. Given the magnitude of this expansion, an enthusiastic response to earlier calls for longitudinal data fueled by improved funding and buoyed by significant advances in statistical methodology, it is difficult to neatly summarize this modern era of longitudinal studies addressing psychological aging. An important feature to highlight is the multidisciplinary nature of most longitudinal studies of aging, with aspects of psychological aging, among the components. As a result, opportunities abound for developing a more elaborated view of aging, one transcending traditional disciplinary boundaries. Geographically, longitudinal studies of aging now exist in

virtually all industrialized countries and are rapidly being initiated in many developing nations.

## History of Collaborations

Based on their extensive infrastructure and funding needs, many longitudinal studies are inherently multidisciplinary and collaborative. Given the expense, the scarcity (relative to cross-sectional work) and the long delay until longitudinal results can be obtained, several attempts have been made to collaboratively bridge across studies. An early example of collaboration among longitudinal studies of aging is an effort, organized by the US Veterans Administration Normative Aging Study (Rose 1976) and funded by an NIA travel grant, which attempted to pool cardiovascular data across eight longitudinal studies. Words of caution from their report include the following statement regarding the appeal and promise of pooling: “The experience of the Cardiovascular Pooling Project, as well as preliminary data analysis in the present Longitudinal Interstudy Program, takes much of the magic out of the notion.” In the 1990s, Kaye Fillmore and colleagues from 25 studies pooled data related to drinking patterns. The Health and Retirement Study (HRS) family, including the English Longitudinal Study of Aging (ELSA) and the Survey of Health, Aging and Retirement in Europe (SHARE), and other multi-site studies such as the UK Cognitive Function and Ageing Study provide extensive opportunities for multi-sample analyses based on similar measures. Independently initiated (ca. 1984) Alzheimer’s Disease Research Centers across the United States created a minimum dataset in 1997 and formalized their collaboration with NIA funding in 1999 as the National Alzheimer’s Coordinating Center to facilitate collaborative research. In 2006, the National Institutes of Health (NIH) Cognitive and Emotional Health Project published evidence they reviewed from longitudinal studies regarding lifestyle and health behaviors related to maintenance of cognitive and emotional health. Much of this evidence, however, still relied on cross-sectional analysis of data.

Based on the realization that replication of some sort is needed to gauge consistency of findings and evidence that meta-analysis of published results is currently limited as a solution, a network was developed to encourage researchers leading longitudinal studies of psychological aging to participate in collaborative analyses that could be more directly compared (Hofer and Piccinin 2009). First funded in 2007, the Integrative Analysis of Longitudinal Studies of Aging ([www.IALSA.org](http://www.IALSA.org)) network is an international collaboration focused on within-person analysis of psychological (particularly cognitive, personality, and well-being) and physical health. Acknowledging the high degree of variation in sampling, measurement, and design across studies, IALSA is emphasizing conceptual harmonization and harmonization of models over reliance on measurement harmonization. Several within-country networks (e.g., CLESA (Comparison of Longitudinal European Studies on Aging), Europe plus Israel; DYNOPTA (Dynamic Analyses to Optimize Ageing), Australia; Harmony, Sweden; HALCyon, UK) have also been developed.

Concurrent work in genetics and other fields requiring large sample sizes and greater statistical power simultaneously encouraged advances in harmonization, in order to permit pooling of data, and development of infrastructure to support federated analyses that avoid the need for data sharing. Motivated by these needs for replication and statistical power, there have been a growing number of efforts to combine forces on larger multi-study analyses and syntheses of research findings. In conjunction with IALSA, a publicly accessible platform for finding, matching and harmonizing metadata across longitudinal studies of aging from around the world is being developed and maintained by a research team known as Maelstrom Research (<https://www.maelstrom-research.org/>). In 2012, three associated projects, DataSHIELD, OBiBa, and DataSHaPER, joined together to create the Maelstrom Research program which has since been extending its infrastructure to accommodate longitudinal research. Maelstrom provides open source software for data cataloguing, harmonization, integration, and co-analysis of data and also actively conducts

research with the goal of reducing challenges surrounding data harmonization and data sharing (including data transformation, statistical modeling, federated data analysis).

## Future Directions

Most existing longitudinal studies of aging involve age-heterogeneous samples measured at widely spaced intervals, some as often as annually, but others with irregular or wider spacing. From both psychometric and developmental perspectives, this presents numerous challenges, several of which have been articulated above. A further concern with such designs involves the reliance on single points in time to represent status or change over a longer period. In addition to ignoring day-to-day within-person variability in performance, these designs do not allow separation of retest effects from developmental changes. One method that addresses both of these is the measurement burst design, in which variables of interest are repeatedly collected from participants in a number of sessions during each measurement wave. One advantage of such a design is that measurement of each wave can be more reliable. Another, more powerful benefit is that retest effects (within burst) can be separated from potentially aging-related within-person changes (across burst) in order to at least partially separate short-term retest changes from long-term developmental ones. While the greater number of sessions adds to participant burden and to the complexity of the study, a variety of such intensive measurement designs show great promise for addressing some of the challenges associated with drawing firm conclusions from longitudinal studies. These methods also provide an additional window on understanding within-person change and variation.

A continuing challenge, which may soon be approachable with the current set of longitudinal studies of lifespan and aging, relates to study of the consistency of aging characteristics across generations and countries. How much of what we learn about current and past older generations will translate to those of the future? This

additional layer of inquiry will provide an exciting and essential dimension to our understanding of universal versus modifiable aspects of aging. It will likely require all and more of the collaborative skills and infrastructure that are currently being developed.

## Cross-References

- ▶ [Age and Time in Geropsychology](#)
- ▶ [History of Cognitive Aging Research](#)
- ▶ [History of Longitudinal Statistical Analyses](#)
- ▶ [Life Span Developmental Psychology](#)

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## History of Sexual Orientation and Geropsychology

Douglas C. Kimmel  
City College, City University of New York,  
New York, NY, USA

### Synonyms

Bisexual; Gay; Homosexual; Lesbian; Same-sex attraction; Transgender

### Definition

Historical perspective on the study of the diversity in aging experiences reflecting sexual orientation and gender identity in the USA.

### Introduction

Homosexuality was listed in the *Diagnostic and Statistical Manual of Mental Disorders* until 1973 when homosexuality per se was removed, and replaced with “ego-dystonic homosexuality,” by a vote of the Board of Directors of the American Psychiatric Association; the decision was later affirmed by a vote of the members (Bayer 1981). Same-sex sexual behavior between consenting adults was criminalized in all of the USA until 1970 when Illinois became the first state to remove it by legislative vote. Consenting same-sex sexual conduct in private was illegal in some

states until 1996 when the U.S. Supreme Court ([Lawrence v. Texas](#)) reversed an earlier decision in 1986 that upheld its criminality ([Bowers v. Hardwick](#)). Homosexuality remains criminalized in many countries, and the archaic laws in England were brought to attention in connection with a royal pardon granted to one of the heroes of World War II, Alan Turing, in 2013. Turing played a leading role in cracking the Nazi secret code but was forced to accept chemical castration after having admitted to the police in 1952 that he was a practicing homosexual (Hodges 1983).

In June of 1969, an uprising in New York City following the police raid on a popular gay and transsexual bar provoked a paradigm shift in the understanding of homosexual identity. What had previously been a personal condition (often thought to be a perversion of sexual attraction) became reconceptualized as a minority group identity (Hay 1990). This event is now celebrated around the world by “gay pride” celebrations. In time, mental and legal issues became reframed from pathology and criminality to matters of discrimination of an oppressed group of individuals who had little else in common except their sexual orientation.

Individuals also began to disclose their minority sexual orientation openly in public demonstrations against discrimination as well as in professional associations, including the American Psychiatric Association and the American Psychological Association. These self-affirming lesbian and gay protesters prompted resolutions designed to remove the stigma of pathology that had long been associated with homosexuality (e.g., Conger 1975). Researchers and academics likewise began to study and openly discuss issues of sexual orientation across the adult lifespan (e.g., Kimmel 1974).

Following the ruling of the state of Hawaii Supreme Court in 1996 ([Supreme Court of Hawaii](#)) that denial of same-sex marriages violated the nondiscrimination clause regarding sex, another paradigm shift emerged. Previously, legal issues regarding sexual orientation were concerned with discrimination based on sexual attraction and behavior. After that ruling, sexual orientation was reframed as a subcategory of

gender discrimination; that is, two individuals of the same sex were not entitled to the same marital rights and benefits as two individuals of differing genders. This paradigm shift linked sexual orientation and gender identity under the umbrella of gender discrimination and laid the groundwork for the coalition of lesbian, gay, bisexual, and transgender (LGBT) individuals opposing all forms of gender discrimination. A new program of education and research has now emerged known by the acronym SOGI (sexual orientation and gender identity; see <http://wwwp.oakland.edu/sogi/>).

### Prevailing Views of Older Homosexuals in the 1960s

In our society there have always been older individuals who did not marry, who lived with someone of the same sex, or who were relatively open about their same-sex attraction (such as Walt Whitman or Gertrude Stein). It was not a positive status for the young LGBT person in the 1960s, however. Moreover, social gender distinctions were strongly held. Women focused on equal rights, and lesbians were often forced to choose between women's issues and gay issues. Gay men and lesbians were pushed into "butch" or "fem" roles. Bisexual men were felt to be hiding their homosexuality and not to be trusted. Transgender persons were limited to being a transvestite, cross-dresser, or drag queen.

Even after the paradigm shift at the Stonewall uprising, the belief was: being gay (LGBT was often collapsed into that single term) might be fun when you are young, but wait until you grow old; you will be lonely and depressed in isolation. A visit to any lesbian or gay bar at the time would have confirmed this belief, as there would be a few examples of such individuals in the bar at closing time.

Stern (1962) provided a description of being old and gay:

the ageing [sic] homosexual is an object of scorn and derision. Though his loneliness is often abject, he seldom arouses sympathy or interest, unless he has money or influence. . . .

Without money, the ageing homosexual may wind up in the Bowery, seeking oblivion in hand-outs and cheap wine. . . . For the most part, though, the ageing homosexual is usually his own worst problem, so desperately lonely and frightened at times that he frantically beats the walls in his anguish.

The homosexual does not appear to live as long, generally as heterosexuals. Some hold that a benevolent nature comes to the aid of the ageing deviate, shortening his term of life. (pp. 231, 232)

Allen (1961) presented a similar view of homosexual men and added,

The female homosexual often ends in the same way. Not all women homosexuals are the masculine, chain-smoking, short-haired dragons they are usually imagined to be, but a great many are. However, whereas the male homosexual often finds it hard to find someone, even another homosexual to live with, the female homosexual more often does find a partner.

One sees, then, two vigorous aggressive old women, sometimes sharing a small house, quarrelling, digging the garden, and trying to rule the neighborhood. Such examples, as everyone knows, have been the subject of innumerable novels. (p. 95)

Almvig (1982), in the introduction to her pioneering study of older lesbians, described the prevailing attitude for women: "Negative stereotyping of older lesbians in literature and film (such as *The Well of Loneliness*, *The Children's Hour*, *The Killing of Sister George*, and *The Fox*) have contributed towards further solidifying the general population's view that lesbians cannot lead satisfying and productive lives. Uneducated attitudes perpetuate the image of a lonely, pathetic and troubled group that just somehow missed having a relationship with a 'good man,' the 'right man,' or just 'any man'" (p. 4).

Adelman (1986) described what it was like to be lesbian in this period: "when marriage was the only socially and practically viable option for women; when few jobs were open to women; when moving about as a single woman was in itself both unacceptable and difficult" (p. 12). "The dominant view of gay people defined them as deviant and deficient. Because there was no visible or viable gay subculture to help offset this homophobic view, gay people were vulnerable to internalizing it: attributing these values to

ourselves and each other. Without benefit of mutual support, avoiding identification with other gay women was a way for lesbians to salvage their self-esteem. . . . For these elders, the struggle for self-acceptance was a painful and solitary process” (pp. 13–14).

As lesbian and gay individuals began to come out of the closet, bisexual and transgender individuals were largely invisible in the twentieth century in the USA. Nonetheless, Finocchio’s Club in San Francisco and similar female-impersonator or drag venues were popular. Ball culture, the house system, the ballroom community, and “Drag Balls” were major events in many communities; the film *Paris is Burning* (1990) portrayed some examples of this variety of LGBT culture.

Kinsey et al. (1948) found that “nearly half (46%) of the [male] population engages in both heterosexual and homosexual activities, or reacts to persons of both sexes, in the course of their adult lives (p. 656).” Their bisexuality was usually ignored as long as they were engaged in heterosexual relationships, and assumed to be homosexuality when arrested in a gay bar raid or caught in some other compromising situation. As Dworkin (2006) noted, “When a bisexual person falls in love he or she sometimes begins to identify (publicly or privately) as lesbian, gay, or heterosexual and thus becomes invisible as a bisexual aging person” (p. 36). Therefore, an aging bisexual person in the 1960s would typically have been regarded as either someone whose homosexuality had been cured by heterosexual marriage or someone who had become degenerate and fallen into homosexuality.

Transgender individuals have been noted in historical records. Katz (1976) reported several examples of “passing women” between 1782 and 1920 who appeared to be male in appearance and behavior. He also described many examples of males who dressed as women or performed in transvestite venues. Actual change of gender from sex of birth was not widely noted until Christine Jorgensen began sex reassignment surgery in the 1950s. Information about transgender options was very limited in the twentieth century and even today, “A substantial proportion of transgender

people do not transition until late middle age or later. . . . People who have struggled with gender questions all of their lives may not have realized until now, with the availability of the World Wide Web and more literature on gender variance, that there was a name for their feelings and courses of action they could take” (Cook-Daniels 2006, pp. 22–23).

## Research on LGBT Aging

The field of geropsychology was only beginning to emerge in the 1960s; there were few studies on either sexuality or sexual orientation of older adults, and most studies focused on males.

Evelyn Hooker’s (1955) pioneering study of homosexual men matched on age with heterosexual men demonstrated that the stigma of mental illness placed on gay men was unsupported by projective tests popular at the time. The Kinsey Institute conducted a study of male homosexuals in the 1960s that found the “older” (over age 45) respondents were “no worse off than our younger homosexuals on various psychological dimensions, and are, on some dimensions, better off. . . . The stereotype which portrays the homosexual as decreasing in psychological well-being as he gets older results, we believe, from incorrectly attributing or overgeneralizing meanings to the sociosexual situation of the older homosexual which he himself does not experience” (Weinberg and Williams 1974, p. 220). The authors also suggested that the “identity crisis” faced by homosexuals earlier in life may in some way prepare them better than heterosexuals to weather the normal “role discontinuity” crisis of later life. Weinberg (1969, 1970) reported that older gay men in this study are no more depressed or lonely than their nongay peers and experienced improved adjustment as they age.

In the 1970s geropsychology was beginning to examine women’s issues, racial and cultural diversity, and a few openly gay gerontologists began studies relevant to their lives. A significant study was conducted by Jim Kelly (1977) as his doctoral dissertation and presented at the 1972 meeting of the Gerontological Society

of America in San Juan, Puerto Rico, where it was awarded the best student paper award. (At the opening reception the President of the Society announced Kelly's award for research on an "unmentionable topic.") This study included respondents up to age 69 and concluded that being gay does not cause problems for older men but that the social stigma of homosexuality may cause problems for older gay men.

Other early empirical studies of chronologically older gay men likewise focused on countering the stereotype of the lonely depressed old homosexual. Despite the unflattering title, "The menopausal queen: Adjustment to aging and the male homosexual," Francher and Hencken (1973) concluded, "In direct opposition to the popular mythology depicting the aging male homosexual as despairing and desolate, this paper proposes that homosexuality may be functional in adjusting to the aging process. Homosexuals commonly experience a 'life crisis' early in their development and are therefore less affected by the trauma of role loss that occurs for most men in later life" (p. 670).

The current author conducted an interview study of gay men between the ages of 55 and 81 (Kimmel 1977, 1979); he noted the diversity among this group, challenging stereotypes associated with aging homosexual men: "The wide diversity of their patterns of aging, the presence of positive aspects of gay aging, and high life satisfaction of many of the respondents contradicts the stereotype of the lonely, isolated old gay man" (Kimmel 1979, p. 239). He termed the phenomenon noted by others of the benefit of the earlier life crisis about identity as "crisis competence," which may be a coping skill that can help buffer against the usual concerns of growing older (Kimmel 1978).

Raymond Berger (1980) conducted a questionnaire study of 112 gay men over age 40 and found that "Few of the negative stereotypes that usually characterize descriptions of this group were supported. Most respondents were well adjusted and satisfied with their lives" (p. 161). He published a detailed account of this study in a significant book that included information about the emerging services for older gay

people and some policy recommendations (Berger 1982).

Berger's work was stimulated by Minnigerode's (1976) research on "accelerated aging" among older gay men, which is the idea that old age begins much earlier for homosexual men than for heterosexual men. In his later edition, Berger (1996) discussed this idea, as well as the critique by Lee (1987) that studies by liberated young researchers were presenting "too rosy" a picture of aging and ignored the "generation gap" between the researchers and the older men who valued secretive lives that allowed them to pass as heterosexual in the mainstream culture.

This debate continues about whether aging for gay men is characterized by sexual rejection (accelerated aging), positive resilience and diversity, or some combination of both and to what extent the aging experience for gay men is the result of cohort and the effects of personality, health, ethnic background, and social class.

Very little attention was given to research on older lesbians. An early exception was Marcy Adelman (1980), who codirected a National Institute of Mental Health grant-sponsored research project in the mid-1970s comparing homosexual and heterosexual men and women over the age of 60. It found that the same developmental challenges apply to gay and heterosexual white adults in the San Francisco Bay Area but there is a significant effect of stigma on the gay and lesbian respondents. She and her colleague, Fred Minnigerode, described the adaptations and problems of older homosexual women and men 60–77 years of age (Minnigerode and Adelman 1978). Her book, *Long-Time Passing: Lives of Older Lesbians*, based on interviews with lesbians 60–85 years old, described their current concerns and earlier life issues (Adelman 1986). Her study revealed an important reciprocal relationship among generations in the lesbian community that helps individuals prepare for their future.

Chris Almvig (1982) studied 74 lesbians over the age of 50: "this study explores respondents' self-perception of mental health, their thoughts about aging and ageism, what they value in relationships, their family relationships and support systems, their relationship to gay culture and to

straight culture and their preparation for the future” (p. 6). She found among the respondents little gender role-playing, that sexuality and affection continued to be a strong life-affirming force, that the struggle for identity in the face of discrimination created a better sense of self, and that being secret about her sexual orientation was the biggest factor determining how the lesbian was affected by aging. She also noted a potential benefit: “Apart from society and society’s expectations for women, perhaps older lesbians have had the advantage of living their own lifestyles without those constraints” (p. 154).

The emerging research in the 1980s prompted the formation of organizations to provide services and to promote further research in the geropsychology of LGBT aging. Almvig and Kimmel, both living in New York City, became cofounders of SAGE, a pioneer community organization providing services and advocacy for older lesbians and gay men, in 1978 ([www.sageusa.org](http://www.sageusa.org)). Adelman was cofounder of Openhouse, an organization in San Francisco providing housing, services, and community for LGBT seniors ([www.openhouse-sf.org](http://www.openhouse-sf.org)).

Del Martin and Phyllis Lyon (1979) authored a significant article in *Positively Gay* titled “The Older Lesbian” that mentioned their cofounding of the Daughters of Bilitis (DOB), named for a woman who was thought to be Sappho’s contemporary (Cruikshank 1991, p. 68).

Sharon Raphael and Mina Robinson (1980) discussed intimacy and aging in lesbians age 50–73. They stressed love relationships and friendship patterns among the respondents and questioned the prevailing stereotypes of lonely isolated older lesbians who had no one to love or care about in old age. Sharon and Mina were cofounders of the National Association of Lesbian and Gay Gerontologists (NALGG). The history of NALGG and related organizations will be discussed later.

Soon after the beginning of modern LGBT geropsychology, the HIV/AIDS epidemic began, in 1981, and transformed the lives of the cohorts most affected. For infected gay men aging was no longer expected, and those who somehow survived with the virus long enough to benefit from

the antiretroviral therapies were confronted with actually growing old (Halkitis 2014). Lesbians, gay men, and supporters became caregivers and developed extraordinary organizations and effective protests to counter the stigma, ignorance, and discrimination about persons with HIV/AIDS. Research on growing older with HIV has become a major focus, both with regard to the psychosocial issues involved as well as the unknown effects of long-term use of the necessary medications (deVries and Herdt 2012).

Building on earlier research regarding the diversity within the small samples that disproved some negative stereotypes of LGBT aging, research in the 1990s focused on exploring racial and ethnic diversity (e.g., Adams and Kimmel 1997), women’s issues (e.g., Sang et al. 1991), and older couples (Quam and Whitford 1992).

As the stigma of mental illness and criminality was lifted by professional organizations – such as the American Psychological Association (APA) and legislation or judicial decisions supported by APA *amicus* briefs – partnership benefits and equality with respect to adoption, custody, and insurance benefits have been fought for and extended to same-sex couples. With the recent affirmation of legal marriage by the U.S. Supreme Court, and the recent ending of federal restrictions on same-sex and transgender benefits for veterans and Medicare recipients, aging LGBT individuals have benefited directly in countless ways. Research on LGBT grandparents, openly lesbian and gay aging veterans, and transgender issues in long-term care facilities are some examples of studies that became possible as a result of these recent changes.

A major focus of psychosocial research in this century has been on health disparities among lesbian, gay, bisexual, and transgender adults, especially as they affect the prognosis for aging (e.g., Fredriksen-Goldsen et al. 2013). Another major theme is providing affirmative services to LGBT elders in psychological and gerontological settings (e.g., Kimmel et al. 2015; Travis and Kimmel 2014). Perhaps the most challenging emerging area of geropsychological research and practice is the gender transitions of older adults and the aging of transgender adults (e.g., FORGE).

The appalling stereotypes and negative attitudes about aging lesbians and gay men have been challenged directly by the nationwide emergence of same-sex marriage. Unlike in the last century, the idea of gays and lesbians growing old does not come as a surprise to geropsychologists today. Although ageism continues to exist in the LGBT community (and widely in society), the fear of growing old can no longer be used as a threatening club to dissuade young people who are discovering their unconventional sexual orientation or gender identity.

### **Organizations Focused on Older Lesbians, Gay Men, and Bisexuals**

The first national conference on Lesbian and Gay Aging was held at California State University, Dominguez Hills, in October 1981, sponsored by NALGG, with over 200 participants. Twenty-four sessions were audiotaped, including a workshop led by Jim Kelly, a program on Outreach Strategies by Sharon Raphael and some board members of SAGE, and a session titled “Black older lesbians & gay men share their history.”

NALGG was founded in 1978 and described itself as “The only group of professional gay gerontologists in the country. . . our membership includes professors, hospital administrators, writers, psychologists, medical doctors, teachers, clergy, students, and others, who are interested in pursuing the study of gay aging and its effects.” It published a newsletter, *Making a Difference*, from 1979 until 1994. It issued a mimeographed *Resource Guide: Lesbian and Gay Aging* in 1989. This resource guide contained an annotated partial bibliography, a list of films and videos, a list of the audio tapes from the 1981 conference, a list of newsletters and publications, and various organizations and services for lesbian and gay elders in the USA. Organizations listed were from San Francisco, San Diego, Long Beach, Berkeley, Los Angeles, Soquel, San Jose, and Hollywood, CA; Washington, DC; Philadelphia and Pittsburgh, PA; Seattle; New York City; Baltimore, Denver; and Columbus, OH.

A brief history of NALGG was provided in the Fall 1990 issue of *Making a Difference*. Sharon Raphael and Mina Meyer (1990) described the founding in Los Angeles by Raphael, Meyer, Jim Kelly, and Richard Southern, a graduate student, who coedited the first issue of the newsletter. Mina Meyer wrote *The Older Lesbian*, the first publication by NALGG. Raphael and Meyer organized the first lesbian symposium at the Gerontological Society of America (GSA) meeting in 1978.

The second national conference on lesbian and gay aging was held in June 1983, in San Francisco, drawing over 300 participants. Donald Catalano became chair of NALGG, and its office moved to San Francisco in 1984, where it held regular meetings and worked with local groups such as Gay and Lesbian Outreach to Elders (GLOE) and Gay and Lesbian Accommodations for the Experienced in Years (GALAXY) that was planning a retirement center in San Francisco.

The major national focus of NALGG during the 1980s was to hold membership meetings and present papers and symposia at each of the major gerontological meetings. The annual conferences of the GSA, the Western Gerontological Society, and the American Society on Aging (ASA) frequently included some content related to lesbian, gay, and also HIV/AIDS issues as a result of NALGG’s efforts. In the 1990 and 1991 meetings of the GSA, NALGG organized a formal “Interest Group” on lesbian and gay gerontology; these meetings were attended by 13 and 28 individuals, respectively (author’s notes).

In 1992 NALGG and the ASA cosponsored the first national conference on LGBT issues titled “Diversity With a Difference: Serving three Million Aging Gays and Lesbians.” It was held in conjunction with the ASA annual conference in San Francisco. Del Martin was the keynote speaker, and her talk drew an attendance of 250 (American Society on Aging 1992). Among the other speakers were Morris Kight, founder of the Gay and Lesbian Community Services Center in Los Angeles in 1971, and Shevy Healey, a founding member of the Old Lesbian Organizing Committee based in Houston. Audio cassettes of the 11 sessions were available at the time.

In the winter 1993/1994 issue of the NALGG newsletter, Sandra Zimmerman, president, reported that “the Board of Directors of the American Society on Aging approved a Task Force on Lesbian and Gay Aging Issues in 1992 and this group held its first open meeting at the ASA Annual Meeting in Chicago last March. . . . As a result of the development of the Task Force and in particular its network system, it becomes critical to ask whether NALGG has a mandate for a continued role in lesbian and gay aging issues?” (Zimmerman 1993). NALGG disbanded as a result of the response of the membership to her survey.

The Lesbian and Gay Aging Issues Network (LGAIN), affiliated with the ASA, carried on the work of NALGG and began publishing its newsletter, *OutWord*, in 1995; it is a standing Interest Network identified as LAIN ([American Society on Aging](#)). The Rainbow Research Group is a standing interest group in GSA: “The Rainbow Research Group helps facilitate connections between researchers interested in LGBT aging as well as researchers who identify as LGBT. Each year the Rainbow Research Group convenes a business meeting, group dinner, and symposium at the annual Gerontological Society of America meeting” ([Gerontological Society of America](#)). *OutWord* (2004) published a history of lesbian and gay gerontology based on interviews with Marcy Adelman, a cofounder of Openhouse in San Francisco; Raymond Berger, author of *Gay and Grey: The Older Homosexual Man* (Berger 1982); Margaret Cruikshank, one of the first educators in the USA to teach about gay and lesbian aging; and Douglas Kimmel, cofounder of SAGE in New York City.

The American Psychological Association Division 44, Society for the Psychological Study of Lesbian, Gay, Bisexual, and Transgender Issues, established a Task Force on aging, which resulted in an edited book, *Lesbian, Gay, Bisexual, and Transgender Aging* (Kimmel et al. 2006). It contained a bibliography of all relevant publications that could be located, which was updated in 2008 on the Division 44 website resource list ([American Psychological Association](#)).

With support from a federal grant, the National Resource Center on LGBT Aging was established in 2010 and became the leading repository of information and research about aging sexual and gender minorities for gerontologists ([National Resource Center on LGBT Aging](#)). This center is led by SAGE and 18 collaborating organizations; it has training resources and certified trainers throughout the USA.

This brief review of the historical changes in the geropsychology of nonconventional sexual orientation and gender identity has traced a remarkable evolution from mental illness, criminality, and sin to an inclusion within the broad array of diversities in aging within the lifetime of the author. Now attention needs to be paid to the diversities within the LGBT older population such as racial, cultural, or ethnic differences, disabilities, cognitive function, and social support.

## Cross-References

- ▶ [Age Stereotyping and Views of Aging, Theories of](#)
- ▶ [Resilience and Aging](#)
- ▶ [Social Support and Aging, Theories of](#)
- ▶ [Stress and Coping Theory in Geropsychology](#)

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## HIV and AIDS in Later Life

Rayna Hirst, Julie Gretler and Casey Conaboy  
Palo Alto University, Palo Alto, CA, USA

### Synonyms

Aging and HIV; HIV in older adults

### Definition

The human immunodeficiency virus (HIV) affects the functioning of the immune system and can lead to a more severe form of immunodeficiency: acquired immunodeficiency syndrome (AIDS). Through compromise of the immune system, HIV often leads to secondary health problems, with young to middle-age patients experiencing increased risk for medical problems typically seen in an older population, such as cancer and cardiovascular disease. Further, advances in medication treatments result in more and more patients with HIV living into old age, leading to additional risks for cognitive symptoms, such as HIV-related dementia, and medical problems associated with aging.

## Introduction

HIV compromises the immune system through preferential attacks on the CD4+ cells (“helper T-cells”) that are responsible for modulating and enhancing overall immune response, such as the direct function of other immune system cells (e.g., white blood cells) (Woods et al. 2009). The amount of CD4+ cells present in the body is used as a measure of the severity of HIV-related immunocompromise. Per the Centers for Disease Control and Prevention (CDC) definition, CD4+ counts below 200 cells/microliter are indicative of an AIDS diagnosis (Centers for Disease Control and Prevention 2016). The systemic effects of HIV may also lead to secondary health problems, as HIV infection increases the body’s susceptibility to other opportunistic infections. This can contribute to the same chronic health problems typically seen in the aging population. These secondary health problems led to the hypothesis that HIV infection is related to a condition resembling premature aging, and those who are HIV positive are considered at higher risk for medical and cognitive problems typically related to aging, such as cardiovascular disease, cancer, and changes in neurocognitive function (Deeks 2011).

Prior to the availability of effective medications for HIV, the expected life span of infected persons was significantly reduced relative to noninfected persons due to high HIV-/AIDS-related mortality rates (Valcour et al. 2004a). According to CDC census data collected between 1981 and 2008, HIV-/AIDS-related mortality rates climbed rapidly in the years before the release of effective antiretroviral treatments, with 451 reported deaths in 1981 increasing to 50,628 deaths in 1995 (Centers for Disease Control and Prevention 2016). However, with the advent of highly active antiretroviral therapy (HAART), also referred to as combination antiretroviral therapy (cART) due to the combined use of three or more antiretroviral drugs, the average lifespan of HIV-positive individuals has increased substantially and mortality rates have decreased. Per CDC census data, following the implementation of HAART treatments, corresponding declines were seen in HIV-/AIDS-related mortality rates.

Mortality rates then stabilized in 1999, and since that time CDC data indicates approximately 17,000 deaths per year (Centers for Disease Control and Prevention 2016). This stabilization of HIV-/AIDS-related mortalities is a direct result of cART's efficacy in establishing better control of overall viral load and stabilization of CD4+ cell counts, thereby enhancing the immune system's ability to respond to HIV and other infections (Centers for Disease Control and Prevention 2016; Gebo et al. 2010). As such, more and more individuals are living with HIV/AIDS for longer periods of time and into old age. According to 2013 CDC census data, current estimates indicate that of over 47,000 individuals in the United States diagnosed with HIV, approximately 21% are 50 years old or older (Centers for Disease Control and Prevention 2016). Therefore, the potential synergistic impact of HIV on the typical aging process is becoming an increasingly important area of study, as more people who have HIV enter the aging population.

As more HIV-positive individuals age, concurrent increases in the national medical cost of HIV infection are also expected. Before the introduction of cART, the annual cost of treating HIV-positive patients in 1998 was estimated at \$18,300 (Gebo et al. 2010). Using multisite data from 2006, Gebo and colleagues (2010) found that higher HIV-related care costs were associated with older age (\$16,541 to \$21,474) and more advanced HIV disease (\$30,415 to \$43,448 in patients with CD4+ cell counts of 50 or lower). HIV-related medical costs present a significant challenge, and the economic burden of these medical costs will likely continue to rise as more of the HIV-positive population transition into older age.

This encyclopedia entry provides a brief overview of the medical, neuropsychological, and psychological considerations associated with aging with HIV/AIDS. Furthermore, protective factors, which correlate with positive outcomes in the aging HIV-positive population, are also presented.

### **Biological Mechanism of HIV**

Through HIV's primary effect on the immune system, the virus causes negative downstream

effects on the functioning of other organ systems within the body. The virus's primary mechanism of action – destroying CD4+ helper T-cells – reduces the body's ability to defend itself from other organisms by targeting the immune system. Through its effects on the immune system, the HIV virus also interferes with the body's ability to monitor its own cells, such as scanning for cancerous cell growth (Woods et al. 2009). A related finding to HIV immunocompromise is the co-occurrence of chronic systemic inflammation in persons who are HIV positive. In response to the virus's presence, the immune system triggers inflammation through proteins produced by immune cells that are important in cell signaling, called pro-inflammatory cytokines (Deeks 2011). Pro-inflammatory cytokines promote systemic inflammation in an effort to combat the virus and can persist over time in response to the virus's presence. This chronic inflammation is thought to underlie many of the other systemic problems seen in persons who are HIV positive, such as increased rates of cancer and cardiovascular disease (Deeks 2011). Lending support to this hypothesis is evidence that antiretroviral treatment decreases the levels of inflammatory markers in HIV-positive individuals, indicating a relationship between HIV and systemic inflammation (Deeks 2011). Nevertheless, even with successful antiretroviral treatment, inflammatory markers remain elevated in persons with HIV, relative to non-HIV-infected individuals, suggesting continued effects of the virus's presence even with good regulation of viral load (Deeks 2011; Wendelken and Valcour 2012). This chronic inflammation may explain the greater prevalence of comorbid medical problems seen in the HIV-positive population.

Chronic inflammation and other immune system changes experienced by individuals with HIV are similar to those found in the aging population. Studies show that as even healthy individuals age, they experience shrinkage of the thymus (the primary lymphoid organ of the immune system, which is involved in the production and training of helper T-cells), reduction of T-cell activity, and increases in systemic inflammation (Deeks 2011). These age-related changes in immune functioning

are collectively referred to as immunosenescence. Immunosenescence closely mirrors changes to the immune system seen as a result of HIV infection. As such, it is hypothesized that HIV's effects on the immune system likely result in premature aging of the systemic body (Deeks 2011). This condition of premature aging could then serve to explain the development of multiple medical problems and neurodegeneration typically associated with aging within the HIV-positive population.

### Medical Implications of HIV and Aging

Medical problems such as cardiovascular disease and other comorbidities become increasingly prevalent as people age. In the HIV-positive population, similar increases in the prevalence of systemic diseases are seen, such as cardiovascular conditions and cancer (Valcour et al. 2004b).

Research demonstrates associations between HIV/AIDS and risk of developing cardiovascular disease and other cardiovascular risk factors like atherosclerosis (Hsue et al. 2004; Schouten et al. 2014). In a cross-sectional study, Schouten et al. (2014) found increased rates of hypertension in HIV-positive participants relative to HIV-negative controls (45.5% vs. 30.5%), as well as increased rates of myocardial infarction (MI; 3.9% in HIV vs. 1.5% in those without) and peripheral artery disease (2.6% in HIV vs. 0.6% in those without). In addition, HIV-positive individuals had significantly more age-associated noncommunicable comorbidities (AANCCs) than noninfected controls (Schouten et al. 2014). Dyslipidemia and abnormal fat distribution are other cardiovascular risk factors comorbid with both HIV infection and some antiretroviral treatments (Valcour et al. 2004b; Simone and Appelbaum 2008). Dyslipidemia is a well-established cardiovascular risk factor, which can lead to further cardiovascular complications such as coronary artery disease, MI, or stroke. Increased rates of atherosclerosis (hardening and narrowing of arteries due to the deposition of fatty plaques) are also seen in HIV-positive individuals relative to controls (mean carotid artery thickness:

0.91 mm in those with HIV vs. 0.74 mm in those without) (Hsue et al. 2004). As there exists a relationship between degree of atherosclerosis and risk of MI or stroke in the non-HIV-infected population, increased rates of atherosclerosis likely also contribute to the development of similar cardiovascular problems in HIV-positive individuals. Evidence indicates even greater risk of developing cardiovascular conditions or risk factors as the HIV-positive population progresses into older age (Valcour et al. 2004b).

The mechanism behind the development of these cardiovascular conditions is thought to be multifactorial, including aging, direct effects of the virus (e.g., CD4+ cell depletion) as well as indirect effects (e.g., chronic inflammation), and HIV/AIDS drug regimens. For example, findings from a large observational study demonstrated an association between combination antiretroviral treatment and increased risk of MI, noting an MI risk ratio of 1.6 per year of exposure to antiretroviral medication (The DAD Study Group 2007). This suggests that even the medications used to manage HIV/AIDS may exacerbate HIV-positive individuals' vulnerability to developing comorbid medical conditions. Additional problems can arise when medications routinely used to manage these cardiovascular conditions are contraindicated due to adverse interactions with HIV medications. For example, the use of either simvastatin or lovastatin is discouraged in individuals who are also being treated with protease inhibitors, a type of antiretroviral medication (Simone and Appelbaum 2008). Thus, cardiovascular risk factors become increasingly difficult to manage in individuals diagnosed with HIV/AIDS.

In addition to increased cardiovascular risk, persons infected with HIV display higher rates of cancer than the non-HIV-infected population. Prior to the advent of potent combination antiretroviral medication, individuals with HIV experienced increased rates of cancers such as Kaposi sarcoma and non-Hodgkin's lymphoma (termed "AIDS-defining cancers") (Simard et al. 2010). The commonality of these cancers in the HIV-positive population is thought to be due to HIV-related immunocompromise, a significant risk factor in the development of these cancer

types (Simard et al. 2010). Following the emergence of antiretrovirals, however, the incidence of these types of cancers has declined. This lends further support to the association between immunosuppression and the genesis of AIDS-defining cancers (Simard et al. 2010). Nevertheless, as the HIV-positive population ages, the risk of developing non-AIDS-related cancers also rises, particularly cancers associated with chronic infection (such as cervical cancer) or viral cause (such as liver cancer) (Simard et al. 2010; Grulich et al. 2007). The pattern of risk associated with cancer rates in HIV-positive individuals is similar to that of organ transplant patients, suggesting that immunodeficiency and decreased immunosurveillance in the body may directly contribute to increased cancer risk (Grulich et al. 2007). While antiretroviral medications do not often achieve normal CD4+ counts, early treatment is thought to be helpful in reducing the risk of developing cancer.

In sum, HIV infection is associated with chronic comorbid health problems, such as cancer and cardiovascular disease, through the virus's direct and indirect effects on the immune system. Additionally, some antiretroviral medications can add to cardiovascular risk, increasing the likelihood of cardiovascular disease. As cancer and cardiovascular disease are also typically seen in the aging population, HIV-positive individuals may be at increased risk for further health compromise as they age.

### **Neurobiology and Neuropsychiatric Considerations**

In addition to increased risk of comorbid medical conditions, HIV infection is linked to changes in brain morphology and neuropsychological functioning. Many of the HIV-related structural and functional changes in the brain are similar to those changes seen in older adults and can lead to the development of HIV-associated neurocognitive disorder (HAND).

HIV impacts the brain by passing through the blood-brain barrier, a filtering mechanism of capillaries carrying blood to the brain and spinal cord

tissue. Once passing through this barrier into the central nervous system (CNS), HIV replicates in the brain through infiltrating both microglia and macrophage cells, which are responsible for consuming cellular debris and foreign substances in the CNS (Woods et al. 2009). The virus affects brain functioning in several ways, such as the formation of multinucleated giant cells which can cause multiple problems for the immune system, as well as the interference of neural function through the production of neurotoxic molecules, causing cell death and synaptodendritic injury (Woods et al. 2009). Chronic systemic inflammation due to HIV and comorbid cardiovascular conditions can also affect the function of the brain through their effect on the brain's blood vessels (e.g., by contributing to atherosclerosis and chronic small vessel ischemic disease) (Valcour et al. 2004b). Additionally, other comorbid medical factors and HIV-specific disease factors may contribute to impaired neuropsychological functioning (Valcour et al. 2004a). In particular, cardiovascular disease is independently associated with changes in cognition and may further compound HIV's effect on neuropsychological functioning. Overall, these direct and downstream effects of HIV on the CNS can lead to changes in the brain structure and thus impact neurocognitive functioning.

While the effects of HIV on the brain can be widespread, the virus more commonly affects the subcortical regions of the brain, such as structures within the fronto-striato-thalamo-cortical circuits (i.e., circuitry connecting the frontal lobe, striatum, thalamus, and other areas of the cortex) and white matter tracts connecting different areas of the cortex (e.g., the corpus callosum) (Ances et al. 2012). HIV may also be associated with volumetric changes in subcortical structures independent of aging and antiretroviral treatment, particularly in the corpus callosum, caudate nucleus (part of the basal ganglia), and amygdala (part of the limbic system) (Ances et al. 2012). These findings suggest that antiretroviral medications may not fully protect HIV-positive individuals from HIV-related brain changes. Additionally, diffusion tensor imaging, or imaging of white matter tracts which connect neurons within the brain,

suggests compromise of white matter tract integrity in the HIV-positive population (Woods et al. 2009). These changes in white matter integrity and gross brain structure occur particularly in the frontal cortex and striatum, which are regions thought to carry greater viral load (Woods et al. 2009). Overall, these structural changes in the gray and white matter of the brain likely underlie the varying levels of cognitive dysfunction seen in this population.

Individuals with HIV/AIDS demonstrate a subcortical pattern of impairment similar to the pattern associated with vascular etiologies of cognitive impairment. Slowed processing/psychomotor speed and impaired attentional processes are typically seen in both older adults and patients with HIV/AIDS (Woods et al. 2009; Wendelken and Valcour 2012). In older adults with HIV, these are thought to be an early indicator of neuropsychological difficulty (Wendelken and Valcour 2012). Bradykinesia (i.e., slowed movement) is also seen in HIV-positive individuals, particularly in later stages of disease due to the virus's effect on nigrostriatal function controlling motor movement (Woods et al. 2009). Executive dysfunction (problems with skills such as attentional control, inhibition, reasoning, and problem solving) and memory deficits are also commonly seen in the HIV-positive population. These difficulties may be mediated by the synergistic disruption of attention and processing speed described above. While this pattern of difficulties is commonly seen in those with HIV/AIDS, a great degree of heterogeneity of cognitive functioning remains. Individual differences in protective and risk factors for cognitive dysfunction likely contribute to this observed heterogeneity, including HIV disease severity, comorbid medical conditions, cognitive reserve, and psychological conditions such as depression or trauma (Wendelken and Valcour 2012).

The severity of HIV-related cognitive dysfunction ranges from "asymptomatic" neurocognitive impairment (i.e., no functional decline) to HIV-associated mild and major neurocognitive disorders (Woods et al. 2009). In a 2010 study, the CNS HIV Antiretroviral Therapy Effects Research study (CHARTER) demonstrated a 47% prevalence rate of HIV-related neurocognitive disorders

(mild and major) out of 1,555 patients receiving antiretroviral therapy (Heaton et al. 2010). Findings from this study also revealed decreased rates of HIV-associated dementia (HAD) relative to rates prior to the advent of antiretroviral medications, from approximately 10–15% prior to cART to just 2% (Heaton et al. 2010). The rates of HIV-associated mild neurocognitive disorder (approximately 44% of the study sample) were fairly similar to the pre-antiretroviral era, suggesting relative stability in the rates of mild neurocognitive disorder secondary to HIV (Heaton et al. 2010). However, Valcour and colleagues found that older age is a significant risk factor for the development of HAD, which could be a result of increased HIV infection duration, greater medical comorbidities, and the increased chance of developing other degenerative diseases in the aging population in general (Valcour et al. 2004a). This finding is suggestive of an increased vulnerability to CNS involvement, as evidenced by increased risk for changes in neurocognitive functioning, in older adults with HIV/AIDS (Valcour et al. 2004a).

In sum, HIV particularly targets fronto–striato–thalamo–cortical circuits, in addition to white matter tracts throughout the brain. Through its direct and indirect action on the CNS (e.g., directly interfering with cellular communication and indirectly affecting CNS function through atherosclerosis of cerebral vessels), HIV can result in cognitive impairment ranging from mild cognitive changes without significant impact on functional abilities to major cognitive decline with accompanying functional impairments. As individuals with HIV/AIDS age, they are not only at increased risk of developing dementia through the presence of HIV but also through comorbid medical conditions, such as cardiovascular disease or cancer metastases. It is important to consider both neurocognitive and functional abilities when tailoring treatment plans to the HIV-positive population in order to optimize their day-to-day functioning.

## Medication Management

As in other causes of cognitive impairment, HIV-related mild and major neurocognitive

disorders are diagnosed based on the relative severity of declines in both cognition and functional completion of independent activities of daily living (IADLs) (Wendelken and Valcour 2012). IADLs include activities such as managing finances, driving, shopping, and cooking meals. An especially important IADL in the aging population is medication management. This is particularly critical for individuals who are HIV positive, as HIV disease and medical comorbidities lead to complicated medication regimens critical to managing and maintaining physical and neuropsychological health. Typically, older adults with more complicated medication regimens are considered at risk for medication nonadherence. Interestingly, in HIV-positive patients, studies demonstrate that older adults are at reduced risk of medication nonadherence, relative to younger individuals with HIV (Ettenhofer et al. 2009; Ghidei et al. 2013). Although older age is associated with improvements in medication adherence within the HIV-positive population, factors such as socioeconomic status and cognitive functioning can affect medication adherence (Ghidei et al. 2013). In particular, cognitive impairment frequently results in decreased medication adherence, particularly with complex regimens such as those seen in patients who have HIV/AIDS (Ettenhofer et al. 2009; Ghidei et al. 2013). Additionally, a cyclical relationship may develop where poor medical adherence further impacts cognitive function, resulting in worse adherence and exacerbating cognitive impairment in older adults with HIV (Ettenhofer et al. 2009). As antiretroviral medication is important for the control of viral load and immune function, medication adherence is crucial for the management of medical and neuropsychological functions. Strategies to enhance medication management in older adults with HIV, such as using alarms as medication reminders or employing a pill box to organize medications, may be valuable additions to treatment plans when working with this population.

### Depression and Protective Factors

Depression is especially concerning for older individuals with HIV, as it can exacerbate the

progression of HIV to AIDS (Bouhnik et al. 2005). As these individuals experience functional declines related to normal aging and HIV, they may also be at risk for declines due to depression. One example of these functional declines is reduced physical functioning (e.g., difficulty walking), which can put older individuals at increased risk of falls, thus increasing their risk of injury or even mortality. Decreased activity, which is common in those with depression, may exacerbate this risk to physical functioning in individuals with HIV. Depression may also impact immunologic function, weakening an already compromised immune system in those diagnosed with HIV (Leserman et al. 2000). Thus, it is likely beneficial for individuals with HIV/AIDS to consider treatments addressing the management and care of depressive symptoms, as mood improvement may result in a better disease prognosis and improved physical health.

Research studies indicate several protective factors that may ameliorate the effects of depression in older individuals with HIV/AIDS, thus reducing the impact of mood on immune function. In particular, individual differences in personality traits may play a role in the relationship between mood and disease progression. Both general positive affect (Ickovics et al. 2006) and optimism (Segerstrom and Sephton 2010) are associated with reduced risk of immune system dysfunction in individuals with HIV. Other protective factors include acceptance of disease prognosis, which may be related to a slower progression to an AIDS diagnosis among gay and bisexual men (Thornton et al. 2000). Related individual factors that may play a positive role in slowing the progression of HIV include spirituality (Fitzpatrick et al. 2007), altruism (Ironson 2007), and self-efficacy (Ironson et al. 2005a). Older individuals with HIV/AIDS can increase the benefit of these protective factors via psychological interventions, thereby improving their disease prognosis.

In addition to individual protective factors resulting in a better prognosis for those with HIV, social support has a positive effect on overall well-being and may lead to fewer HIV-related symptoms (Ashton et al. 2005) and a slower progression to AIDS (Leserman et al. 2000).

Those with HIV in the aging population may lack adequate social support due to potentially diminishing social circles. Thus, it may be especially important for older individuals with HIV to seek out social support given its positive effect on HIV disease prognosis.

Research indicates that many of these protective factors are beneficial to individuals with HIV/AIDS through their effect on behavior. For example, personality factors such as optimism are associated with healthier behaviors, including more exercise, better coping mechanisms, and enhanced mood (Ironson et al. 2005b). In terms of increasing an individual's protective factors throughout treatment, therefore, it may be more beneficial for individuals to directly address these behavioral mechanisms rather than attempting to change other, more intrinsic characteristics such as optimism, as these may be more difficult for individuals to modify. Thus, it would be beneficial to encourage older individuals with HIV to incorporate healthy habits and coping mechanisms, as focusing on behavior change in treatment will be critical for these individuals to have the best disease prognosis possible.

Nevertheless, addressing behavioral changes in treatment may not be sufficient in improving mood. Therefore, treatment of individuals with HIV/AIDS who also suffer from depression should specifically target mood enhancement as well. Within the aging population, individuals with HIV should be encouraged to “remain engaged in living” in order to increase overall protective factors such as social support and healthy coping strategies (Ironson and Hayward 2008). Encouraging HIV-positive individuals to remain involved in their communities and maintain an active lifestyle may inherently increase healthy coping and social support, thus improving disease prognosis. Yet it is important to keep in mind that clinicians must be sensitive to the discussion of individuals' HIV diagnosis, particularly when encouraging them to enhance their own positive attitude (Ironson and Hayward 2008). Some individuals with HIV/AIDS could interpret efforts to increase their optimism as a suggestion that mood improvement is simply a

matter of “thinking positively,” which is disaffirming to the difficulties they may face due to their illness. Treatment providers must work to be sensitive to their clients' experience and aware of the influences of their own beliefs regarding both aging and HIV status in order to deliver culturally competent care.

## Conclusion

HIV, a potentially devastating disease that puts individuals at risk for cognitive and physical difficulties, affects more individuals in the aging population than ever, even with the advent of more effective treatments such as cART. Biological changes seen in the progression of HIV are quite similar to those associated with aging, potentially resulting in premature aging in individuals with HIV. Thus, HIV-positive individuals are dually at risk for medical difficulties – those related to their HIV diagnosis and those related to aging. Older individuals with HIV/AIDS may also experience declines in neuropsychological functioning (e.g., executive dysfunction), which may lead to difficulties completing IADLs such as medication management and treatment adherence. Comorbid psychiatric disorders such as depression may further complicate the picture when considering their effect on immune functioning, disease prognosis, and quality of life. Therefore, treatment must address all of these risk factors while also promoting protective factors such as social support and adaptive coping strategies in order for older individuals with HIV/AIDS to have the best prognosis possible.

## Cross-References

- ▶ [Behavioral and Psychological Symptoms of Dementia](#)
- ▶ [Cognition](#)
- ▶ [Cognitive Neuroscience of Aging](#)
- ▶ [Comorbidity](#)
- ▶ [Dementia and Neurocognitive Disorders](#)
- ▶ [Palliative Care](#)

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## Home-Based Primary Care

Rachel Rodriguez<sup>1</sup>, Clair Rummel<sup>2</sup> and B. Heath Gordon<sup>3</sup>

<sup>1</sup>VA Palo Alto Health Care System, Palo Alto, CA, USA

<sup>2</sup>VA Puget Sound Health Care System – Seattle Division, Seattle, WA, USA

<sup>3</sup>Mental Health, G.V. (Sonny) Montgomery Veterans Affairs Medical Center, Jackson, MS, USA

### Synonyms

Home care; Interdisciplinary team care; Non-institutional care

### Definition

Home-based primary care is designed to provide comprehensive, longitudinal primary care services in the homes of individuals with complex, chronic disabling disease using an interdisciplinary team of skilled practitioners.

### Several Headings (Free Choice)

As the world's population rapidly ages, the prevalence of individuals with multiple, complex medical conditions is rising. Within the United States, data suggest that 92% of older adults, aged 65 and over, have at least one chronic medical condition such as heart disease, hypertension, arthritis,

diabetes, chronic lung illness, or cancer. Seventy-seven percent of these older adults have at least two chronic medical conditions. Among the oldest old, individuals 85 and older, approximately 50% are dependent in at least one activity of daily living (ADL) such as feeding, dressing, mobility/transportation, bathing, or toileting. Additionally, nearly half of the oldest old group also may have a neurocognitive impairment such as Alzheimer disease and thus greater need for assistance with their daily care. This progressively older world population, with increasing prevalence of chronic illness and physical limitations, results in a growing population of older adults who are chronically, medically ill and homebound. Therefore, health care systems around the world must find ways to contend with this increasing demand for primary and long-term care services for the homebound aged.

Several variations of home health care programs have been developed internationally to meet the needs of the medically complex, homebound patient. One such program in the United States is the Medicare Skilled Home Care program (<http://www.medicare.gov/coverage/home-health-services.html>). This program serves patients with short-term conditions that require focused care. Examples of skilled health services provided include: intermittent skilled nursing care, physical therapy, speech-language pathology, and occupational therapy. These services utilize multiple providers and typically with little coordination/integration among them. In the United Kingdom and Europe, there are many outreach programs which provide multidimensional, home-based, geriatric assessments aimed to define needs and develop care plans for the homebound elderly (Stall et al. 2013). While these programs may provide some level of assistance to homebound older adults, they are not designed to provide ongoing primary care services to address acute and/or changing care needs. Without regular access to primary care services, these medically frail individuals must utilize alternative programs in times of health crises, such as emergency room visits and/or hospitalization (Stall et al. 2014). These alternative solutions can address the acute need, but there is no bridging

of care responsibilities such that the post-discharge care plan may become disjointed. Medically frail individuals who do not receive adequate follow-up services are further at risk for continued decline, readmission, or admission to a long-term care facility.

Home-based primary care programs (HBPC) have emerged through efforts to bridge these care services and better address the needs of the homebound older adult. These HBPC programs provide comprehensive, longitudinal primary care services in the homes of individuals with complex, chronic disabling disease using an interdisciplinary team of skilled practitioners. Many HBPC programs employ practitioners from a wide range of disciplines including but not limited to geriatricians, nurse practitioners, registered nurses, social workers, pharmacists, dietitians, occupational therapists, physical therapists, and dental assistants. A recent review program found that HBPC programs can reduce both hospitalizations and long-term care admissions while improving care recipient and caregiver quality of life and satisfaction with care (Stall et al. 2014).

One longstanding version of an HBPC program exists within the Veterans Health Administration (VHA), the healthcare component of the United States Department of Veterans Affairs. The VHA first established the hospital-based home care (HBHC) program with six sites in 1972 (Beales and Edes 2009). The program then expanded over the years, and the name was changed to home-based primary care (HBPC) in 1995. VHA HBPC now operates in more than 150 sites across the United States. The mission of VHA HBPC is to deliver longitudinal, comprehensive, and interdisciplinary primary care in the homes of veterans for whom routine clinic-based care is not effective due to complex and chronic medical, social, and behavioral conditions (Beales and Edes 2009; Edes 2010; Hicken and Plowhead 2010). Given this criteria for enrollment, it is natural that many of the Veterans Affairs HBPC patients are older adults. Data from 2009 described the VHA HBPC population as an older (76.5, mean age) and predominately male (96%) patient population with a high prevalence of chronic disease (Beales and Edes 2009).

VHA HBPC patients are seen in a variety of noninstitutionalized care settings ranging from their homes to large assisted care facilities to smaller registered care facilities for the elderly.

Using an interdisciplinary approach where the team collaborates in providing patient-centered care to address behavioral and mental health concerns, the primary goals of VHA HBPC programs are to maximize functioning, minimize hospitalization, and promote and maintain quality of life for aging patients with chronic disease. VA HBPC interdisciplinary teams are often headed by a physician medical director, while a nurse or social worker serves as the program manager. Additional allied health care professions such as pharmacy, nutrition services, and physical and occupational therapy round out the interdisciplinary team. Recognizing the high rate of concomitant mental health conditions among this particular medical population, VHA HBPC programs have also integrated full-time, doctoral-level mental health providers to support the team in meeting these goals (Hicken and Plowhead 2010; Karlin and Karel 2014). Mental health providers can be either a psychologist or psychiatrist, though the Veterans Health Administration (VHA) HBPC program typically employs more psychologists (Karlin and Karel 2014). Psychologists also support the overarching goals of VHA HBPC by providing better access to and improving the quality of mental health care among this population.

Most psychologists within VHA HBPC are working with older adults with comorbid medical illness and mental health concerns. As such, the remainder of this entry will focus on models of psychological assessment and clinical intervention for psychologists working in the home. While centered in the VHA HBPC practice model for psychologists, all mental health practitioners working in the home setting may find the information provided applicable to their practice. The entry ends with a discussion of the advantages and challenges of providing mental health care in home care settings.

### **A Model for Psychological Assessment in a Home-Based Primary Care Program**

The VHA HBPC program utilizes an integrated care model to provide collaborative,

patient-centered care for managing enrolled veterans' care needs. Within this interdisciplinary model, the mental health provider assists the team in care management using a stepped care approach. This stepped care approach includes the entire interdisciplinary team in the assessment process for identifying, monitoring, and treating mental and behavioral health concerns.

Every veteran enrolled in VHA HBPC completes a series of medical and mental health screenings as part of an initial home visit, which is scheduled with the veteran, his or her family caregivers (or other care providers as relevant), and one or more VHA HBPC medical providers such as a nurse practitioner, nurse, and/or social worker. While there is some variability among HBPC programs in how these initial evaluations are conducted, all include VA-mandated screenings for conditions such as depression, PTSD, substance abuse, suicide and/or risk for self-injurious behavior, dementia warning signs, and caregiver strain (Gordon and Karel 2014). The evaluating team members also identify the veteran's (and caregiver's) medical treatment preferences and values, treatment issues associated with the environment of care, and any safety needs. Any abnormal finding may trigger a more comprehensive screening of presenting concerns (e.g., anxiety, cognitive functioning, chronic pain, suicide risk). This evaluation team then addresses any urgent care needs through phone consultation with other team members or by accessing appropriate community or VA care resources. The evaluating team then shares the findings during an interdisciplinary team meeting for discussion of treatment goals and to establish an interdisciplinary plan of care.

The role of the psychologist during these team meetings is to assist the team with identifying potential mental health concerns or any psychosocial barriers to receiving appropriate care as well as assisting with treatment planning for behavioral and mental health conditions. Some VHA HBPC teams prefer to use test scores on initial screening measures to identify those veterans in need of mental health care, while other teams prefer to utilize the initial findings as one aspect of the clinical picture, which is then

evaluated by all to determine if more specialized mental health assessment or treatment is needed. While it is beyond the purpose of this entry to cover all the elements of a comprehensive psychological assessment, the sections that follow will review some aspects of a psychological evaluation that are unique to VHA HBPC.

### **Psychological Assessment**

Psychological assessment in HBPC is most effective and beneficial to the team when evaluations target patients with complex symptom profiles, when symptoms are of greater severity than can be managed with routine medical care, when a patient's clinical presentation and/or environment change dramatically, or when there is a need to clarify any concerns regarding patient risk or safety (e.g., suicide, neglect). In those areas, a psychological assessment enhances the team's understanding of the symptomology, person-environment interaction, and helps to clarify appropriate treatment goals and interventions.

HBPC psychological evaluations are different from those outside of an interdisciplinary setting in several ways. First, the VHA HBPC population is at high risk for mood and anxiety-related disorders due to the high prevalence of medical conditions, marked functional impairments, and often stressful environmental circumstances. Therefore, psychological evaluations must consider the medical conditions, treatments, and care environment as part of the entire clinical picture. Next, the consumers of these evaluation reports are from numerous other disciplines. Reports should be concise and clearly identify specific findings and recommendations that address the symptoms and/or treatment modifications requested of others. Finally, psychological evaluations not only assist with clarifying a differential diagnosis or in identifying behavioral and mental health treatment recommendations, but also help the team understand the patient's context. Evaluations include consideration of the adequateness and appropriateness of the care environment (e.g., social support systems, setting) as well as the patient's abilities and willingness to consent to and engage in medical or behavioral and mental health treatments.

### **Cognitive/Neuropsychological Assessment**

Neurocognitive disorders are common among the VHA HBPC patient population, but cognitive change also may be associated with medical conditions or treatment effects (e.g., anticholinergic or electrolyte depletion effects of some medications). The psychologist assists the team by providing a more in-depth neurocognitive evaluation using tools appropriate for the patient. Objective data can help determine if the noted decline is secondary to medical concerns, is within acceptable limits for the individual, or is suggestive of abnormal cognitive aging such as mild cognitive impairment or a neurocognitive disorder. As not all psychologists will have experience/expertise in neuropsychological testing, some HBPC teams may find that a neuropsychological consult is needed for additional testing.

Neurocognitive assessment not only assists with clarifying diagnoses, but also informs the team regarding appropriate interventions. The HBPC psychologist utilizes test results to educate the team on a patient's strengths and limitations as some deficit patterns may impact both how medical care information is presented and what approach is needed to increase the likelihood of remaining compliant with recommended care. For example, assessment results may suggest the patient is experiencing symptoms of depression comorbid with a neurocognitive illness. However, the extent of patient's cognitive/memory impairment may be such that the patient will not benefit from a psychotherapeutic approach requiring self-initiating behaviors and/or higher order cognitive-focused interventions, as is common in evidence-based therapies. The psychologist might then work with the interdisciplinary team and/or caregiver to identify alternative strategies that have been shown to improve depressive symptomology (e.g., behavioral activation, problem solving).

Capacity. Providers meeting with patients and families in the home setting sometimes discover that a patient's situation has decompensated to the point that marked changes seem warranted to improve the patient's health, well-being, and/or safety. The HBPC psychologist then assists the team by performing an evaluation of the patient's

decisional and functional capacities in one or more areas. The areas most commonly evaluated in the VHA HBPC setting include the patient's ability to manage his or her own finances, reside independently, or make important medical decisions. Evaluations of this type assist the team in determining if a patient's choices should be honored or if alternative arrangements are needed.

### **Behavioral Medicine Assessment**

The treatment and management of complex, chronic illness may at times result in the patient experiencing psychological or psychosocial stressors which medical interventions may not be able to alleviate. When this occurs, the HBPC psychologist can assist the team in the assessment and behavioral treatment of medically related conditions such as sleep disorders, chronic pain, smoking, weight management, sexual functioning, and medical/medication compliance. Assessment techniques are utilized to identify target behaviors and develop strategies that empower the patient to choose healthier alternatives and diminish the barriers impeding successful collaboration with the treatment team and or targeted interventions.

### **Caregiver Assessment**

Previous data has found the VHA HBPC population averages eight or more chronic medical conditions, including dementia (Edes 2010). Given this, readers may anticipate that a large number of spouses and/or other care providers serve a significant caregiving function in assisting HBPC patients with management of medical care and ADLs. Over time, caregiver strain can lead to increased mental health problems, decreased health functioning, and marked caregiver burden. Caregiver strain impacts not only caregiver health but also the success of the HBPC model as it diminishes the ability of caregivers to provide adequate care and thus allowing the patient to remain in the home. Psychologists can use caregiver assessment tools to evaluate a caregiver's social support network, strengths and limitations, health, perceptions of caregiving, and overall well-being. The psychologist may then provide individual caregiver interventions or make recommendations to the team for appropriate strategies

to implement in the home to reduce caregiver distress.

### **Risk Assessment**

Risk is evaluated by every VHA HBPC team member, but psychologists are typically called upon to provide comprehensive risk assessments and interventions services for patients at increased risk for suicide or other self-injurious behavior. Overall, the VHA HBPC patient population is considered among the high risk group due to the numerous risk factors frequently cited in the suicide literature (e.g., older, male, multiple medical conditions, new chronic conditions that limit functioning). Additional risk categories that VHA HBPC psychologists evaluate as part of a home-based assessment included firearm and driving safety. The focus is to identify those patients at increased risk for intentional and/or accidental harm to self or others when possessing a firearm and/or driving, if the patient has a significant mental health or neurocognitive impairment that would increase the risk. Psychologists then work with any patient and family to help decrease those risks by securing firearms or vehicle access, as appropriate. A final risk area is that of elder abuse and neglect. Psychologists can assist the team with completing an evaluation of abuse or neglect, in managing sensitive issues that may result in such discoveries, and in helping the team deal with any negative experiences associated with addressing the concerns. For example, many countries, including the United States, require mandated reporting of instances of abuse or neglect to law and social service agencies by health care providers; however, the requirements of what constitutes abuse and neglect and what professional disciplines are mandated reporters vary. Indeed, these requirements even vary by state within the United States. Psychologists can assist the team in determining if any concerns or reports meet criteria for reporting to an outside agency and how to best navigate these mandates from a patient-centered perspective.

### **A Model for Clinical Intervention in the Home-Based Primary Care Setting**

VHA HBPC relies upon empirically based treatments in the provision of mental health

interventions for both patients and their families. Many VHA HBPC psychologists and teams use components of collocated, collaborative, and stepped-care approaches to effectively and efficiently identify those patients which may benefit from mental health interventions. Data on a nationwide VHA HBPC mental health provider survey indicated that only 10% of providers were seeing every patient in the program (Karlin and Karel 2014). These data suggest HBPC mental health providers deliver direct care services most often when they are alerted to a specialized need, which is based upon the screenings conducted by the larger interdisciplinary team. Approximately 53% of VHA HBPC mental health providers reported utilizing abbreviated interventions (1–3 sessions), while 79% reported often or frequently providing full interventions (10+ sessions) (Karlin and Karel 2014).

Individual psychotherapy functions similarly to that in clinic-based populations. Research consistently has shown that older adult populations respond as well as younger populations to targeted treatments, though minor modifications are needed at times to address sensory or medical needs. Among the most frequently presented mental health diagnosis in the VHA HBPC population are depression, coping with illness, anxiety, and adherence issues (Karlin and Karel 2014).

However, it should be noted that working in the home care setting can create additional logistical problems for scheduling interventions that is not likely to occur in the traditional clinic-based setting. Given the large geographic catchment areas that some VHA HBPC programs cover, HBPC mental health providers sometimes find it impossible to meet face-to-face with certain patients on a weekly basis. When this barrier occurs, mental health interventions may benefit from modifying the care plan to utilize face-to-face, telemedicine, and/or telephone technologies. Mental health providers also sometimes cluster appointments to a specific geographical area in order to maximize travel efficiency and thus increase the time spent with individual patients.

### **Couple/Family**

VHA HBPC psychologists also are able to provide couples therapy focused on managing conflicts that stem from the strain on a relationship due to complex medical conditions, financial burdens, family issues involving care, or other concerns. Occasionally there is opportunity to address more complex relational dynamics, but usually the focus remains on the medical care and advocating for improvement in order to benefit the patient so that he/she may remain in the home as long as possible. This focus is different from caregiver support as it includes multiple parties in the intervention process.

### **Caregiver Support**

As noted in the assessment section above, many chronically ill homebound patients will require the services of a caregiver for assistance with ADL/IADL care. The caregiving role can be challenging and potentially impact caregivers' physical and mental health, work, social relationships, and quality of life. When this occurs, the HBPC psychologist can provide caregiver support interventions to alleviate stress and better enable the caregiver to cope with the demands of caregiving. Caregiver support may take many forms, including but not limited to psychoeducation about the medical illness and/or cognitive impairment of the patient, traditional psychotherapy to address symptoms of depression and/or anxiety, or skills training using problem-solving and behavior management interventions to address specific problems. As with couples/family treatment, the primary focus is on reducing caregiver strain and prolonging the length of care in the home for the patient. Sometimes, the mental health care needs of the caregiver are greater than can be addressed by HBPC psychologist. In those instances, the psychologist works with the caregiver to identify and connect to a provider in the community that can emphasize the unique mental health needs of that caregiver.

### **Interdisciplinary Team and Program Support**

The HBPC psychologist serves an important role on the team by using therapeutic skills to advocate for patients, promote an atmosphere of mutual

respect among providers, and facilitate positive communication and collaboration among staff. For example, psychologists can model appropriate professional behavior for the interdisciplinary team, both when communicating with other interdisciplinary professions and during collaborative discussions in interdisciplinary team meetings. Or, they may serve the larger HBPC program by educating the staff on clinical and professional topics. For example, psychologists can provide education and training on how to conduct brief cognitive or mood assessments, assess for risk, or communicate evaluation and treatment results to help improve overall care. The HBPC psychologist also can provide training on self-evaluation and self-care strategies to help providers deal with professional burnout and/or difficulties in managing patients with challenging conditions or behaviors.

Additionally, since psychologists have training in research and often in program development, some may serve in varying leadership capacities on the team. Psychologists can assist the team in addressing referral processes, monitoring and improving the quality of care of HBPC patients, and through collaboration with other hospital and community-based services, as appropriate. Psychologists also have advanced training in ethics and care standards and often may find ways to assist interdisciplinary team members in appreciating the unique boundaries and/or conflicts that occur within the provision of care in a home setting such as identifying issues associated with patient confidentiality, privacy, patient autonomy, or other ethical conflicts that may arise in the home setting.

### **Environment of Care**

Psychologists assist the interdisciplinary team by evaluating the environment of care and aiding the team in determining what is acceptable, and in accord with a patient's values and preferences, versus what environmental factors are beyond the acceptable range for safety and optimal adaptive functioning. Input can assist the team in clarifying those environmental circumstances that need to be addressed as well as in developing targeted interventions also respect the unique needs and values of the patient. As indicated

above, a benefit of working within the home-based primary care environment is that doing so allows the psychologist to work directly with the patient and/or their family, in context, to address a specific issue of concern.

### **Advantages and Challenges of Mental Health Care Provision in Home-Based Primary Care**

Working in the home setting provides several distinct advantages and disadvantages that the mental health provider must be ready to contend with. Below is a review of these, as well as suggestions for compensatory strategies that may be of benefit.

#### **Advantages**

##### **Improved Access to Mental Health Care**

A significant benefit of having a psychologist integrated into the HBPC team is increased access to mental health services for chronically ill older adults. The HBPC program improves access to mental health services for patients who: (a) are no longer able to easily access outpatient services and/or (b) may be reluctant to pursue specialty mental health services in traditional settings due to stigma. The provision of services in the patient's home overcomes a variety of logistical barriers for chronically ill older patients, such as physical limitations, a lack of transportation, and low energy. Offering in-home assessment and treatment also may increase the acceptance of services from a population that has historically found outpatient mental health services stigmatizing (Yang et al. 2009).

Through integration with a primary care team, the psychologist is better able to reach older adult patients, who have shown a preference for presenting mental health symptoms in a primary care setting (Areán et al. 2002). The psychologist's association with a trusted HBPC nurse case manager may increase the likelihood of a patient accepting a referral (Hicken and Plowhead 2010). Patients may feel more comfortable and in control in their own homes versus an office setting. Patients who have refused traditional outpatient mental health services in the past have been found to accept a home visit from an HBPC

psychologist and actively engage in psychotherapy in the comfort of their own home (Hicken and Plowhead 2010). The psychologist's role on the larger treatment team may also increase the chances of the patient staying engaged in treatment.

##### **Enhanced Assessment and Treatment Planning**

The home setting provides an abundance of information that is unavailable in a traditional outpatient or inpatient setting and can greatly enhance assessment and treatment planning. The HBPC psychologist can more easily evaluate the reliability of a patient's self-report on issues, such as medication compliance, ability to access emergency services, and ability to maintain sanitary conditions. For example, a 75-year-old man may present as capable during a 50-min outpatient session, but a home visit may reveal an excessively cluttered and unsanitary home with several safety concerns, which raises a red flag about the patient's ability to safely live independently. A more accurate assessment of the patient's functioning can be made during a home visit than in a traditional setting, which is particularly important if the psychologist has been referred for a capacity evaluation. In addition to being able to assess actual functioning within the patient's primary environment, the clinician can assess the patient's awareness of safety issues and his or her ability to respond to and manage unsafe environments (Hicken and Plowhead 2010).

Another significant benefit of providing services within a patient's home is increased access to people involved in the patient's life. This can be particularly helpful when working with cognitively impaired patients who may no longer be able to provide accurate historical information and self-reports. Family members, friends, home-health aides, and other health care providers are frequently encountered during visits. With client consent, valuable information can be gathered from these collateral sources, such as information about their history, and observations of the patient's mood, memory, sleep, daily activities, safety at home, and medication compliance.

With the patient's permission, a family member or home-health aide (HHA) can participate in aspects of treatment to help implement

interventions and monitor follow through (Yang et al. 2009). This can be particularly helpful with generalization of skills when the HBPC psychologist is not able to see patients weekly and when working with cognitively impaired patients. Conversely, home visits also allow for a closer examination of the caregiver's ability to assist in implementing a treatment plan (Hicken and Plowhead 2010). Family members may have their own medical or mental health concerns that make it difficult for them to assist patient's or unreliable. The presence of collateral significant others can also be a challenge as discussed further below.

Information gathered from observation of the patient's environment and discussion with collaterals can help the psychologist determine if a change in behavior can be supported, and at what level, in the current environment (Hicken and Plowhead 2010). For example, an HBPC psychologist, referred to provide treatment for insomnia, learned during the first visit that the patient's wife has dementia and inquired about her sleep patterns. This line of questioning revealed that his wife wanders at night causing the patient significant anxiety and stress. The patient reported that he was not willing to place her in a facility. The psychologist used this information to develop a treatment plan that included caregiver education and support and set realistic expectations around the patient's success given his caregiving responsibilities.

## Challenges

### Role Confusion and Establishing Professional Boundaries

With the many advantages of providing care in the home setting come a number of challenges. While the patient may feel more comfortable in their home, it can be difficult to establish a professional tone outside the controlled and predictable office setting. The physical signs that assist with role establishment, such as a standardized meeting space and a waiting room, are absent during home visits leading the patient to perceive the session as more of a social visit than a professional one (Yang et al. 2009).

The informal setting may increase the patient's perception of the psychologist as a friend or family member resulting in role confusion and more time spent engaging in small talk than in therapy (Knapp and Slattery 2004). The patient may request assistance with tasks that are outside the clinician's role or scope of practice such as transfers, explanation of bills, and assistance with cleaning. The clinician may be pulled to assist with these tasks and may experience feeling overwhelmed, burdened, or anxious when exposed to significant needs in the home or requests to function outside one's traditional scope. This can lead to the clinician actively fixing the problems, instead of empowering the patient (Yang et al. 2009). The home care psychologist must consistently weigh the pros and cons of assisting a patient with safety concerns versus supporting independence and autonomy.

Within the home setting there also are more opportunities to experience unusual or challenging behaviors, and boundary crossings are more likely to occur (Knapp and Slattery 2004). Clarifying the referral question prior to the visit, as well as explaining the psychologist's role and the purpose of the visit during the initial session, can help decrease role confusion and maintain professional boundaries (Hicken and Plowhead 2010). The psychologist may wish to reiterate the role of the psychologist throughout service delivery to help clarify roles (Knapp and Slattery 2004). If needed and appropriate, the HBPC psychologist can collaborate with and refer to other members of the interdisciplinary team to address those concerns outside the psychologist's role, such as seeking assistance from the social worker to connect the patient to needed resource or from the dietician to assist with nutritional concerns. At the same time, an HBPC psychologist might find a patient in a situation where ethical practice dictates that she complete a task outside of her defined role (Yang et al. 2009). For example, if a clinician arrives for a home visit and is informed that the patient, who lives alone and is at high risk for falls, has not set up his medical alert system due to physical limitations, the clinician may feel an ethical responsibility to assist the patient with that task prior to completing the home visit.

### Privacy and Disruptions

Unexpected interruptions are common during home visits, including telephone calls, bathroom breaks, other visitors arriving, family pets, and television noise. Psychologists can help limit distractions by selecting a quiet area in the patient's home and arranging the seating, but often this is difficult due to small living spaces, limited seating options, and noise outside of the clinician's control. It is vital to review with the patient and their family, if present, the importance of a distraction free area for sessions early and often (Hicken and Plowhead 2010). This is particularly true when administering standardized assessment measures, such as brief cognitive assessments, whose validity can be threatened by interruptions. Asking the patient to turn off his or her cell phone and alerting others in the home that an assessment is being completed can limit threats to assessment validity.

Helpful information can be gathered from observing the patient's response to interruptions, such as how the patient interacts with others and if the patient utilizes interruptions to regulate the intensity and content of the therapy sessions (Yang et al. 2009). For example, when a patient who usually does not respond to family members who walk through the session area engages in a lengthy and unrelated conversation with his daughter one session, it may be helpful to discuss the purpose or function of the behavior as part of the therapeutic process.

### Ethics

Challenging ethical dilemmas can arise during in-home service provision. Maintaining confidentiality, a primary tenet of the relationship between a mental health provider and patient, can be particularly hard in home care (Blass et al. 2006). There are many threats to confidentiality during a home visit starting with gaining access to the patient, who may reside in a facility or live in a home with multiple other people (Yang et al. 2009). For example, a fellow assisted living facility resident may request information about who the provider is and which resident is receiving services. This can be addressed by using nonspecific, but correct responses, such as stating

the provider's name and company, without stating the explicit reason for the visit. This is done both to maintain the privacy and confidentiality of the patient without impacting the psychologist's ability to access the patient.

Once in the patient's home, a caregiver or family member may feel reluctant to leave a provider alone with the patient as they may feel responsible for the patient or curious about the nature of the visit. Patients may at first consent to having a family member or caregiver present during the session without a full understanding of the personal topics discussed. Clinicians also must be aware of the "illusion of privacy" where sessions, thought to be private, are overheard intentionally or not by others in the home (Hicken and Plowhead 2010). A lack of privacy and fear of being overheard may result in patient avoidance of potentially important topics, such as family conflict, or the expression of negative emotion for fear of concerning a family member. The clinician must provide education on the rationale and importance of confidentiality early on and frequently throughout service delivery. The clinician can engage the patient in problem-solving ways to increase confidentiality (i.e., white noise maker, sit in the backyard, utilize available office space at an assisted living facility) (Hicken and Plowhead 2010).

Of particular importance when providing care in the home setting is a clear review of mandated reporting requirements. Observation of possible self-neglect, elder abuse, and child abuse are more likely to occur during home visits than in traditional settings. Depending on the clinical situation, the clinician may engage the patient in the reporting process to reduce anxiety and provide education on what to expect (Yang et al. 2009).

The nature of home visits, in which the provider goes to the patient, may make undue influence a greater concern (Yang et al. 2009). Without the option of "no showing," it is more difficult for patients to passively avoid sessions or terminate therapy. Patients may then continue with services that they are not actively interested in resulting in limited progression on treatment goals (Blass et al. 2006). Knowing that the psychologist is part of the larger primary care team also may

make it more difficult for the patient to refuse services or terminate. The clinician must remain mindful of these potential effects and address them within the therapeutic relationship.

The increased intimacy of the setting may lead to more frequent offerings of food and drinks and gift giving. The clinician must regularly weigh the pros and cons of accepting small gifts or food as a means to enhance rapport or refusing them as a means to establish and maintain professionalism (Yang et al. 2009). The cultural meaning of food and gift offerings must be considered when weighing the pros and cons of acceptance.

### Safety

All professional homecare providers confront a number of safety concerns on a regular basis. Common concerns include weapons in the home, the presence of unknown family members or acquaintances, and intoxicated patients or caregivers. Beyond the potential safety concerns in a patient's home, the home care psychologist must also be mindful of safety concerns in the patient's building and neighborhood. HBPC policies and experienced home care psychologists recommend the following safety precautions when providing care in a home setting (Hicken and Plowhead 2010; Yang et al. 2009):

- Prior to a home visit, evaluate safety risks by reviewing the patient's chart for a history of violence.
- Call ahead to review program policies regarding weapons, substance use, and family pets.
- If the clinician senses a threat to safety at any time, leave immediately without fearing judgment from the treatment team.
- Position seating so the clinician is in between the patient and the exit.
- Conduct a joint visit with another team member if safety is a concern.
- Carry a cell phone with emergency numbers programmed in at all times.

- Provide a schedule of home visits to other team members so they are aware of the clinician's whereabouts.
- Discharge or refuse to admit patients who may be a danger to staff.

### Competence

Since there are no published guidelines or standards of practice for home-based psychology, HBPC psychologists may wish to refer to the American Psychological Association guidelines for working with older adults and competencies for psychology practice in primary care (American Psychological Association 2004; McDaniel et al. 2014). Similarly to psychologists operating in rural settings, HBPC psychologists may come across patients whose treatment needs exceed the clinician's training (Hicken and Plowhead 2010). In these cases, it is vital that HBPC psychologists consult with colleagues, complete additional training when indicated, and/or assist patients with locating appropriate services either through the VA or in their community.

## Summary and Conclusions

Due to the shifting demographics and increasing rate of chronic illness, health care delivery systems across the world must look for ways to meet the needs of medically complex, frail, homebound elders for whom traditional, office-based primary care does not serve well. This has led to the creation of home-based primary care (HBPC) programs. Interdisciplinary teams come together in HBPC to provide longitudinal, comprehensive primary care in the homes of their patients. While several variations of HBPC exist, the VHA HBPC model is unique in that it includes mental health practitioners, usually doctoral-level psychologists, as members of the interdisciplinary team to provide for the mental health needs of the aging veteran. The inclusion of psychologists in HBPC creates the opportunity for new ways to think about models of psychological assessment and clinical intervention,

as well as challenges and advantages to psychological practices in the home.

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## Hong Kong Centenarian Study

Bobo Hi-Po Lau<sup>1</sup> and Karen Siu-Lan Cheung<sup>2</sup>

<sup>1</sup>Faculty of Social Sciences, The University of Hong Kong, Hong Kong, China

<sup>2</sup>Sau Po Centre on Ageing and Department of Social Work and Social Administration, The University of Hong Kong, Hong Kong, China

## Synonyms

Centenarians; Chinese; Health; Hong Kong SAR; Successful aging

## Definition

This chapter synthesizes the findings of the Hong Kong Centenarian Study (HKCS). Based on multidimensional models of successful aging, this chapter evaluates the levels of physical, functional, psychological, and social well-being of Chinese centenarians in Hong Kong. Extant models of successful aging were applied to the current dataset to estimate the percentages of successful agers among this group of exceptional survivors using different operational criteria.

## Introduction

The growth in the proportion and number of elderly people has become a salient feature of population in many parts of the world (United Nations 2013). The rise is particularly prominent among the oldest-olds (i.e., individuals aged 80 or above). It is expected that by 2100, the world's population of oldest-olds will increase sevenfold, from 120 million in 2013 (14% of the total population) to 392 million in 2050 (19%) and to 830 million in 2100 (28%). China, in particular, is forecasted to have 90 million of oldest-olds by 2050 and become the country with the largest

oldest-old population. Meanwhile, the population of centenarians (i.e., individuals age 100 or older) will grow at an even faster rate, from 441,000 in 2013 to 3.4 million in 2050 and to 20.1 million in 2100, which is 45 times of the population of 2013.

Similar to the worldwide case, with a population of approximately 7.1 million, the segment of the oldest-olds is projected to grow from about 318,100 in 2014 (4.4% of the total population) to 1,144,300 in 2064 (14.7%) in Hong Kong (Census and Statistics Department, HKSAR 2015). The growth rate is more than twice of that of their younger counterparts (age 60–79). The population of centenarians (from 289 persons in 1981 to 1,890 persons in 2011) also increased quickly, such that by the near future these long-lived individuals will become a commonplace in Hong Kong society (Cheung et al. 2012).

Centenarians are of interest to gerontologists, geriatricians, physicians, and researchers of a wide repertoire of disciplines because they depict what life is like at the extreme of longevity. The health and well-being profiles of these exceptional survivors are valuable to the study of both successful and pathological aging processes (Gondo 2012; Rowe and Kahn 1997). The lives of these individuals can illustrate how the body, mind, and social networks adapt to the (almost) inevitable biological aging process; how early life experiences and habits affect quality of life at the end of the lifespan; as well as how important values such as life satisfaction, happiness, successes, and health are redefined and achieved in spite of waning socioeconomic resources and functional capacities. In all, centenarians are valuable to the study of multiple disciplines as they depict the “what” and “how” of successful aging and “why” they can survive to such an extreme old age (Arnold et al. 2010). In the light of the quickly aging population in Hong Kong and the Chinese population at large, the Hong Kong Centenarian Study (HKCS) sought to understand successful aging especially at the extreme of longevity. HKCS represents the first centenarian study in the territory (Cheung et al. 2012; Wong et al. 2014). This chapter reports the methodology of the study and provides a brief overview of the lives of Hong Kong centenarians based on their performance in

multiple dimensions of successful aging – physical health, functional health, psychological well-being, activities and health habits, and social well-being (Bowling and Dieppe 2005).

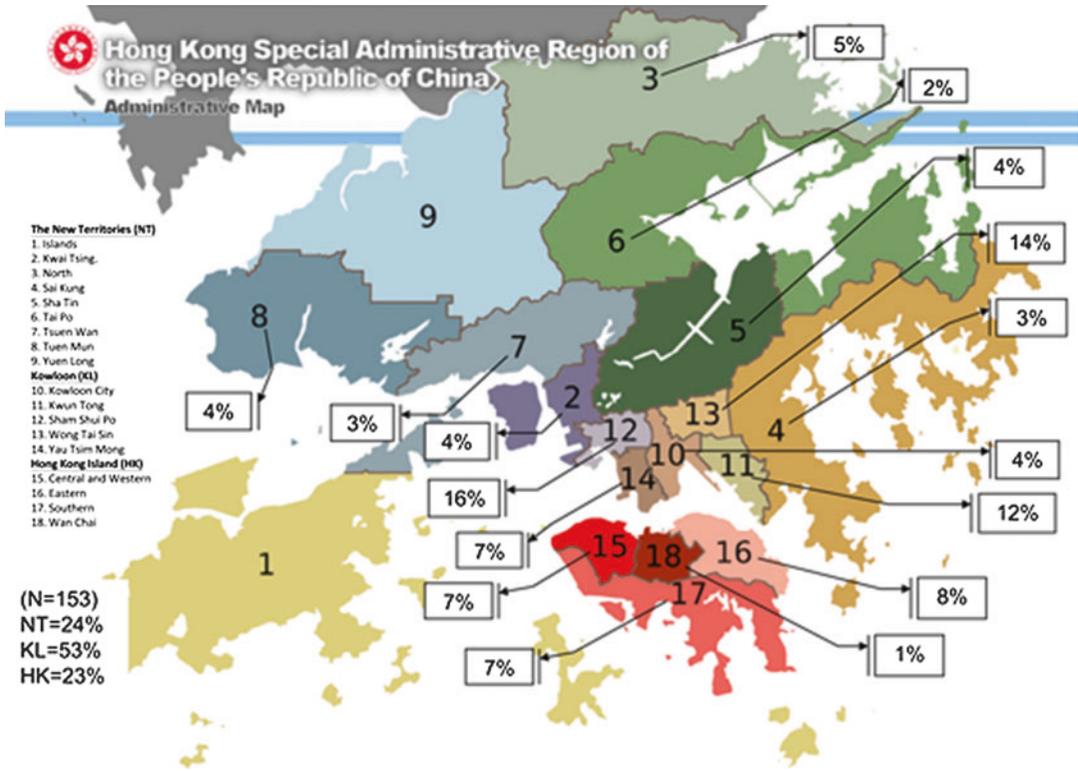
## Methodology

### Sampling

One hundred and fifty-three Cantonese-speaking Chinese near-centenarians and centenarians who were born between 1905 and 1915 were interviewed in April to September, 2011. In order to recruit a geographically representative sample, a quota sampling method was used according to the proportion of oldest-olds aged 85 or above in the 18 Geographical Constituency Areas (GCAs) of the territory (see supplementary Fig. 1). In the census data of Hong Kong, the oldest age group with geographical distribution information is 85 years old and above. No geographical distribution information about centenarians in specific is publicly available. Recruitment was conducted through two social and clinical networks. First, through the auspices of the Hong Kong Council of Social Service (HKCSS), 628 letters of invitation were sent to day care centers, district elderly community centers, neighborhood elderly centers, social centers for the elderly, home support team throughout the territory, and the University of the 3rd Age (U3A) centers. Two hundred near-centenarians and centenarians were reached. Among them, 56 elders participated (participation rate 28%) in the study. Second, based on the database of Elderly Health Clinics (EHC) of the Department of Health (DH) of the Hong Kong Special Administration Region Government, 210 letters of invitation were sent to eligible elders, and 97 of them (participation rate 46%) participated in the study.

### Procedures

A face-to-face interview was arranged within 2 weeks after the participant had expressed interest in participating in the study. Prior to the any study procedures, a written informed consent was sought from the participant. In cases where the participant failed to exhibit sufficient cognitive



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**Hong Kong Centenarian Study, Fig. 1** Distribution of participants across the 18 geographical constituency areas (GCA) of Hong Kong

capacity to offer consent, proxy consent was sought. At least one family member and/or registered social worker were present and witnessed the signing of the consent form and the interview.

Each participant was interviewed once in their home or affiliated elderly service center/care facility. The interview was structured and took around 1.5–2 h. During the interview, a battery of questionnaires and a physical examination were conducted. The questionnaires were based on two validated instruments – the 2008 version of the Chinese Longitudinal Healthy Longevity Survey (Zeng 2008) and the Elderly Health Center questionnaire from the Department of Health, HKSAR Government) – and was piloted in 2010 (Cheung et al. 2012). The questionnaires covered questions on physical health, subjective health, functional health, psychological well-being, daily activities, social and healthcare needs and service utilization, and demographics. The

physical examination involved a handgrip strength test, a sit-to-stand test, and several other on-site tests of physical performances. After the administration of the questionnaires and the physical examination, participants were invited to participate in a blood test. Upon obtaining another written informed consent, 20 ml venous blood was taken by the phlebotomist. No proxy was allowed for blood taking. A total of 102 participants participated in the blood test. Analyses on the levels of 33 biomarkers (e.g., albumin, C-reactive protein, hemoglobin, glycated hemoglobin, high- and low-density lipoproteins) were conducted in the laboratory of the Queen Mary Hospital, Hong Kong. The Human Research Ethics Committee for Non-Clinical Faculties of the University of Hong Kong and the Ethics Committee of the Department of Health provided research ethics approval for all procedures.

## Results

### Demographic Characteristics

A scrutinized age cross-checking was performed based on at least one official document from the participants, such as the Hong Kong identity card (HKID), as well as their reported Chinese lunar zodiac year and the age of their children. Among the 153 cases, three females were found to have their self-reported ages (SRA) being notably inconsistent with their years of birth appeared on the HKID. The ages of another three cases were not verified successfully due to the absence of HKID and participants' total loss of cognitive capacity. For the latter three cases, the ages of the participants were reported by their proxy. Apart from these six cases, there were 33 cases (6 males and 27 females; 22.5% of 147 cases) with SRA being 1 year older, following the traditional Chinese culture to declare a year older than the actual age. The mean (SD) of SRA was 97.7 (2.4) years. 126 participants were between 95 and 99 years old. The remaining 27 participants were aged 100 or above, with the oldest being 108 years old.

Most of the participants were female (77.8%). The percentage of female participants among the age group of 95–99 was 78.6% (i.e., 99 participants), whereas the ratio among centenarians (aged 100 or above) was 74.1% (i.e., 20 participants). The majority of the sample was born in the rural area (63.4%) and in the Mainland China (83.7%). Half of the sample was coresiding with their family members or friends (50.3%), with the rest of them either living alone (30.7%) or in a care facility (19.0%). The median annual household income per head was HKD \$36,000 (USD \$4,643.51). About 42.1% participants fell into this category (HKD \$30,000 to HKD \$39,000). Less than 10% had an annual household income (per head) of HKD \$80,000 or more. 85.6% participants reported the socioeconomic status as “similar,” “wealthier,” or “much wealthier” compared to most local households. In terms of education attainment, slightly more than half of the sample did not attend any schooling (55.9%), 33.3% attended some primary education (equivalent to 1–6 years of schooling), while

only a minority attained more than 6 years of education (10.5%).

### Subjective and Physical Health

Participants generally had favorable evaluations of their overall health despite their advanced age. In terms of the overall subjective health, 39.8% reported having “good” or “very good” health, while 39.2% evaluated their health as being “moderate.” More important, 47.0% reported their health as being “much better” or “better” than their same-aged peers, while 32.7% remarked their health being just similar to their peers. When asked to compare their health to the condition 1 year ago, a significant portion of participants did not perceive any significant differences (38.6%). A small proportion of participants (10.5%) even reported improvements in their health.

In fact, chronic diseases were common among the participants. Out of a list of 30 common elderly chronic diseases, the mean (SD, range) number of self-reported diagnosis was 2.9 (1.9, 0–9; see Table 1).

The most common diseases were cataract and hypertension. Other diseases such as diabetes, fractures, and gout were also common. Serious cerebrovascular/cardiovascular diseases such as strokes, congestive heart failure, and coronary heart disease were relatively uncommon; the same was the case for cancer (in the previous 5 years) and chronic obstructive pulmonary diseases among near-centenarians and centenarians. Only 3.9% and 1.3% were diagnosed as suffering from Alzheimer's disease and other psychiatric diseases, respectively. The average Charlson age-adjusted comorbidity index (Charlson et al. 1987), which covers serious health conditions including, among other diseases, coronary heart disease, congestive heart failure, stroke, dementia, chronic pulmonary diseases, stomach ulcer, moderate to severe renal failure, cancer, liver diseases, and diabetes, was 6.6 with a SD of 1.4.

Table 2 provides the results of the biomarker analysis. Based on the normal ranges for average adults (age 20–79) (Expert Panel on Detection, Evaluation, and Treatment of High Blood

**Hong Kong Centenarian Study, Table 1** Distribution of self-reported diagnosis of 30 chronic diseases

Diseases	Diagnosis <i>n</i>	%
1. Cerebrovascular accident/stroke	11	7.2
2. Congestive heart failure	11	7.2
3. Coronary heart disease	19	12.4
4. Hypertension	99	64.7
5. Irregularly irregular pulse	13	8.5
6. Peripheral vascular disease	0	0.0
7. Alzheimer's disease	6	3.9
8. Dementia other than Alzheimer's disease	0	0.0
9. Head trauma	0	0.0
10. Hemiplegia/hemiparesis	1	0.7
11. Multiple sclerosis	2	1.3
12. Parkinsonism	0	0.0
13. Epilepsy	0	0.0
14. Arthritis	18	11.8
15. Hip fracture	19	12.4
16. Other fractures (e.g., wrist, vertebral)	20	13.1
17. Osteoporosis	19	12.4
18. Cataract	115	75.2
19. Glaucoma	7	4.6
20. Any psychiatric diseases	2	1.3
21. Pneumonia	8	5.2
22. Tuberculosis	3	2.0
23. Urinary tract infection (in previous 30 days)	4	2.6
24. Cancer (except skin cancer, in previous 5 years)	5	3.3
25. Diabetes	20	13.1
26. Emphysema/chronic obstructive pulmonary diseases/asthma	13	8.5
27. Renal failure	3	2.0
28. Thyroid disease	4	2.6
29. Gout	20	13.1
30. Stomach ulcer	9	5.9

Cholesterol in Adults 2001), more than 80% participants had shown normal levels on white blood cell, neutrophil, monocyte, eosinophil, basophil, C-reactive protein, cholesterol, sodium, chloride, total protein, globulin, total bilirubin, alkaline phosphatase, alanine aminotransferase, and aspartate aminotransferase. A significant proportion of participants fell out of the normal range on

creatinine (percentage of participants outside normal range = 63.7%), red blood cell distribution width (48.0%), and platelet (48.0%). Nonetheless, it is noteworthy that the ranges considered as “normal” were derived from average adults aged between 20 and 79 years old. It is possible that some of these benchmarks have to be readjusted to cater for the advanced age of the sample.

Most participants reported no physical discomfort within the previous 2 weeks of data collection (73.9%) and experienced good quality of sleep (62.7%). The mean (SD) systolic and diastolic blood pressures were 137.9 (23.0) mmHg and 80.3 (13.8) mmHg. Most participants (86.3%) had regular pulse rates. Of particular note, 45.8% reported having had one or more episodes of illness or accident in the previous 2 years that required hospitalization. Days of hospitalization ranged from 0 to 365, with a median of 12 days. One in five participants (20.9%) had experienced a fall in the previous 6 months. Regarding their oral health, slightly more than half of the sample (58.8%) was completely edentulous. The range of remaining teeth was 1–24, with an average (SD) of 3.3 (5.4). Three participants (2.1%) had 20 remaining teeth or more. Nonetheless, 74.5% wore dentures to assist oral functions. 19.6% participants had a weight loss of more than 3 kg in the previous 6 months. However, most (61.4%) had maintained a normal body mass index (BMI) of 18.5–24.9 kg/m<sup>2</sup>. The average (SD) BMI was 21.7 (3.5) kg/m<sup>2</sup>. The mean (SD) handgrip strength of the right and the left hands were 13.1 (5.8) kg and 12.7 (5.6) kg, respectively.

Frailty, as a physiologic systematic vulnerability to resolve to homeostasis after a stressful event (e.g., a fall accident), is common among very old individuals (Morley et al. 2013). Based on the definition of the International Academy on Nutrition and Aging (IANA), frailty is measured as a phenotype reflected by the combination of feelings of Fatigue, diminished capacity for Resistant and Aerobic activities, presence of five or more chronic diseases (Illnesses), and substantial Loss of weight (IANA-Frail scale; see Table 3). Accordingly, most of the participants fell into the intermediate category of “pre-frail” (56.2%). The proportions of participants in the non-frail and

**Hong Kong Centenarian Study, Table 2** Biomarkers levels ( $N = 102$ )

Biomarkers	Unit	Normal range <sup>a</sup>	Normal; $n$ (%)	Mean	SD	Minimum	Maximum
White blood cell (WBC)	mm <sup>3</sup>	4.4–10.1	86 (84.3)	6.1	1.9	3.2	16.2
Red blood cell (RBC)	K/mm <sup>3</sup>	3.8–5.1	64 (62.7)	4.0	0.6	2.0	6.0
Hemoglobin (HGB)	g/dL	11.7–14.8	61 (59.8)	11.8	1.4	7.6	14.9
Hematocrit (HCT)	%	0.340–0.440	72 (70.6)	0.359	0.041	0.228	0.432
Mean corpuscular volume (MCV) MmL	FL	82.0–96.9	73 (71.6)	90.2	8.8	67.6	111.6
Mean corpuscular hemoglobin (MCH)	pg	27.5–33.4	78 (76.5)	29.8	3.3	20.8	37.6
Mean corpuscular hemoglobin concentration (MCHC)	%	33.0–36.0	60 (58.8)	33.0	1.1	29.1	34.9
Red blood cell distribution width (RDW)	%	11.7–14.0	53 (52.0)	14.2	1.3	12.6	22.1
Platelet (PLT)		179–380	53 (52.0)	187.7	52.5	98.0	356.0
Neutrophil	%	2.2–6.7	88 (86.3)	3.8	1.4	1.7	9.6
Lymphocyte	%	1.2–3.4	80 (78.4)	1.7	0.7	0.1	6.1
Monocyte	%	0.20–0.70	97 (95.1)	0.4	0.17	0.13	1.20
Eosinophil	%	0.00–0.50	92 (90.2)	0.2	0.19	0.00	1.12
Basophil	%	0.00–0.10	101 (99.0)	0.03	0.02	0.00	0.10
C-reactive protein (CRP)		<8.0	88 (86.3)	5.5	8.6	1.0	58.0
Cholesterol	mg/dL	<5.2 desirable	82 (80.4)	4.4	0.8	3.0	6.3
Triglycerides	mg/dL	<1.7 desirable	74 (72.5)	1.4	0.9	0.5	6.3
High-density lipoprotein cholesterol (HDLC)	mg/dL	<sup>b</sup>		1.4	0.4	0.7	3.2
Low-density lipoprotein cholesterol (LDLC)	mg/dL	<sup>c</sup>		2.4	0.6	1.1	4.2
Non-high-density lipoprotein cholesterol (non-HDLC)	mg/dL	<sup>d</sup>		3.0	0.8	1.6	5.2
Glycated hemoglobin (HbA1c)	%	4.0–6.0	60 (58.8)	6.1	1.0	5.0	14.0
Sodium	mEq/L	136–148	97 (95.1)	142.4	3.0	134.0	149.0
Potassium	mEq/L	3.6–5.0	66 (64.7)	3.7	0.4	2.8	4.5
Chloride	mEq/L	100–109	89 (87.3)	104.4	3.5	93.0	112.0
Urea	mmol/L	2.9–8.0	62 (60.8)	8.0	2.6	3.8	17.8
Creatinine	μmol/L	49–82	37 (36.3)	95.6	29.2	47.0	200.0
Total protein	g/L	67–87	93 (91.2)	73.7	5.6	58.0	87.0
Albumin	g/L	39–50	61 (59.8)	39.5	3.2	31.0	47.0
Globulin	g/L	26–40	89 (87.3)	34.1	5.1	21.0	51.0
Total bilirubin	U/L	4–23	101 (99.0)	9.0	4.4	4.0	24.0

(continued)

**Hong Kong Centenarian Study, Table 2** (continued)

Biomarkers	Unit	Normal range <sup>a</sup>	Normal; <i>n</i> (%)	Mean	SD	Minimum	Maximum
Alkaline phosphatase (ALP)	U/L	47–124	95 (93.1)	77.9	37.1	37.0	368.0
Alanine aminotransferase (ALT)	mU/mL	8–25	93 (91.2)	18.6	26.6	6.0	265.0
Aspartate aminotransferase (AST)	mU/mL	15–37	92 (90.2)	28.5	12.0	14.0	110.0

<sup>a</sup>Normal range adopted herein mainly infers to the normal adults based on the executive summary of the third report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) (Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults 2001)

<sup>b</sup><3.4 (2 or more risk factors); < 4.1 (0–1 risk factor)

<sup>c</sup><2.6 (for persons with coronary heart disease or coronary heart disease risk equivalents); <3.4 (2 or more risk factors); < 4.1 (0–1 risk factor)

<sup>d</sup><3.4 (for persons with coronary heart disease or coronary heart disease risk equivalents); <4.2 (2 or more risk factors); < 4.9 (0–1 risk factor)

**Hong Kong Centenarian Study, Table 3** Distribution of frailty items and phenotypes

Frailty item	Question	Deficit, <i>n</i>	Deficit, %
Fatigue	Feeling full of energy?	38	24.8
Resistance	Able to crouch and stand for three times consecutively?	47	30.7
Aerobic	Able to walk continuously for 400 m at a time by yourself?	91	59.5
Illnesses	Having five or more chronic diseases?	14	9.2
Loss of weight	Lost 3 kg in the previous 6 months?	30	19.6
<b>Frailty phenotypes</b>		<b><i>n</i></b>	<b>%</b>
Non-frail (no deficit)		30	19.6
Pre-frail (1–2 deficits)		86	56.2
Frail (≥3 deficits)		37	24.2

frail categories were 19.6% and 24.2%, respectively.

According to the results of the physical examinations, most participants had intact mobility in

upper extremities (95.4% were able to touch the back of neck and waist by both hands, and raise both arms), were able to pick up a book on the floor from standing (71.9%), were able to stand up from sitting in a sturdy chair without supportive device (53.6%), and could complete a 360° turn within seven steps (62.1%). Very few participants had sensory impairment to the extent that had hindered their participation in the physical examination. Two participants (1.3%) were visually impaired such that their physical examination was hindered, but had intact (or corrected-to-normal) auditory functions. Six (3.9%) participants had auditory impairments that impeded the physical examination, but had intact (or corrected-to-normal) visual function. Another six participants (3.9%) had both visual and auditory impairments. 9.8% participants wore an assistive device to help with their hearing during the interview.

In sum, chronic diseases were found to be common among Hong Kong Chinese centenarians. Around half of the sample had experienced hospitalization in the previous 2 years when they were already nonagenarians or even centenarians. However, physical discomfort and sleep problems were not common. Most participants had fewer than three signs of frailty. 56.2% participants were

**Hong Kong Centenarian Study, Table 4** Distribution of ADL and IADL independency

Independency in ADL	<i>n</i>	%
Bathing	113	73.9
Dressing	130	85.0
Toileting	138	90.2
Indoor transfer	137	89.5
Continence	110	71.9
Feeding	149	97.4
<b>Number of dependent ADL</b>	<b><i>n</i></b>	<b>%</b>
None	85	55.9
1–2	49	32.2
≥3	18	11.9
<b>Independency in IADL</b>		
Shopping	81	53.3
Prepare meals	89	58.2
Washing clothes	109	71.7
Using public transport	54	35.8
Telephoning	127	83.0
Handling finances	128	84.2
<b>Number of dependent IADL</b>		
None	54	35.3
1–2	35	24.9
≥3	64	41.8

categorized as pre-frail. In the light of the robust effect of subjective health on mortality and morbidity (Idler and Benyamini 1997), the most encouraging finding was that despite their advanced age, most participants had preserved a favorable evaluation of their physical health.

### Functional Capacity

55.9% and 35.3% participants were respectively independent on all six activities of daily living (ADL; bathing, dressing, toileting, indoor transfer, continence, and feeding) (Katz et al. 1963) and six instrumental activities of daily living (IADL; shopping, preparing meals, washing clothes, using public transport, telephoning, and handling finances) (Lawton and Brody 1969) (See Table 4). The average (SD) number of dependent ADL and IADL were 0.9 (1.4) and 2.1 (2.1). The tasks which most participants required assistance were using public transport, shopping, and preparing meals.

The mean (SD) MMSE score from 140 participants who provided valid answers on more than

**Hong Kong Centenarian Study, Table 5** Distribution of GDS-SF scores

Scores	<i>n</i>	%
0 (not depressed)	60	39.2
1–4 (slightly depressed)	57	37.3
5–9 (mildly depressed)	19	12.4
10–15 (moderately to heavily depressed)	11	7.2
Excluded cases (with less than 10 valid items)	6	3.9

ten items of the test was 24.0 (4.7). Out of these 140 participants, 73.6% obtained a MMSE score of 21.0 or more, which indicates intact cognitive capacity (Chiu et al. 1994).

### Psychological Well-Being

Most participants enjoyed a high level of psychological well-being, indicated by a low level of depression, suicidal ideation, and negative psychological traits, as well as a high level of positive psychological traits. Depression was measured by the 15-item Geriatric Depression Scale – Short Form (GDS-SF) (Sheikh and Yesavage 1986). The mean (SD) GDS-SF score was 2.5 (3.6). A substantial percentage of participants scored 0 (i.e., no depressive symptoms), while 19.6% scored above 5.0 which indicates a depressive tendency (see Table 5).

Suicidal ideation was also rare, with only 3.3% participants answering “agree” or “strongly agree” to the items “want to end my life” and “have thought about suicide” at the time of the data collection. Negative psychological traits such as meaninglessness (“agree” and “strongly agree”: 3.3%), anxiety (“always” and “often”: 5.9%), and loneliness (“always” and “often”: 7.8%) were not commonly experienced. However, a much higher proportion of participants (34.6%) responded “always” and “often” on the item “feeling more useless as one gets older.” The pattern of responses implies that negative affect and meaninglessness were uncommon among the current sample. However, the perception of uselessness was relatively prevalent among this group of very old adults.

Participants tended to experience substantially more positive psychological traits than negative

psychological traits. 81.0% responded that they were “able” and “very much able” to “look on the bright sides of things (optimism).” 79.1% “liked” and “very much liked” to “maintain their belongings clean and tidy (conscientiousness).” 73.2% could often “make their own decisions (autonomy).” More importantly, 66.6% replied that they “often” or “always” felt they were “as happy as when (they were) young (happiness).”

### Daily Activities and Health Habits

The majority of participants were nonsmoker (72.5%) and nondrinker (74.5%) even the past. Only 26.2% and 23.5% had a history of regular smoking and drinking, respectively. Most participants ate fruits (81.7%), vegetables (81.7%), meat (62.1%), and fish (79.1%) (almost) daily. 77.1% maintained a habit of regular exercises. In terms of daily activities, 82.4% watched television or listened to the radio, 50.3% had solitary outdoor activities (e.g., taking a walk in the parks), and 39.2% did household chores. Despite their advanced age, around one in seven (13.8%) participants had traveled abroad for leisure in the previous 2 years.

### Social Well-Being

Reflecting the advanced age of the participants, only 9.2% were still married and living with their spouse. Most participants were bereaved (81.0%). Also, only about one-third (31.3%) of the sample still had one or more living siblings. Instead, most participants (77.8%) had more than one living children. The median number of living children was 3 (range = 1–8). Most participants (58.2%) reported to have a spouse or child to confide to when they need emotional support. Other common confidants include friends and neighbors, grandchildren and their spouses, and other relatives. However, it is noteworthy that 14.4% of the sample reported having no one to turn to when they need confidants.

Among the 77 (50.3% of the total sample) participants who lived with either family members or friends, 68.8% lived with their children or grandchildren only, 10.4% lived with their spouses only, and only 5.2% lived with both children/grandchildren and spouse. Domestic

helpers are common among Hong Kong households. Among those 77 participants, 26.0% coresided with a domestic helper. Among these households with domestic helpers, half of them were two-person households with only the elderly participant and his/her domestic helper. The domestic helpers tend to shoulder a substantial proportion of elderly care in these households.

In terms of social activities (e.g., visiting relatives, meeting friends at a restaurant, clubs and religious group gatherings, volunteerism), 28.1% of the sample attended social activities almost daily and 18.3% have weekly social gatherings. However, alarmingly, almost equally many participants (44.5%) reported having social activities at a frequency less than monthly. Some barriers including mobility and health issues, lack of company, transportation problems, and lack of toileting facilities may hinder participants' participation in social activities. Out of ten barriers of social activities, the average (SD) number of barriers participants were facing was 2.2 (1.8).

### Successful Aging

There is little dispute that centenarians would have fulfilled “successful aging” if longevity alone is enough to define the elusive concept. However, as Havighurst (Havighurst 1961) proposed when the term was first coined, successful aging is to “add life to years” and should be about maximizing quality of life and happiness of the elderly. To investigate the phenomenon of successful aging among very old adults, previous studies have tested the utility of multidimensional models of successful aging on nonagenarians and centenarians (Cho et al. 2012; Nosraty et al. 2012).

Rowe and Kahn (Rowe and Kahn 1997) model of successful aging conceptualizes the condition as the combination of: (a) absence of diseases and disability, (b) intact cognitive and physical functioning, and (c) engagement with life. Based on this conceptual framework, Cho and associates (Cho et al. 2012) found that only 4.4% of their American centenarian sample achieved the criteria of intact cognitive and physical functioning. More remarkably, none of their centenarian

participants achieved all three criteria of the model. This model was subsequently applied to the current Hong Kong Chinese sample. The criteria for successful aging were operationalized as the combination of: (a) having none of the 30 chronic illnesses, (b) possessing a MMSE score of 21 or above, (c) independent in ADL, (d) having weekly social activities, and (e) not “often” or “always” feeling useless. Out of the 153 participants, only 2 (1.4%) were able to fulfill all the five criteria. However, the number of successful agers increased to 13 (8.5%) after the criterion for chronic illnesses was relaxed to only excluding those who have one or more serious health conditions covered by the Charlson age-adjusted comorbidity index.

Cho and associates (Cho et al. 2012) suggested an alternative model of successful aging which encompasses three criteria, namely good subjective health, perceived sufficiency of economic resources, and self-reported happiness. Compared to Rowe and Kahn’s model (Rowe and Kahn 1997), Cho and associates’ model places a greater emphasis on the role of subjective appraisals of coping resources (e.g., health, economic resources, and psychological resilience) over “actual” physical and cognitive capacity. The prevalence of successful agers in the current sample was therefore recalculated based on Cho and associates’ new model by operationalizing successful aging as the combination of: (a) “good” or “very good” overall subjective health, (b) evaluating one’s socioeconomic status as wealthier than most local households, and (c) “often” or “always” feeling “as happy as when (they were) young.” Sixteen participants (10.5%) attained successful aging. Compared to the model of Rowe and Kahn which places heavy emphasis on intact cognitive and physical functions as well as the absence of diseases, the model of Cho and associates renders a much larger proportion of the sample being included in the “successful ager” category.

Nosraty and colleagues (Nosraty et al. 2012) tested a multidimensional model of successful aging that has explicitly identified the biological, psychological, and social dimensions among an unselected sample of nonagenarians. Their results

neatly demonstrate that the proportion of successful agers depends heavily on the criteria one uses to define successful aging. Among the six models of different levels of difficulties they have tested, the most demanding model is similar to Rowe and Kahn (Rowe and Kahn 1997) and requires a successful ager to have no chronic diseases, no vision and hearing impairments, full independence in physical performance (indoor transfer, dressing, using stairs, getting out of bed, walking 400 m continuously), absence of depression, good subjective health, self-reported happiness, regular meeting with children, and phone calls with family members and friends. This demanding set of criteria rendered only 0.5% of their Finnish participants aged 94 or above being regarded as successful agers. However, the least stringent set of criteria, which involves no dementia, good vision and hearing, independence in physical performance, and regular meeting with children and phone calls with family members and friends, resulted in 7.8% of their older participants being categorized as successful agers.

The current sample was used to test the most and the least demanding models for successful aging of Nosraty et al. (2012) in order to illustrate how different repertoire of criteria will lead to disparate proportions of successful agers. In the attempt to reconstruct the most demanding model with a set of variables similar to the original study as possible, successful aging was measured based on the combination of: (a) the absence of coronary heart disease, congestive heart failure, cerebrovascular accident/ stroke, diabetes, arthritis, hip fracture, Parkinsonism, and Alzheimer’s disease; (b) absence of difficulties in indoor transfer, dressing, walking for 400 m continuously, sit-to-stand without supportive device, and crouch-to-stand for three times; (c) absence of vision and hearing impairments; (d) absence of depression indicated by a GDS-SF score of less than 5; (e) “good” or “very good” subjective health; (f) being “often” or “always” “as happy as when (they were) young”; (g) engaging in weekly or more often social activities; and (h) living with family members or friends. Only 3 out of the 153 (2.0%) participants in the current sample fulfilled all the criteria for successful aging. For the least demanding model

of Nosraty et al., the combination of criteria (b), (c), (g), and (h) was used, and the absence of multiple diseases (criteria (a)) was replaced with the absence of only Alzheimer's diseases. Similar to the original findings, 11 (7.2%) participants from the Hong Kong sample achieved all the criteria for successful aging.

In all, successful aging in multiple dimensions do not appear to be a common phenomenon among Hong Kong Chinese centenarians. Based on different sets of criteria for successful aging, the proportion of successful agers ranged from 1.4% to 10.5%. A successful aging model that stipulates more preserved functions and the absence of more chronic diseases tend to engender a lower proportion of successful agers than a model that is more heavily based on satisfaction on different dimensions of life.

## Conclusion

Despite the value of successful aging and centenarian research, a number of areas are awaiting further investigation. First, a greater understanding on how very old adults *themselves* define concepts such as quality of life and happiness are needed to validate extant conceptual models on successful aging. The qualitative study by Wong and associates (Wong et al. 2014) with six successfully aged Chinese centenarians from Hong Kong shows that maintaining positive relationships with neighbors and family and possessing a collection of positive memories are important keys to happiness. However, a positive expectation for the future (i.e., hope) did not feature heavily in centenarians' happiness. In fact, many participants remarked that their "clocks are ticking." Hence, living 1 day at a time and "think less" about the future is the way to stay happy in the tenth decade of their lives. Second, because aging population is a worldwide phenomenon and the elderly's lives tend to exemplify cultural imperatives more so than those of their younger counterparts, a greater understanding is needed on how cultural imperatives influence "what is successful aging" and "how to achieve successful aging." Third, following the footsteps of many

frontiers of longevity research, further investigation on how nature (e.g., genes, diseases) and nurture (e.g., pollutants, family norms) interact to engender longevity is needed. Similarly, greater understanding on how different domains of lives weave together and interact to produce positive outcomes is needed for gerontologists and geriatricians. As a result of their waning self-care capabilities and physical functioning, very old adults may experience a diminishing sense of autonomy and increasing depressive symptoms. Future studies may therefore explore how very old adults use different cognitive restructuring strategies to cope with these challenges. Also, studies on how different personality traits facilitate adaptation to senescence, how spirituality and social support counter the effect of the reduction in active engagement in daily activities, and how to enhance age-friendliness in the social and physical environment will be essential.

The "graying" of population is haunting policy-makers of most countries in the world. Alongside the increase in the elderly population is the reduction in the proportion of active labor force (usually referred to individuals aged 15 to early 60s). In other words, aging population may imply a drastic increase in social and healthcare service demands. However, the World Population Ageing report published by the United Nations in 2013 remarked that "On the positive side (...) older persons can increasingly live independently" (pp. xii) (United Nations 2013). In framing a public health response to population aging, WHO has therefore released the first *World report on ageing and health* to redefine the term of "healthy aging" which focuses on the notion of functional ability and intrinsic capacity underlying physiological changes and psychosocial changes, relevant environmental characteristics, and the interactions between the individual and these characteristics (Beard et al. 2015).

In coping with the challenges of the aging population, enabling a greater proportion of the elderly to become "successful agers" are equally, if not more, important than adjusting social and healthcare policies to cater for the ever-expanding demand. The knowledge of how near-centenarians and centenarians thrive in a buzzing

cityscape like Hong Kong, especially for those who have maintained much functional independence and social engagement, is imperative to enriching the understanding on successful aging in general. Our team has begun this line of inquiry by investigating successful aging and frailty of these exceptional survivors (Cheung and Lau 2015; Kwan et al. 2015). The lived experiences of near-centenarians and centenarians will inform researchers and policy-makers what health conditions are reasonable (versus less reasonable) to expect and achieve at the end of lifespan, how to support the oldest-olds to capitalize their personal and interpersonal resources to cope with the physiological and cognitive declines, and how to prepare the future seniors for a more successful all-rounded aging process.

## Cross-References

- ▶ [Chinese Longitudinal Healthy Longevity Study](#)
- ▶ [Georgia Centenarian Study](#)
- ▶ [Health in Centenarians](#)
- ▶ [Psychological Theories of Successful Aging](#)
- ▶ [Well-Being in Centenarians](#)

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Davis 1997). However, individuals with the necessary therapeutic skills and knowledge of horticulture may also use horticulture as a therapeutic modality in other credentialed practice, such as occupational therapy or physical therapy. Programs in horticultural therapy offer older adults physical, emotional, social, spiritual, and cognitive benefits.

## Background and History

Horticultural therapy is a relatively new discipline; however, recognition of the therapeutic effects of plants and horticulture dates back many centuries to 2000 BC and the lush agricultural landscapes of Mesopotamia and to Persian gardens, designed to please all of the senses, around 500 BC. During the Middle Ages, monastic gardens were used for growing medicinal plants and to provide places for the sick to dwell and recuperate. As well, in the late eighteenth and nineteenth centuries, hospitals and asylums encouraged patients into the gardens as a soothing distraction from their illnesses. In the 1940s, the US government established veterans' hospitals to care for wounded, returned servicemen. Working with plants in these hospital gardens, it was noted, resulted in remarkable improvements in their emotional, mental, and physical health.

The first formal training programs in horticultural therapy began in the United States in the early 1970s. However the term “horticultural therapy” was uncommon in the health sciences until the early 1980s, following the first systematic and empirical studies to examine the purposeful use of plants and gardening activities to improve or maximize an individual's social, cognitive, psychological, and physiological functioning (Kaplan 1973; Langer and Rodin 1976; Ulrich 1984). More recently, the use of horticultural therapy as a means of maintaining or improving the quality of life of older adults is gaining attention in the international literature. Studies have reported positive benefits of horticultural therapy for older adults that include relaxation and relief from stress (Kaplan 1973; Relf 1992; Scott et al. 2014), reduction in pain perception (Ulrich 1984),

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## Horticultural Therapy

Theresa L. Scott  
School of Psychology, The University of  
Queensland, St Lucia, QLD, Australia

### Synonyms

Horticulture therapy; Nature-assisted therapy; Social and therapeutic gardening; Therapeutic horticulture

### Definition

Horticultural therapy describes a process, either active or passive, of purposefully using plants and gardens in therapeutic and rehabilitative activities designed to positively affect a set of defined health outcomes for individuals (e.g., improved mood, improved self-esteem, enhanced social interaction). Horticultural therapy can include hands-on activities, such as potting up plants, or passive involvement such as viewing a garden through an open window and listening to birdsong. The focus is on multisensory experiences and engaging all of the senses. Horticultural therapists are trained professionals who possess knowledge in plant science, human science, and horticultural therapy and are experienced in the application of horticultural therapy practice (American Horticultural Therapy Association (AHTA) 2015;

increased attention (Hartig et al. 1991), modulation of agitation (Whall et al. 1997), improved mood, enhanced social interaction (Kingsley and Townsend 2006; Yee Tse 2010), meaningful engagement, improved self-esteem (Scott et al. 2014), and enhanced physical well-being (Wannamethee et al. 2000).

Indoor gardening has been reported to be effective for improving sleep, agitation, and cognition (Epstein et al. 1991) and improving the quality of life (Yee Tse 2010) of persons with dementia. Memory can be stimulated by being exposed to the sights and smells of plants in planned horticultural therapy activities (Hartig et al. 1991). Outdoor gardens provide access to fresh air and sunshine and exercise, which helps regulate circadian rhythms that regulate sleep and appetite (Park et al. 2009). Preliminary studies suggest that a carefully designed and accessible horticultural therapy garden may reduce the need for high-dose psychotropic drugs to treat behavioral disturbances in older adults with dementia in long-term care facilities (Epstein et al. 1991; Detweiler et al. 2012), although as is common in studies with this vulnerable group, sample size has been limited and more controlled studies are needed.

## Psychological Processes

Natural environments and their elements can act as a distraction, reducing stress and anxiety and promoting health and well-being. For example, prior research demonstrated that viewing nature through a window had physiological and psychological healing benefits postoperatively for patients who viewed the canopy of a large tree from their hospital beds, compared to those who viewed a brick wall (Ulrich 1984). Being in nature or viewing plants and gardens through a window or in pictures provides relaxation and restorative benefits. Using multiple modalities of measuring stress response – including blood pressure, pulse rate, electrodermal activity, electroencephalogram activity, salivary cortisol level, and self-reported mood states – numerous studies have reported that experiencing or being in view of nature, gardens, and plants helps regulate emotion, lowers stress levels, and fosters improved

mood (Detweiler et al. 2012; Relf 1992; Ulrich 1984; Ulrich et al. 1991).

One explanation for the stress-reducing effects of natural environments is that natural environments and their elements are less perceptually demanding than urban environments and require involuntary attention; they therefore provide restoration, a break from mental effort, and the capacity to recover from focused attention (Kaplan and Kaplan 1989). Furthermore, according to biophilia theory, people respond positively to natural environments and their elements because such a response is an evolved, adaptive one. From an evolutionary perspective, human beings are drawn to natural environmental features, such as plants, trees, and water, that are not only aesthetically appealing but would also have enhanced the survival of our species millions of years ago (Wilson 1984). According to the theory, humans have evolved with a capacity to prefer, and respond positively to, nature.

## Applications

Increasingly horticultural therapy programs facilitated by trained therapists are located in a wide variety of care settings, including hospitals, rehabilitation centers, residential care facilities, psychiatric care facilities, institutions, prisons, and special education programs, to positively affect patient and resident well-being (AHTA 2015). In these settings, horticultural therapy can be an active or passive process, which occurs in the context of an established treatment plan. The process itself is considered the therapeutic activity, rather than the end result (AHTA 2015).

Older adult participants, especially those living in long-term care facilities, may vary in their physical abilities, social skills, intellectual and emotional needs, and values. Horticultural therapy activities can be modified to meet the needs and preferences of individuals and designed to improve or maximize the participant's psychological, physiological, social, and cognitive functioning. People with physical and cognitive limitations, bed- or wheelchair-bound residents, can take part in meaningful and motivating

plant-related activities as part of a recreational therapy program. Since the frequency of participation in many occupational and leisure pursuits often declines with increasing age – a decline most acutely experienced by frail older adults – horticultural therapy makes a significant contribution to recreational and rehabilitative therapy programs in residential care facilities.

Planned horticultural therapy activities should be person centered and result from an individual assessment of the participant's current and optimal level of functioning, their personal preferences, and personal goals. According to the American Horticultural Therapy Association's (2015) practice standards, the therapist should (1) conduct an assessment of the individual that acknowledges their abilities and limitations; (2) develop an individualized intervention plan; (3) develop observable, measureable, behavioral goals (with the client); (4) document progress; and (5) review the intervention plan if necessary.

### Example Activities

Some example horticultural therapy activities include the following:

- Hands-on propagation of plants, plant cuttings, and seeds
- Potting up seedlings
- Observations of gardens, plants, and natural curiosities
- Flower arranging
- Smell-and-tell sessions, touch and identify familiar flowers, plants, fruits, and herbs
- Nature crafts, e.g., pressing foliage, making potpourri sachets
- Garden club discussion groups (e.g., recalling past gardens, seasons, learning Latin names of plants)
- Community outings (e.g., visiting public parks and gardens)

### Settings

Horticultural therapy programs can include group or individual activities that are conducted indoors,

outdoors in a covered area, or a garden. Whether group or individual, the sessions are goal directed and individualized to the client and have documented progress. Treatment goals may include the needs of the individual, such as achieving a sense of purpose, as well as the common goals of the group, for example, to encourage or increase socialization. Planned horticultural therapy programs can be modified to provide accessible and cost-effective activities for residents of nursing homes. Horticultural therapy can provide a nonpharmacological alternative intervention to manage agitation and exit-seeking behaviors in people with dementia (Whall et al. 1997; Gigliotti et al. 2004). Furthermore, horticultural therapy activities are more engaging for people with dementia than traditional activities such as games (Gigliotti et al. 2004).

### Therapeutic Gardens

Horticultural therapy can include activities in an outdoor garden or sitting and observing or wandering through a therapeutic garden. The term *therapeutic garden* describes outdoor gardens that include a variety of plants that are chosen for their aromatic and tactile qualities to attract biodiversity and to enhance sensory stimulation. Therapeutic gardens possess familiar features to promote reminiscence and enhance memory, and looping paths to encourage exercise. The importance of regular physical activity to maintaining functioning is widely recognized, and activities such as regular visits to outdoor gardens can be organized into the recreational program of residential care facilities, providing a means of improving physical functioning and reducing stress and anxiety.

*Healing gardens* describe a variety of pleasurable spaces that promote restoration, relaxation, and horticultural therapy objectives through an appreciation of the aesthetics of nature. *Healing* and *wandering gardens* are specially designed therapeutic gardens for people with dementia with the aim of stimulating the senses, encouraging positive memories, and providing a safe place to ambulate. An enclosed, outdoor garden that

excludes toxic plants and pesticides, where looping paths are built into the design, provides a safe place for people with Alzheimer's disease to wander or pace. Concern for residents' safety and potential for risk of falls may impede the installation or use of such gardens in dementia care facilities. However, as Detweiler and colleagues (Detweiler et al. 2012) found, the benefits of frequent use of a safe outdoor garden may reduce the rate of falls for frequent users, as compared to infrequent or nonusers.

For older adults residing in the community, exposure to the therapeutic benefits of horticulture can be promoted through visits to community gardens or working in their home garden. Gardening at home may be an important form of social and productive activity and exercise through which the health and well-being of older adults may be maintained or improved. People tend to take up gardening due to the many tangible benefits, such as to grow and harvest fresh fruits, vegetables, and flowers, and later in life for the intangible rewards, such as aesthetic pleasure, restoration, identity, and self-esteem (Kaplan 1973; Scott et al. 2014).

*Social and therapeutic gardening* programs are designed to offer group gardening for recreation; however, they also present opportunities for enhanced physical, psychological, and social well-being. Participation in group gardening programs provides isolated or lonely older adults with access to social partners and the impetus for social exchange around a shared identity and appreciation of the aesthetics of gardens. In addition community gardening programs encourage ongoing involvement and repeat interactions between participants and therefore increased social cohesion (Kingsley and Townsend 2006).

## Future Directions

Horticultural therapy may be a cost-effective treatment modality to support cognitive, affective, psychomotor, and psychosocial functioning and to improve quality of life for older adults, in particular for those living in assisted living and

residential aged care facilities. Admission to a long-term care facility is often characterized by loneliness, a loss of identity, and independence; residents have considerable recreational hours available. Emerging evidence shows that the benefits of including horticultural therapy activities for residents encompass meaningful engagement, self-expression, mental stimulation, and socialization, as well as visual, olfactory, and auditory stimulation. For people with dementia, horticultural therapy may offer an alternative nonpharmacological intervention to manage agitation that, when delivered by a trained therapist, has no reported adverse treatment effects. Indoor gardening programs are affordable and relatively effortless to include. In particular, for older adults living in long-term care facilities, where the incidence of depression and anxiety is high, horticultural therapy may be a useful and cost-effective adjunctive treatment modality to other forms of psychotherapy, such as cognitive behavioral therapy, to enhance emotional well-being for residents.

While a growing body of theoretical and empirical evidence describes horticultural therapy as an appropriate and adjunctive therapy to treat a range of conditions and to improve overall well-being in older adults, to date there are few controlled clinical trials. More necessary funding, leading to more randomized controlled trials and other rigorous systematic analyses of the therapeutic benefits of horticultural therapy, and as compared to other therapies, is needed.

## Cross-References

- ▶ [Activity Theory, Disengagement Theory, and Successful Aging](#)
- ▶ [Aging and Psychological Well-Being](#)
- ▶ [Aging and Quality of Life](#)
- ▶ [Cognitive Behavioural Therapy](#)
- ▶ [Environmental Influences on Aging and Behavior, Theories of](#)
- ▶ [Music Therapy, Applications in Geropsychology](#)
- ▶ [Social Connectedness and Health](#)
- ▶ [Social Group Interventions for Older Adults](#)

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## Housing Solutions for Older Adults

Bruce Judd

Australian School of Architecture and Design,  
Built Environment, University of New South  
Wales, Sydney, NSW, Australia

## Synonyms

Aging in place; Downsizing; Seniors' housing

## Definition

Housing is both a noun and a verb encompassing the physical nature of shelter for habitation (the individual dwelling), its physical organization and relationship to other dwellings (housing or settlement type), its geographical location (urban, regional, rural, or remote), the means whereby it is secured (tenure), and the attitudes and behavior of its residents regarding their living arrangements.

“Older adults” is a relative term but generally applies to those in or approaching retirement. Chronologically, aging varies considerably between individuals, cultures, and socioeconomic circumstances, but for policy and administrative convenience, retirement age is usually around 60–65 years of age for determining eligibility for pensions and other retirement benefits. The United Nations uses the age of 60 as the threshold for defining an older person for its aging index and 65 for calculating dependency ratios. However, the preretirement cohort from 50 or 55 years of

age is also often included in the definition of an “older” person and is therefore assumed for the purposes of this entry.

Housing solutions for older adults are enormously variable internationally. In traditional cultures with extended family structures, housing for the elderly family members has generally been accommodated within the family home, with three or more generations sharing the same dwelling and care and assistance for the oldest generation provided within the family. This has been both a cultural norm and a necessity where state welfare is nonexistent or extremely limited. In many immigrant communities, traditional intergenerational living arrangements can persist following migration. However, in developed welfare-state societies with nuclear family structures, the responsibility for aged care is generally subsidized to varying extents by the state, and care is less likely to be provided within the family. This has led to the development of specialized housing for older people in various forms including seniors’ housing developments, retirement villages, and various levels of institutional residential aged care. The majority, however, continue to live in the general community and prefer to do so for as long as possible. This entry will focus primarily on housing options for older people in the general community and age-specific independent-living environments.

### **Housing Problems of Older Adults**

“Housing solutions” imply problems that need to be solved, and indeed a number of housing problems regarding older adults can be identified. Prominent among these is the global phenomenon of population aging resulting from the combination of decreasing fertility rates and increasing longevity, due largely to advancements in medical science and exacerbated by the arrival of the postwar baby boomers into older age. This is having a profound impact on national economies due to the increasing dependency ratio (those in the workforce to those not in the workforce), placing an increasing financial burden on a diminishing tax base to support increasing costs of pensions,

health, and aged care. While providing challenges broadly to economic and social policies, population aging is also driving a greater focus on appropriate housing provision for older people due to their sheer increase in numbers and growing political influence.

An almost universal response to population aging by governments has been to encourage aging in place and to increase the delivery of support and care services to the home, in order to reduce transitions into institutional aged care. Paradoxically, however, much of the existing (and new) housing stock is not suitable for aging in place due to its poor accessible design and high maintenance requirement. Moreover, there is a perception that older people underutilize their dwellings and that it is both in their interest and the efficiency of the housing market to encourage them to move to more appropriately sized and designed housing. While this view appears to be supported by the ratio of household size to number of bedrooms, it has been contested (Batten 1999; Wulff et al. 2004; Judd et al. 2010), yet remains a recurring theme in public policy debates.

The fact that many older people are on fixed (pension) incomes, which limits their housing options, is another problem. Most vulnerable are those in the private rental market who are much more likely to be in housing stress (i.e., spending more than 30% of income on housing costs) than homeowners and often with insecure tenure, unpredictable rental increases, and unfavorable landlord/tenant legislation. While homeowners are generally less vulnerable, an increasing percentage are reaching retirement age with a mortgage and may be asset rich but income poor. They may be reluctant to move from the familiar home and neighborhood or be constrained by moving costs and the availability and affordability of suitable housing and location alternatives.

The entry of the postwar baby boom generation (born 1946–1964) into older age also presents a problem. This cohort has lived through a very different set of circumstances than their parent’s generation. They have had better education and job opportunities and, as a result, have greater affluence and higher levels of consumption

including housing. Baby boomers are more likely to live longer, be more health conscious, and have fewer children. They are more likely to be divorced and live alone or in smaller more diverse households. They are more likely to have accumulated more wealth over the life cycle and to have superannuation to sustain their lifestyle into older age (Hugo 2003; Quine and Carter 2006). They are also more likely to be active in older age while expending their wealth on travel and other activities rather than transferring it as inheritance to their children. They have been found to be more likely to enter retirement years with a mortgage and to be more comfortable about relocating but less inclined toward age-segregated living (Quine and Carter 2006; Olsberg and Winters 2005). In short, they enter older age with very different set of attitudes, expectations, and behaviors toward housing than previous generations, which will impact on housing preferences and hence the housing market.

## Housing, Aging, and Well-Being

The importance of the home environment to the health and well-being of older people has long been recognized in social gerontology. This has been the case since the emergence of environmental gerontology in the late 1950s and early 1960s drawing on Kurt Lewin's field theory and Roger Barker's ecological psychology and theory of behavior settings. The focus of these theories was the interdependence of person-environment relationships and particularly the notion of environment-behavior congruence or fit. This understanding was further developed in Lawton's seminal ecological theory of aging and notion of environmental press, a dynamic model relating level of competence to the demands (or press) of the environment. As competence declines with age, adaptation may involve increased performance in response to greater environmental press, modifications to the environment (including housing) to reduce press, or relocation to environments with less press (Lawton 1982).

The shift from disengagement theory to activity theory in social gerontology also had

significant implications for the housing of older adults. While disengagement theory had emphasized the inevitability of the mutual withdrawal from engagement of older people and society, activity theory posited that maintaining social and physical activity was important for successful aging (Rowe and Kahn 1997). Aging in place within the existing home and community was therefore seen as an important means of maintaining independence and participation. Environmental gerontology has also contributed to an understanding of the increasing importance of the subjective meaning of home and neighborhood as people age (Peace et al. 2006). Spatial behavior changes with age. People who have lived for long periods of time in particular locations develop strong attachment to the both physical and social aspects of place (Rowles 1978). The physical characteristics of the home, neighborhood, and transport infrastructure can all have an important bearing on the ability of older people to maintain independence and social participation.

## Aging and Housing Policy

These developments in gerontological theory have also been reflected in changes in public policy on aging and housing, with a growing emphasis on active, positive, healthy, and productive aging to encourage independence, health, and well-being among the older population. In terms of housing, the most common and international policy response to population aging has been to encourage aging in place in order to reduce reliance on, and the cost of, residential aged care. This is seen as a win-win policy by governments seeking to combat projected increases in health and aged care expenditure and by older people themselves who overwhelmingly prefer to remain living in their home and familiar neighborhood for as long as possible.

But precisely what aging well in place means is less clear: in what kind of place? Does it mean remaining in the longstanding family home, moving to more appropriately designed and/or located housing in the private housing market, remaining within the general community, or moving into an

age-segregated seniors' housing development or retirement village? All of which fall short of moving to institutional aged care. The World Health Organization defines aging in place rather broadly as: "Meeting the desire and ability of people, through the provision of appropriate services and assistance, to remain living relatively independently in the community in his or her current home or an appropriate level of housing. Aging in place is designed to prevent or delay more traumatic moves to a dependent facility, such as a nursing home" (World Health Organization Centre for Health Development 2004). This could include age-segregated seniors' housing developments and retirement villages, but not institutional care, and may include a range of different dwelling types and tenure options.

To enable increased aging in place, it has also been necessary for governments to increase the level of support and care available in the home. This includes support for home modifications, assistance with day-to-day domestic activities and increasing the level of aged care services delivered to the home, more recently including those with dementia. However, the downside to aging in place can be loneliness and isolation within the community, the possibility that some may remain longer in the family home than they should, and the burden of care that can be placed upon family members, often an aging partner.

Urban planning policies often acknowledge that changing demographics due to population aging will require greater diversity of housing types for smaller and more diverse (including older) households but rarely translates these aspirations into tangible outcomes that increase the supply of age-friendly housing options. Attempts to improve the design of new dwellings to be more suitable for aging in place have also proved to be challenging. While accessibility standards for people with disabilities have long been applied by governments to civic and commercial buildings and public space, they are rarely broadly applied to new residential construction.

## Age-Friendly Housing Design

There are various paradigms for inclusive design that can improve the suitability of housing design for older adults to age in place, including "visitable," "adaptable," and "universal" design. Visitable design aims to enable a person in a wheelchair to visit a dwelling by incorporating three basic features: a step-free entrance, appropriate width doors and circulation spaces providing a path of travel to the living area, and a toilet meeting the requirements of disability standards. For older people, visitable design can assist in maintaining social contact with family and friends and reduce the cost of home modifications in the future as some of the fundamental design elements are already in place.

Adaptable design is an approach where a dwelling is designed and constructed to facilitate easy and inexpensive modification at a future date when required. Adaptable design features include reinforcement of bathroom walls to enable installation of grab rails, extending kitchen flooring finishes under removable cupboards to enable wheelchair access and bathroom plumbing configurations to facilitate easy removal of a bath and replacement with an accessible shower. Standards for adaptable design have been developed in a number of countries and have been applied to age-specific housing, but are rarely required in the design and construction of all private housing. Adaptable design has also been demonstrated to reduce home modification costs and admissions into institutional care for older people while reducing the risk of falls and hence health and aged care costs.

Universal design is the most inclusive approach for age-friendly housing design, defined as "the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialised design" (Center for Universal Design 1997). While not aimed at any specific age group or ability level, universal design offers the most comprehensive approach to the design of housing to facilitate aging in place. Universal design

embodies seven key principles articulated by the Center for Universal Design: equitable use, simple and intuitive use, perceptible information, tolerance for error, low physical effort, and size and space for approach and use (Center for Universal Design 1997). There have been numerous attempts to translate these principles into design guidelines, usually including features such as a step-free pathway to the home; good lines of sight, lighting, and visibility; appropriately wide doorways, openings, and corridors; reinforced walls for easy installation of grab rails; slip-resistant flooring; open planned kitchens with adjustable shelving, storage drawers, and lever handles; open planned bathrooms and toilets with level shower access and adjustable handheld showerheads; smart technology to enable fully electronic control and communication systems; and space for future installation of stair lifts or elevators (Department of Health and Ageing 2007).

However, age-friendly housing is not just about the dwelling, but also the neighborhood. Without a supportive neighborhood environment, the ability to age in place and remain socially engaged can be limited. Without access to and participation in the life of a local community, aging in place can result in loneliness and isolation. Since 2005, as part of the Aging and Life Course Program, the World Health Organization has recognized the importance of age-friendly environments to healthy aging. The project identified 11 elements of an age-friendly neighborhood: a pleasant and clean environment, importance of green spaces, somewhere to rest, age-friendly pavements, safe pedestrian crossings, accessibility, a secure environment, walkways and cycle paths, age-friendly buildings, adequate public toilets, and age-friendly customer service (World Health Organization 2007).

Close proximity and accessibility to local retail, health, and community services, as well as public transport and safe, age-friendly public spaces, are of particular importance for maintaining community/neighborhood participation, particularly in car-oriented low-density

suburban environments as driving can become difficult for older people or impossible due to loss of their driver's license. Paths of travel need to be continuous and step-free with low grades and level surfaces, unobstructed by objects or vegetation, and well lit at night. Public transport nodes need to provide shade, shelter, and seating as well as include easy-to-understand signage and route information (Judd et al. 2010) (refer to entry "► [Age-Friendly Communities](#)" for a more detailed discussion).

## Factors Influencing Housing Choice

Older people are a diverse group and therefore will have diverse housing needs and preferences. Personal factors influencing choice include household size, wealth (in terms of both assets and income), housing history (including mobility and tenure), cultural background, and personal circumstances regarding relationship status, health and ability levels, and lifestyle preferences. Structural factors impinging on older people's housing choices include urban planning and development controls; the nature of local housing markets and their impact on housing costs, types, design, and availability; the provision of local infrastructure and services; housing-related taxation regimes; and government benefits available for housing assistance and support for older adults. Negotiating these can be a daunting task for older people when faced with housing decisions. Housing options available to older adults can include staying put, moving to more appropriate accommodation including downsizing into a smaller dwelling, or into age-segregated communities such as seniors' (55 and over) housing developments or retirement villages.

## Staying Put

Staying put is by far the most preferred housing option for the majority of older adults. Contrary to arguments about underutilization, older people

often fully utilize their homes after retirement. Australian research (Judd et al. 2010) has indicated that the vast majority of older people regard the space in their mostly three or more bedroom homes as suitable for their household needs and use “spare” bedrooms for activities important to their health and well-being such as home office space, guest bedrooms for visiting family and friends, and hobbies. In some cases couples need to sleep apart for health reasons and for others, a bedroom is required to accommodate an overnight carer.

Where the design of the home is not supportive of staying put, home modifications will be necessary. Typical problems confronting older people are two-storey dwellings (stairs), steps at dwelling or building entrances, doors, and hallways that are too narrow for those requiring assistive devices such as wheelchairs and walkers, inadequate space in bathrooms and toilets, raised shower hobs, and confined space in shower recesses. For walk-up apartment dwellers, access is problematic other than on the ground floor. Home modifications typically involve changes to the dwelling including addition of ramps, wider doors, grab bars, and handrails to both interior and exterior and installation of stair lifts or elevators in two-storey dwellings. The aim is to tailor the dwelling modifications to fit the individual needs of residents thus enabling them to maintain independence and age in place. Home modifications have been found to assist in reducing the risk of falls and enabling recipients to live independently in the community for longer (Kochera 2002).

The cost of home modifications can vary enormously depending on the design of the dwelling, the degree of modification required, and the ability level of residents. They can also be esthetically unattractive and impact on the resale value of the dwelling. Often home modifications are necessary in response to a sudden health crisis making it difficult for older people to meet the costs. Home modifications may be fully or partially subsidized by government subject to an income and assets test or may be the responsibility of the older homeowner. Housing equity withdrawal products such as reverse mortgages may be useful in assisting with such costs for older home owners.

However, for private renters, home modification is difficult as landlords are usually reluctant to meet the costs, and landlord and tenant legislation is often lacking in facilitating modifications to improve accessibility.

## **House Sharing and Multigenerational Living**

For those older adults who wish to stay put but do not fully utilize space in the home, house sharing or multigenerational living may be an option. House sharing refers to an arrangement whereby surplus space in the home is used to accommodate another older or younger person, or persons, resulting in a more efficient use of the dwelling, providing companionship, sharing of expenses, and assistance with domestic duties. For the secondary resident(s), this may be undertaken on a boarding or rental basis or through purchasing equity in the dwelling. In some countries there are not-for-profit agencies or private broking firms who assist in the “match-making” process.

Multigenerational living is another form of house sharing that can support aging in place. A multigenerational household is one where two or more generations of the same family (other than dependent children) occupy a particular dwelling. In 2011, one fifth of Australian households were multigenerational, many including financially independent adult children of older parents who are working or studying, having remained living at home or returned after living independently, or in some cases aged parents requiring care. Since housing is generally not designed with multigenerational living in mind, issues of control, privacy, and interference between generations can arise (Liu et al. 2015). Some home building companies market multigenerational housing designs with a semi-self-contained zone incorporating a bedroom, small living room, and bathroom facilities. Access may be via a common entry vestibule or separate entrances. The existence of such housing products suggests recognition of market demand for housing designed for multigenerational households, allowing optimization of privacy, independence, and social support

between generations, including opportunities for family care for the oldest generation.

## Moving and Downsizing

While the majority of older people wish to stay put, moving is an option for those who find their existing dwelling unsuitable for their needs or wish to move for other reasons, some of whom downsize into smaller dwellings. While downsizing implies a reduction in physical dwelling size, the term often has broader connotations referring broadly to a reduction in housing consumption which may, or may not, involve a reduction in the actual size of the dwelling but may also refer to a reduction in the size of the property (garden) associated with the dwelling, the value of the dwelling (downpricing), household belongings (de-cluttering), or even simply moving to another home or location (Judd et al. 2014).

The extent of moving and downsizing in later life is often less than is assumed. Australian research has found that while 30% of Australians 50 years of age and over were considering downsizing (Adair et al. 2014), only a small proportion (18%) had moved within a 5-year period and an estimated half of these (9%) had downsized to dwellings with fewer bedrooms (Judd et al. 2014). For both groups lifestyle preference was the most common reason given for moving. Inability to maintain the house and/or garden and children leaving home were much more often cited by downsizers as circumstances leading to moving, along with relationship breakdown, death of partner, illness, and disability. When considering a replacement dwelling, low maintenance featured much more strongly among downsizers than other movers. However, lifestyle improvement and location to shops, transport, health services, children, and relatives and having a more accessible home were considered equally important by both groups. Most who had downsized did so within the private housing market in the general community and around one fifth into age-segregated retirement villages. Most had moved from three and four bedroom dwellings into two or three bedrooms dwellings, aptly

described as “smaller but not too small” (Judd et al. 2014).

A number of barriers to older people downsizing have been identified: firstly, financial barriers including the costs of moving (e.g., estate agents fees, removalist fees, stamp duty tax, and in some cases temporary accommodation and storage fees) and the potential impact on pension eligibility of capital gains from the sale of the home. A second barrier is a lack of supply of the kind of housing that potential older downsizers are looking for – smaller two or three bedroom, single-level dwellings with accessible design, and a small manageable amount of private open space. Apartments are often not attractive to older people who have lived their lives in low-density suburban environments because of the uncertainties around building management, noise, privacy, and the demographics of neighbors. Thirdly are the psychological and practical barriers to moving and downsizing. Important among these is not only the attachment to the family dwelling and neighborhood, but also the physical and psychological stress of the moving process including disposal of personal possessions, preparing the home for sale, packing and unpacking belongings, and having to reestablish social networks in a new location (Judd et al. 2014). Attempts have been made by governments to help reduce moving costs via stamp duty tax concessions, quarantining proceeds of sale from impacting on pension eligibility and grants to older home buyers, but these do not appear to have resulted in a significantly increased degree of moving or downsizing among older people.

## Naturally Occurring Retirement Communities

A natural consequence of population aging and increasing aging in place is higher concentrations of older people in the community – but more so in some communities than others. For example, rural towns with limited employment opportunities for older people may age faster than the national norm, resulting in higher concentrations. Similarly, high concentrations may develop in popular

retirement areas such as coastal regions. When the point is reached that the majority of residents are older people, these areas have been termed naturally occurring retirement communities (NORCs). The term, which originated in New York with services aimed at concentrations of aging Jewish residents, has now become commonly used across the USA “to describe a community that was not intentionally built as housing for older adults, but has evolved to the point that it is comprised mostly of older residents” (Ginzler 2012). NORCs can vary considerably in scale from whole towns or suburbs to small precincts; in location from inner urban, suburban, or rural towns or regions; and in housing type from single-family housing to apartments, referred to, respectively, as “horizontal” and “vertical” NORCs.

Such concentrations of older adults provide the opportunity through economies of scale to target services to such areas to support aging in place while maintaining social networks and neighborhood attachment. In the USA, support services are typically provided by a combination of public and private agencies via NORC Supportive Services Programs (SSPs), including provision of federal funding in many states. The term NORCs is less used in countries outside the USA though examples of apartment blocks and residential areas with high concentrations of older people do exist, often attracting a higher level of age-specific services than surrounding areas with lower concentrations. The concept of NORCs is, however, likely to become increasingly prevalent as populations age and aging in place is increasingly favored over institutional and cohort living, both by governments and older people themselves.

### **Accessory Dwellings**

Accessory dwellings, also referred to as granny flats, are usually smaller self-contained dwellings on the same property as a primary dwelling and may be subdivided within, attached to, or in some cases detached from the primary residence. Historically these have often been known as “granny flats” and, as the name suggests, were often

occupied by older parents of the primary residents. Accessory dwellings have not always been sanctioned under planning legislation, but recently there has been a resurgence of interest in some jurisdictions as they represent an affordable housing option in response to population aging and escalating housing costs. For older adults, an accessory dwelling can provide independent accommodation with family support or be an additional source of income if rented out.

### **Social Housing**

Social housing options vary considerably internationally but are an affordable housing option for low-income older adults. Whether managed by public housing authorities, housing associations, or not-for-profit community housing organizations, social housing offers affordable and secure accommodation with access and rents determined according to income. Older adults in social housing can be in mixed-age communities or in age-specific developments. Social housing landlords are more likely to undertake modifications to improve accessibility for residents with physical impairments. Social housing may be in the form of large housing estates or scattered throughout the general community. However, reductions in supply of social housing by many governments have resulted in higher concentrations of tenants with high support needs in large public housing estates, leading to increased social problems including crime. Since older people are more vulnerable to crime, fear of crime can discourage their use of local community facilities and open space and hence impact adversely on their health and well-being. Despite this, older people in social housing have often been long-term residents who have developed strong social ties within their community.

### **Intentional Retirement Communities**

Intentional retirement communities (also known as self-organized retirement communities (SORCs)) occur where a group of older people

privately fund, create, and manage their own mutually supportive community, providing housing, shared common facilities, and care services. This may be a small group of close friends or a group that is purposely formed around the desire to collectively create such a community. The housing may comprise purpose-built new buildings or adapted existing houses or apartment buildings with shared indoor common facilities and outdoor spaces.

Cohousing (also known as housing cooperatives or coops) is the most established form of intentional retirement community. The idea of cohousing originated in Denmark in the 1970s and was later promoted among older adults by the Danish government as part of its active aging strategy. While well accepted in Scandinavia and the Netherlands, the concept has also been adopted in North America (Durrett 2011). As a housing option for older people, cohousing can either be multigenerational or age restricted (usually 55+), though it is the latter that comprises an intentional retirement community. Cohousing communities are planned, designed, and managed collectively by their residents, often including a communal house with dining and other facilities. Coops are membership based with residency obtained either through purchase (equity coops) or leasehold agreements (non-equity coops), and members are actively involved in all decision-making.

The strength of intentional retirement communities is the mutual support and neighborliness that they offer older people who might otherwise be isolated, lonely, and unsupported. As for not-for-profit entities, they also can often offer more affordable housing options than in the private housing market and can be designed to be age friendly and accessible. However, they do require commitment to a more communal way of life and willingness to collaborate in the financing, planning, and the development process as well as participate in ongoing governance, which may explain why they have been taken up less in the more individualistic societies of North America and Australia than in European countries with a social-democratic tradition.

## Manufactured Home Estates and Mobile Home Parks

A manufactured home estate is a form of low-cost housing where individual dwellings produced in a factory in transportable sections are assembled and connected to services on leased sites in a managed village. Often, depending on the target market, they will include communal facilities such as common rooms, recreational facilities, and space for traveling vehicles such as motor homes, camper trailers, and caravans. Dwellings are individually owned and a lease fee is paid for the site, common facilities, and management services. While most manufactured home estates are not age segregated, many are age concentrated and some are age restricted and therefore more akin to retirement villages. The major difference to a retirement village is that the dwellings can be sold either on-site or disassembled and relocated to another site. Manufactured home estates are favored by some older adults who wish to downsize or downprice into more affordable housing either in a low-cost area or in a high-amenity lifestyle (e.g., coastal or regional town) location. They offer lower maintenance than a conventional single dwelling due to the small site area and the proprietor's maintenance of common property and facilities. Since the manufactured housing products on the market are not necessarily targeted to seniors and are elevated about the ground, they are often not accessibly designed and therefore may require modification to accommodate older adults with impairments.

Mobile home parks (also known as caravan parks) serve the needs of older tourists (often referred to as gray nomads) for short-term accommodation and also function as low-cost housing for long-term residents as their principal place of residence. The itinerant lifestyle of gray nomads is particularly popular among the aging baby boomer generation who may, or may not, also have a permanent dwelling. Unlike manufactured home estates, mobile home parks usually have shared toilet, shower, and laundry amenities, though some of the more expensive mobile homes may have their own facilities. Mobile home parks have on-site management and daily,

short- or longer-term lease fees for use of the site and services provided.

### Age-Specific Housing Options

In addition to the various housing options in the general community are a range of options in age-specific communities. Age-specific communities are housing enclaves available only to older adults, usually 55 or over who are able to live independently – also referred to as age-segregated or congregate housing. These are multi-unit developments comprised of small to large groups of detached, semidetached, attached, or apartment dwellings, aimed at the older, independent-living housing market, usually designed to be more accessible than general market housing and often including some kind of community facilities. In some cases, this may also include provision of some support services for independent living. At the most basic level, this could simply be a seniors-only commercial multi-unit housing development with a 55-year-old age threshold covenant without community facilities or services other than common access and open space. In such cases, ownership would be by freehold title with shared responsibility for maintenance and repairs of common property via monthly fees and some kind of body corporate or owners' association. Should assistance or care be required, this can be delivered to the home in a similar manner to those aging in place in the general community.

Managed retirement villages provide a higher level of on-site management, whether provided by a non-government, not-for-profit organization, or private company with greater provision of community facilities, sometimes including on-site support services to assist in maintaining independent living. At the high end of the market, privately developed retirement villages (also referred to as lifestyle villages), often located in resort areas, can have very elaborate communal and recreational facilities and support services. Retirement village dwellings may be occupied on a freehold, leasehold, or rental basis, all requiring a monthly fee for maintenance, repairs, and

management costs. Leasehold models normally include a substantial up-front loan to the provider, a monthly lease fee, and exit fees.

Retirement villages appeal more to the older-old age cohorts (75 and older) who are more likely to be frailer, single, and female and appreciate the companionship, safety, and security of age-restricted living environments. Where dissatisfaction with retirement villages is expressed, it is usually concerning unexpected costs (e.g., increases in monthly fees), maintenance, and management issues. There is some evidence that age-restricted living is less favored by the baby boomer generation who are more likely to want to age in place in the general community, but in the face of population aging, this sector is expected to continue to grow. See the “► [Retirement Villages](#)” entry in this encyclopedia for a more detailed discussion.

### Conclusion

This entry has outlined the context, problems, and solutions of housing for older adults. While acknowledging the diversity of older people and their needs and the variety of housing responses internationally, it has emphasized the importance of appropriate and affordable housing for the health and well-being of older people including both their objective physical needs and subjective meanings of home and neighborhood. It has argued that changes in gerontological theory toward active and healthy aging, along with the demands of population aging, have seen a major shift away from reliance on institutional aged care to aging in place in the community, with support services increasingly delivered to the home. This, together with the pressures of population aging and the increasing political influence of older people, is placing greater importance on the provision of appropriate housing and neighborhood environments for older adults in the general community.

### Cross-References

- [Age-Friendly Communities](#)
- [Retirement Villages](#)

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## Human and Civil Rights of Older People

Colleen Doyle<sup>1,2</sup> and Gail Roberts<sup>1</sup>

<sup>1</sup>Australian Catholic University and Villa Maria Catholic Homes, Melbourne, VIC, Australia

<sup>2</sup>National Ageing Research Institute, Melbourne, VIC, Australia

### Synonyms

Aged; Elderly; Universal rights

### Definitions and Historical Perspective

Older people with mental illness are among the most vulnerable in the community, due in part to discrimination, stigma, and denial of their basic rights. Equally people with cognitive impairment due to dementia or other neurological disorders are particularly at risk of having rights denied either unwittingly or consciously by their “carers.” Protection of the most vulnerable is acknowledged as a central tenet of human rights, and older people can be greatly supported by a human rights approach (Australian Human Rights Commission 2012; Broderick 2010).

Human rights are rights that everyone is entitled to regardless of their age, citizenship, nationality, race, ethnicity, gender, sexuality, religion,

language, abilities, or any other status (International 2010a, b). These were first promulgated in the Universal Declaration on Human Rights in 1948, which has since been recognized as customary law binding in all countries. The principles are embedded in other international laws, conventions, declarations, resolutions, and many individual country laws, including those guiding health professionals. Universal human rights are the cornerstone of international human rights law and form “a common standard of achievement for all peoples and all nations...” (United Nations 1948).

Civil rights are inherent rights of a citizen by virtue of their status as a citizen of their country. The concept of civil rights has been established since at least Roman times. In the United States (USA) and elsewhere, civil rights are protected by federal and many state constitutions, or their equivalent. In the United Kingdom (UK), some civil liberties were formally defined and proclaimed in the Magna Carta of 1215.

Human rights and civil liberties are interlinked. A right is demanded, while a liberty is the freedom to enact a right. The 1966 International Covenant on Civil and Political Rights and the International Covenant on Economic, Social, and Cultural Rights provided further recognition of, and support for, international human and civil rights which are inclusive of, but not only for, older people.

While basic human and civil rights have been articulated and continue to be refined in legal frameworks, their application to vulnerable older people and especially those with mental illness or cognitive impairment has been slower to establish. This is partly due to the fact that provision of health and social services for older people is a relatively recent addition to our support frameworks. Prior to World War II, older people who needed care were helped in their family homes, grouped with the poor in poor homes or work farms, or housed in asylums for the mentally ill. There were no special institutions for the long-term care of older people. In the 1940s, Marjorie Warren began her work in the UK that transformed care of older people as she advocated for careful assessment of older patients, special

training of medical students in the assessment and care of those patients, and for stronger links to hospitals. Nursing homes became an established form of care for older people unable to care for themselves in their own homes.

In the USA during the 1970s, there was increasing recognition of the role that aged care could provide in supporting older people who were discharged from acute hospitals to nursing homes. This marked the beginning of the teaching nursing home movement in that country. In Australia, the teaching nursing home model took much longer to eventuate, but the rights of older people to adequate health care were advanced because of subsidies in a national health system. In Australia, the Ronalds report (World Health Organization 2015) highlighted factors that affected residents’ ability to raise matters about their care. These included feeling isolated from family and friends, being unable to have a say in decisions about their care, having little knowledge about their rights as consumers, and fear of punishment if they spoke out. As a result, a residential aged care services advocacy and monitoring program was established. Today, federal aged care advocacy programs aim to assist older people to voice their concerns and to ensure that advocacy is delivered efficiently and effectively. The rise of the Alzheimer’s association greatly contributed to giving people living with dementia and their carers a voice in policy, practice, and research (Ronalds 1989). Similarly, advocacy organizations for older people with mental illness, such as *beyondblue*, have been instrumental in giving a voice to this group in the last decade (Hunter and Doyle 2014).

## Key Principles

Two key human rights for older people are the right to adequate health care and the right to participate in decisions about their health regardless of physical or mental disability. Related to these rights, major human rights issues for older people include elder abuse, homelessness and barriers to accessing government services, and the opportunity to participate in

community and public life. Civil rights relevant to older people are age discrimination, the right to have a say in health care, and workplace discrimination.

### **Right to Adequate Health Care**

According to the 1948 Universal Declaration of Human Rights, the right to adequate health is part of the right to an adequate standard of living that includes access to food, clothing, housing, medical care and social services, and security in the event of unemployment, sickness, disability, widowhood, old age, or other circumstances beyond one's control (United Nations 1948). The World Health Organization has defined "health" as "a state of complete physical, mental and social wellbeing, and not merely the absence of disease or infirmity" (World Health Organization 1946). This definition has relevance to the right of older people to access appropriate care to maximize their health status. In 1978, the Declaration of Alma-Ata further ratified the importance of access to primary health care for all, to help provide "(health promoting), preventive, curative and rehabilitative services accordingly" (World Health Organization 1978).

### **Right to Participate in Decisions About Health**

#### **Person-Centered Care**

The concept of person-centered care has emerged as an articulation of the right to participate in decisions about health (The Health Foundation 2014). It is of special significance for older people who may be less able to exercise their rights to express their health and social care needs and to participate in decision making about that care due to ill health or other reasons. In person-centered care, the older person is a partner in his/her care rather than the recipient and maintains as much control in decision making regarding the care as possible. The person-centered care approach is now considered best practice in acute and long-term aged care.

The core approach advocated in person-centered care is engagement in a respectful, collaborative partnership between the person and his/her health and social care providers. This partnership will identify and provide health and social care that meets the needs of the person, and where applicable his/her family carers, based on personal and social circumstances. Person-centered care enables older people to become more health literate and enhances their ability to confidently articulate their needs to compassionate, responsive, and integrated service providers. A person-centered care approach actively supports the person to help identify and express their individual care needs and to participate as an equal partner in decision making about their care. The concept is extended to care of people living with dementia as well, ensuring that cognitive impairment does not preclude choice in care. Choice should be promoted, even for someone with severe cognitive impairment associated with late stage dementia.

#### **Autonomy and Independence**

A person-centered approach to care will promote and respect the autonomy and independence of the older person receiving care. Autonomy and independence may be interpreted and expressed in a variety of ways, dependent upon a person's world view, and are influenced by a person's culture and values. For some older people, exercising autonomy and independence may involve delegating a trusted other to make decisions on their behalf. How a person wishes to make decisions about their care, and with whom, should be established as early as possible and reviewed regularly by their care professionals.

Older people have the right to participate in decision making about treatments, including the right to choose whether they want particular medical treatment, and they also have right to be protected from cruel, inhuman, or degrading treatment or punishment. This has special relevance to older vulnerable people living in the community, in nursing homes, or those who are hospitalized.

Many older people are unaware of their rights, and it is incumbent upon practitioners, governments, and policy makers to uphold and support these rights through the prudent development of

law and policy and for service providers and health professionals to inform all people of their right to access treatment and to provide appropriate access and care that respect these rights. There is also a right to prevention, treatment and control of diseases, and access to essential medicines (Office of the United Nations High Commissioner for Human Rights 2015).

## **Rights of People with Dementia**

People with dementia sometimes have their rights to full participation in health-care decisions impeded by their cognitive impairment because of presumption on the part of their health-care practitioner. There can be an assumption that a diagnosis of dementia means that the individual cannot make decisions at all. Even in mental health research, people living with dementia experience barriers to participation in research (Doyle et al. 2013). There are often multiple gatekeepers for people living with dementia. Unless an advance directive regarding participation in research or health-care decisions has been completed, those seeking to protect people with dementia may unwittingly remove their freedom and right to participate in an activity that could give extra meaning to their life. Participation in research may enable them to make a contribution to society at a time when their contribution is otherwise considered by some to be less meaningful. In Australia, the National Statement (NHMRC et al. 2007) indicates that fair participation in research also includes fair distribution of the benefits of participation.

People with dementia may also experience barriers to accessing adequate mental health services. In Australia, federally funded mental health plans are not available to those living in residential aged care, which means that services from psychologists are more expensive and potentially out of reach for financially disadvantaged older adults (Davison et al. 2016).

The voices of people living with dementia and their families have been slowly getting louder. Consumer participation has increased internationally in recent years for people with dementia as a

result of Alzheimer's associations encouraging people with dementia to engage in assignment of research priorities, to participate in public forums, and to meet regularly with politicians (Department of Parliamentary Services 2010). Parliamentary Friends of Dementia meet regularly to allow interchanges at a political level about dementia. The aims of the group are to provide opportunities for stakeholders, practitioners, researchers, and peak bodies working on dementia treatment, research, or awareness to share their work and discuss policy issues with senators and members of parliament, to provide a forum to discuss issues of importance to politicians and their constituents, and to exchange information about dementia issues (Department of Parliamentary Services 2010).

## **Advance Care Planning**

Advance care planning is one way of supporting the rights of older people to exercise their autonomy and to preserve preferences in health care for those who have lost their capacity to participate in health-care decision making. It originated in the USA in the early 1990's and its practice is supported internationally although mostly in western countries. While its adoption is not yet widespread, its prominence is growing. Relatively few older people have an advance care plan due to a number of complex factors. These include individual and family beliefs and values, perceived relevance, access to opportunity, and the reliance of plans on their clarity and relevance to presenting circumstances. Fragmented health communication systems also mitigate against the effective recognition and use of advance care plans.

Advance care planning is a process of ongoing discussion between a person, his/her family, and significant others, including health-care professionals, and it can be used to guide the future health and social care of the person. The process can occur in the community or other health-care settings although it is most commonly available for people moving into residential aged care. The planning process may help facilitate autonomous

decision making and can assist proxy decision makers and health professionals to make decisions that accord with the older person's values and stated preferences at a future time when the person no longer has the capacity to make such decisions. A person's preferred process for health and social care decision making can also be ascertained by advance care planning (Berger 2010).

Advance care plans can take different forms. It may be one or a combination of the following: a verbal understanding of the person's wishes among family members and the treating health-care team, a written statement or description of the person's wishes, a legally binding written refusal of particular medical or other health-care treatments (an advance directive), or the legally binding appointment of a substitute decision maker (also a type of advance directive). Older people with episodic mental illness may use advance care plans to assist with their care during mental illness.

The implementation of advance care plans for people living with dementia may hold special challenges. Crucially, an early diagnosis of dementia, where it is determined that the person still has capacity, is usually required to make formal legal arrangements about future decision making, such as appointment of a proxy decision maker and completion of other forms of advance directives such as a limitation or refusal of medical treatment.

### **Freedom of Choice when Living in Residential Aged Care and the Role of Control in Mental Health**

Basic rights to outcomes from a minimum required standard of care are outlined in Australia's outcome standards monitored by an independent accreditation agency (Australian Aged Care Quality Agency 2015). These standards highlight access to emotional support, treatments, recreational therapy, rehabilitation support, assistance in obtaining health practitioner services including psychiatric support, assistance in obtaining access to specialist therapy services,

support for care recipients with cognitive impairment, provision of services to manage "challenging behavior," and assistance to enable the care recipient to exercise choice and control over his/her lifestyle. Standards relating to the provision of services within a client's own home are less prescriptive in ensuring that clients with mental illness have their rights protected.

### **Consumer-Directed Care**

The concept of consumer-directed care (CDC) has been adopted in the care of older people to promote their autonomy in choosing and directing their own health care. It has its roots in the disability rights and independent living movements beginning over 30 years ago. With the success of deinstitutionalization, the disability rights movement began to conceptualize independent living as an issue of autonomy instead of simple self-sufficiency and required that people with disabilities were viewed as consumers. Therefore, the CDC model was tightly aligned with fulfillment of civil or disability rights (Ruggiano 2012).

Consumer (or self)-directed care, also known as "cash for care," is a model of health and social care delivery designed to provide a flexible, "person-centered" approach to care choices and service delivery for a range of people, including older people and their carers. CDC can help uphold the right of older people to participate in decision making about their health, by enabling them to manage their own care, rather than only having the choice of the involvement of an external "case manager." There is, however, recognition that many older people may prefer or even require a case manager to assist with their decision making and choice in health and social care and the providers of that care. Government-funded consumer-directed care "packages" have been implemented in the aged care sector in many European countries including the UK, Austria, France, Italy, the Netherlands, Sweden, and Germany and in the USA since the 1990s. More recently, it has also been introduced into home care for older adults in Australia. Different CDC models exist in different contexts such as complete consumer direction, where consumers hold and manage the budgets, and a mix of consumer

direction and case management where case managers and consumers share responsibilities for the budget management (Taylor and Donoghue 2015). Consumers' preferences for different CDC models are varying and there is no one-size-fits-all model (Ottmann et al. 2013).

## Age Discrimination and Ageism

Although older people are not explicitly identified in existing international human rights laws that protect the rights of all, the implied rights of older people are nevertheless acknowledged in some of the laws in countries that strive to uphold and respect the Universal Declaration of Human Rights. The need for a specific International Convention on the rights of older people is gaining momentum, fuelled in part by the changing age profile of western countries where the proportion of the population over 65 years is increasing.

The social construction of aging has been especially negative in western countries, where age discrimination can lead to older people not being afforded their full rights. Older people with mental health problems face discrimination in health policy, practice, and research (England 2007). Negative attitudes and perceptions about aging are the result of ageism, which leads to older people not receiving services that are afforded to younger people. Having the "double jeopardy" of psychiatric stigma and old age leads to the mental health of older people being neglected. The stigma of working with older adults with mental illness has led to psychogeriatrics being viewed as one of the least desirable specialties among health professional graduates (England 2007) and psychologists being largely absent from residential aged care in Australia (Davison et al. 2016). In order to protect the rights of older adults with mental illness, it is necessary to remove age barriers to accessing services, make sure that specialist services for older adults are resourced adequately, work to reduce stigma attached to mental health issues, and pay more attention to older people without strong advocates, such as those with alcohol and drug abuse and those growing older with lifelong severe mental illness (England 2007).

Many people believe that mental health problems such as dementia and depression are an inevitable part of growing older and that living in residential aged care is inevitably a depressing lifestyle. Some public health campaigns have been instigated to reduce such negativity and raise awareness of the efforts that can improve the quality of life of older adults with mental health issues, such as the *beyondblue* public health campaigns (beyondblue 2015) and Dementia Awareness Month (Australia 2015), but more needs to be done to promote residential aged care services as desirable places to live and work. Programs to reduce isolation and strengthen social support among older people with mental health problems will assist to prevent depression symptoms (England 2007). Media guidelines on reporting about mental illness have improved the way in which news outlets portray people with mental illness, including people with dementia (Doyle et al. 2012), but reports about residential aged care continue to feed stigma associated with the negative lifestyle associated with living in nursing homes.

Older people with a history of mental illness can also experience discrimination by insurance companies when traveling or seeking health insurance. The Burdekin Report in the 1990s (Human Rights and Equal Opportunity Commission 1993) identified considerable discrimination against people with mental illness in the insurance industry, and 20 years later, the situation had not greatly improved. A survey by the Mental Health Council of Australia in 2011 showed that people with a history of mental illness experienced considerable difficulty in obtaining insurance products. Consumers with mental health conditions sometimes face higher premiums or outright refusal of insurance if they reveal their mental health history to the insurer. This in turn results in difficulty in accessing mental health services that are offered at a subsidized rate by health insurance companies (Mental Health Council of Australia 2011).

## Workplace Discrimination

The right to work, free from discrimination on any basis, is another fundamental human right. Limiting older persons' access to the workforce is a

breach of this right. In 1991 UN Principles for Older Persons reiterated support for the health, dignity, independence, and financial security of older persons. The UN Principles, while not binding, encourage all states to provide support and adequate social systems for older people to have the opportunity to work or have access to other income-generating opportunities and to be able to participate in determining when to retire. The link between work, income generation, and health is well established and has particular resonance for societies where ageism can exclude or marginalize older people who wish to continue working or to find work. Older people with disabilities or dementia can be particularly disadvantaged in their efforts to find and maintain work, at great social and economic costs to the community. Those with cognitive impairment due to dementia or mental illness are particularly vulnerable to workplace discrimination and may hide their conditions in order to maintain their positions at work.

## Elder Abuse

Older people are vulnerable to abuse, and the growing number of older people worldwide indicates a potential increase in the incidence of elder abuse.

The World Health Organization has defined elder abuse as:

“a single, or repeated act, or lack of appropriate action, occurring within any relationship where there is an expectation of trust which causes harm or distress to an older person”. Elder abuse can take various forms such as physical, psychological or emotional, sexual and financial abuse. It can also be the result of intentional or unintentional neglect. (World Health Organization 2002a)

Health professionals and others who come into contact with older people can play an important role in identifying potential or actual elder abuse and protecting elders from abuse. Many countries have enacted laws aimed to protect their elders from abuse; some countries have enacted legislation that requires mandatory reporting of suspected elder abuse by some professionals.

Other approaches designed to protect the rights of older people not to be abused include aged care and health-care standards, special services, consumer telephone “hotlines” and organizations, state statutory bodies including ombudsmen, and education and training for some professionals, including health professionals and some professionals in the legal and financial sectors. Elder abuse is a violation of basic human rights that must be addressed by a team approach across many levels of society (World Health Organization 2002b).

## Conclusion

Psychologists and other mental health professionals can take a broad advocacy role as well as promoting equity and the protection of human rights, legal rights, and moral rights for their older clients (Australian Psychological Society 2007). The continuing development of human and civil rights for older people requires the degradation of stigma, continuing sensitivity to discrimination, and building strong social, legal, and political frameworks.

## Cross-References

- ▶ [Advocacy with Older Adults](#)
- ▶ [Age Discrimination](#)
- ▶ [Behavioral and Psychological Symptoms of Dementia](#)
- ▶ [Mental Health and Aging](#)
- ▶ [Retirement Villages](#)

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## Human Resource Management and Aging

Dorien Kooij  
Department of Human Resource Studies, Tilburg University, Tilburg, Netherlands

### Synonyms

Older workers

### Definition

Human resource management refers to the management of work and people, for example, by offering HR practices, such as training and compensation, to employees. HR practices lead to

positive worker outcomes, such as engagement and performance. However, employee motives and abilities change with aging, affecting the utility of HR practices for employees. Therefore, research on aging at work focuses on how the influence of HR practices on worker outcomes might change with aging and on HR practices particularly tailored to older workers.

Human resource management (HRM) refers to all activities associated with the management of work and people within organizations (Boxall and Purcell 2011). This broad definition implies that many different concepts at different levels are part of HRM and that different actors are involved in HRM. At the organizational level, researchers distinguish HR principles or philosophies and intended HR policies (Wright and Nishii 2013), which refer to the vision and intentions of key decision makers in the company (e.g., board of directors) with respect to managing people. These intended HR policies are implemented by lower-level managers and HR professionals, which are referred to as actual HR practices. At the individual level, these objective actual HR practices are perceived, interpreted, and experienced subjectively by employees. It is important to make this distinction between intended HR policies, actual implemented HR practices, and employee perceptions of HR practices, because they are found to differ significantly and they are differently related to employee outcomes, such as attitudes, performance, and health. It is known that particularly HR practices as perceived by employees (referred to as perceived HR practices) lead to positive employee outcomes (Wright and Nishii 2013).

Different theories are relevant in explaining why HR practices lead to employee outcomes (Kooij and Van De Voorde 2015). An important theory explaining why HR practices increase positive employee *attitudes* is social exchange theory (Blau 1964). Based on the norm of reciprocity, this theory argues that individual employees view HR practices as a personalized commitment toward them, as an investment in them, and as a recognition of their contribution, which they will reciprocate through corresponding positive attitudes and behavior toward the organization. This line of reasoning is supported by many (mostly

cross-sectional) employee survey studies in HR research (Wright and Nishii 2013).

The most important framework relating HR practices to employee *performance* is the ability, motivation, and opportunity (AMO) model, which argues that HR practices positively influence employee performance by enhancing employee knowledge, skills, and abilities (A), by stimulating employee motivation and commitment (M), and by providing skilled and motivated employees with the opportunity to perform (O). For example, a recent meta-analysis on 120 studies at the organizational level (Jiang et al. 2012) found that skills-enhancing (e.g., training and selection), motivation-enhancing (e.g., compensation and promotion), and opportunity-enhancing (e.g., job design and employee involvement) HR practices were related to financial outcomes both directly and indirectly by influencing human capital (i.e., ability) and employee motivation and subsequently voluntary turnover and operational outcomes. This study also reflects an important trend in HR research to focus on bundles of HR practices instead of on HR practices in isolation. Bundles of HR practices are sets of interrelated and internally consistent HR practices, which are aimed toward the same goal (e.g., enhancing skills).

Finally, researchers increasingly use the job demands-resources (JDR) model (Demerouti et al. 2001) to link HR practices to *health* outcomes. The JDR model proposes that job demands (i.e., physical, social, or organizational aspects of the job that require sustained physical or mental effort and are therefore associated with certain physiological and psychological costs) lead to continuous overtaxing and hence to exhaustion. Following the JDR model, HR practices can lead to higher job demands, such as time pressure and role overload, which activate a health impairment process and will thus decrease employee health. For example, a recent multilevel employee survey study among government workers (Jensen et al. 2013) found that employee perceptions of high-performance work systems (i.e., HR practices aimed at increased organization performance, such as incentive-based compensation and performance management) lead to role

overload and anxiety. In sum, HR research shows that HR practices influence employee outcomes. However, since workforces are aging in many developed countries (Hedge and Borman 2012) and aging involves changes in biological, psychological, and social functioning (Kanfer and Ackerman 2004), it is important to look at HRM from an aging perspective.

## The Role of Aging

The most important changes that are part of the aging process involve abilities and motives. It is known that physical abilities and fluid intelligence, such as working memory and speed of processing information, deteriorate with age and that crystallized intelligence, such as general knowledge and verbal comprehension, improves with age (Kanfer and Ackerman 2004). Although these changes in abilities are important in itself, they also lead to changes in goals and motives; since losses (e.g., in physical health) start to outnumber gains (e.g., in general knowledge) in older age, older people will think more carefully about how to allocate their resources, such as time, energy, and effort, resulting in a shift in their goals and motives. This is explained by lifespan theories, such as the selection, optimization, and compensation (SOC) model (Baltes and Baltes 1990).

The SOC model, which is a metatheory on lifespan development, proposes that older people will engage in three strategies to deal with changing abilities that are part of the aging process. These strategies are selecting fewer goals or outcomes (e.g., delegating lower priority responsibilities to others), optimizing resources to reach these goals or outcomes (e.g., keep up work skills and abilities), and compensating for losses in outcome-relevant means (e.g., use external aids). These strategies are aimed at achieving four lifespan goals: (i) growth, which refers to reaching higher levels of functioning; (ii) maintenance, which refers to maintaining current levels of functioning in the face of new challenges; (iii) recovery, which refers to recovering to previous levels of functioning after a loss; and (iv) regulation of

loss, which refers to functioning adequately at lower levels when maintenance and recovery are no longer possible.

As employees age, they experience losses in their abilities, and they will allocate fewer resources to the growth goal and more resources to the maintenance, recovery, and regulation of loss goals. These changes in the allocation of resources across the lifespan are supported by evidence on age-related changes in work-related goals and motives (i.e., the importance employees attach to job characteristics and work outcomes). A recent meta-analysis on 86 studies and survey study among university and health-care employees (Kooij et al. 2011, 2013), for example, found that work motives pertaining to challenging work, career advancement, working with people, recognition, and compensation (so-called growth and extrinsic motives) were lower among older workers than younger workers, while motives pertaining to interesting work and use of skills, accomplishment, autonomy, helping and teaching others, and job security (so-called intrinsic, security, and generativity motives) were higher among older workers in comparison with their younger counterparts. In other words, intrinsic, security, and generativity motives appear to increase in strength with age, while growth and extrinsic motives appear to decrease in strength with age.

Because of these changes, the utility and thus the influence of HR practices on employee outcomes also change with age (Kooij et al. 2010). In addition, researchers have questioned whether universally applied HR practices are suitable for older workers at all and have thus focused their attention on HR practices specifically tailored to older workers.

At the organizational level, two HR philosophies on older workers can be distinguished: depreciation and conservation (Kooij and Van De Voorde 2015). According to the depreciation HR philosophy, the value of individual employees peaks early in their career, reaches a plateau in their midcareer, and then steadily declines as the employee approaches retirement. According to the conservation HR philosophy, all employees, regardless of their age, can continue to add value over a long period provided they are adequately

educated, trained, and managed. Research demonstrates that employers adopt both philosophies and implement HR policies that are in line with a depreciation philosophy (e.g., early retirement schemes) and HR policies that are in line with a conservation philosophy (e.g., flexible working hours, ergonomic measures, reduction of working hours, and training programs for older workers; Knies et al. 2015). Similarly, different bundles of HR policies for older workers are distinguished by employers (Van Dalen et al. 2014). These are exit HR practices (e.g., part-time retirement), related to a depreciation HR philosophy, and development (e.g., continuous career development) and accommodation HR practices (e.g., decreasing workload for older workers), both related to a conservation model.

Line managers or lower-level managers play an important role in implementing these intended HR policies as they are increasingly responsible for the implementation of HR practices (Knies et al. 2015). Hence, these managers are crucial for ensuring that HR policies are implemented as intended, either among all employees or among specific groups of employees, but also for making tailor-made arrangements for individual employees (i.e., idiosyncratic deals). However, line managers may hold negative stereotypes about older workers which impact their attitudes toward and decisions on these older workers. They may thus decide not to implement certain HR practices (universal or specifically tailored to older workers) among older workers. Fortunately, more recent studies (e.g., vignette studies) among managers demonstrate that stereotypical views of line managers do not influence their decisions when more information is available on the individual attributes of older workers (Knies et al. 2015).

At the individual level, there are a number of studies examining HR practices specifically tailored to and as perceived by older workers. These HR practices tailored to older workers particularly include training opportunities adapted to older workers' needs; flexible work conditions, such as flexible work schedules; and new work roles, such as internal consultant or mentors. From the studies examining these HR practices, we know

that particularly training opportunities adapted to older workers' needs helping older workers to update and develop their skills have positive effects on older worker commitment, perceived organizational support, and intention to continue working (Kooij and Van De Voorde 2015). For example, building on social exchange theory, a survey study among older nurses and professionals found that training and development HR practices tailored to these older workers influenced intention to remain via perceived organizational support, while flexible HR practices did not affect perceived organizational support and intention to remain (Armstrong-Stassen and Ursel 2009). Although HR practices specifically tailored to older workers have positive effects on older worker attitudes, they can also have perverted effects. For example, offering older workers specific training programs or workload reductions might contribute to age prejudice (Schalk and Desmette 2015).

Besides these types of HR practices specifically targeting older workers, organizations offer universal HR practices, such as universal training, performance appraisal, and rewards, to all their employees. Because motives and abilities change with age, researchers found that some of these universal or general HR practices are less and some of these universal HR practices are more appropriate to motivate and retain older workers (De Lange et al. 2015). Four bundles of HR practices for aging workers are distinguished based on the goals of these HR practices as perceived by employees (Kooij et al. 2014). Using the lifespan goals as proposed by the selection, optimization, and compensation model as an organizing scheme, four broad bundles of HR practices for aging workers can be distinguished:

1. Development HR practices, such as training and development on the job, which may help workers to reach higher levels of functioning (growth goal)
2. Maintenance HR practices, such as job security and flexible work hours, which may help workers to maintain current levels of functioning in the face of new challenges (maintenance goal)

3. Utilization HR practices, such as horizontal job movement, task enrichment, and participation in decision-making, which may help workers to recover to previous levels of functioning after a loss by removing job demands that have become unachievable for an employee from the job and replacing them with other demands that *utilize* already existing, but not yet necessarily applied, skills and personal resources (recovery goal)
4. Accommodative HR practices, such as reduced workload and working part-time, which may help workers to function adequately at lower levels when maintenance and recovery are no longer possible by protecting or sparing them (regulation of loss goal)

The influence of these HR bundles is found to change with age. Since motives change with age, the utility of HR practices changes with age as well. According to social exchange theory (Blau 1964), the utility or value of specific HR practices determines to what extent employees reciprocate through corresponding positive attitudes and behavior toward the organization. Therefore, the influence of HR practices on employee attitudes and behaviors can be expected to change with age as well. As mentioned, previous research found that growth motives decrease and that security motives increase with age (Kooij et al. 2011, 2013). In line with these findings, meta-analytic and survey studies found that development HR practices, such as training and development on the job, are less important in eliciting positive worker attitudes of aging workers, but that maintenance HR practices, such as job security and flexible work hours, are more important in eliciting positive worker attitudes of aging workers. Accommodative HR practices, such as reduced workload and working part-time, are found not to change with age, but to be more important in eliciting positive worker attitudes of workers engaging in selection, optimization, and compensation strategies (Bal et al. 2013).

Besides influencing the relation between HR practices and employee attitudes, aging might also influence relations of HR practices with performance and health (Kooij and Van De

Voorde 2015). For example, because of skill obsolescence and constriction, HR practices aimed at development are particularly important for the performance of older workers. In line with this reasoning, the relation between development HR practices and performance has been found to strengthen with age. In addition, aging might influence the relation between demanding HR practices, such as high-performance work systems (HPWS), and employee health. On the one hand, HPWS might be worse for older workers' health compared to younger workers, because of deteriorating abilities and loss of personal resources needed to offset demands related to HPWS. On the other hand, this relation might be attenuated, because older workers are better at regulating their emotions than younger workers, and might thus be better able to deal with these demands. To date, no research has been done on the moderating role of aging in relations between HR practices and health. Nevertheless, it is known that granting older workers higher levels of autonomy helps them to deal with job demands (Kooij and Van De Voorde 2015).

### Future Research Directions

There are three fruitful areas for future research in HRM and aging. First, more (longitudinal) studies are needed that examine which HR practices (besides training programs tailored to older workers and maintenance HR practices) will elicit positive outcomes among aging workers. These studies should also examine the mediating mechanisms (e.g., perceived organizational support, human capital, person-environment fit, or job crafting behavior; De Lange et al. 2015) through which these HR practices have a positive effect. Since many of the studies on aging workers focus on employee attitudes, such as commitment or satisfaction, these studies should also include other employee outcomes, such as performance, productivity, employability, work ability, or health (Kooij and Van De Voorde 2015). For example, HR practices aimed at empowering employees (i.e., high-involvement work practices) might stimulate job crafting behavior,

allowing aging workers to continuously adjust their job to changing abilities and motives that are part of the aging process, resulting in positive attitudes, performance, and health of these aging workers. Second, the role of lower-level or line managers in implementing HR practices among older workers deserves more research attention. Line managers are crucial in implementing and potentially tailoring HR practices to aging workers, but research on the role of line managers in managing aging workers is scarce (Knies et al. 2015). Third, future studies should focus on the context and examine when specific HR practices have a positive influence on aging worker outcomes. Important moderators are age-related factors, such as physical abilities, tenure, and future time perspective, but also type of occupation, line manager support, and organization climate could play an important role (Kooij and Van De Voorde 2015). For example, it might be that the influence of specific HR practices on employee attitudes, performance, and health only increases with age when the company has an age-supportive climate.

## Cross-References

- ▶ [Age and the Psychological Contract](#)
- ▶ [Leadership and Aging](#)
- ▶ [Organizational Strategies for Attracting, Utilizing, and Retaining Older Workers](#)
- ▶ [Work Design and Aging](#)
- ▶ [Work Motivation and Aging](#)

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## Ikaria Study, Greece

Christina Chrysohoou<sup>1,2</sup>, Christos Pitsavos<sup>1,2</sup>, George Lazaros<sup>1,2</sup>, John Skoumas<sup>1,2</sup> and Christodoulos Stefanadis<sup>1,2</sup>

<sup>1</sup>1st Cardiology Clinic University of Athens, Athens, Greece

<sup>2</sup>Research Institute for Longevity and Prevention of Geriatric Diseases, Athens, Greece

### Synonyms

Ikaria; Longevity

### Definition

Ikaria Island has been acknowledged as a place with high prevalence of nonagenarians, around the world. The aim of this prospective survey was to evaluate all those clinical, lifestyle, anthropometric, behavioral, social, and nutritional characteristics and gene–environmental interaction that can be related with longevity in a cohort of 1500 individuals, permanent inhabitants of Ikaria Island, above the age of 40 years. Furthermore, a secondary aim was to fulfill a prospective long follow-up of this elderly and middle-aged population. Additionally, the results of this study can be linked to the results of other similar surveys in order to create the profile of long-living populations worldwide.

## Introduction

Demographic analyses throughout the developed world suggest that the oldest old (i.e., people of age 80 years and older) are the fastest growing portion of the population. Due to these changes, the United Nations' Global Population Pyramid is undertaking a shift, from the classical shape of a pyramid to a cube. The resultant change in the age distribution of the world's population has been partially attributed to the medical advancements in recent years, a reduction in maternal and infant mortality, as well as in improved nutrition (Cohen 2003). Beyond these global considerations, it is of interest that there are places around the world where people live longer, and, most importantly, they are active beyond the age of 100 years. Specifically, in the past years anthropologists observed that people living in Sardinia (Italy), Okinawa (Japan), Loma Linda (California), and Nicoya Peninsula (Costa Rica) have very high life expectancy, with the percentage of individuals over the age of 90 being at amazing rates as compared to the developed world's average rate of nonagenarians. These places have been defined as the "Blue Zones" and are a part of a large anthropologic and demographic project of the Quest Network, Inc. funded by the National Institute on Aging and National Geographic ([The Blue Zones](#)). It has been observed that people living in these areas share common behavioral and lifestyle characteristics, despite the different race, nationality, and regional characteristics they have.

Clearly, longevity is a complex attribute, determined by factors such as exposure to disease, variability in sleeping patterns, smoking, physical activity, and diet, in addition to the indirect emotional and cognitive influence on physiological pathways. Recently it was reported that people in Ikaria Island, Greece, have also one of the highest life expectancies in the world and, therefore, joined the “Blue Zones.” Ikaria Island is located in the central–eastern part of the Aegean Sea and the total population of the Island is 8,312 (census 2001), and the vast majority of them follows a traditional way of living (i.e., traditional dietary habits that included plant foods, daily physical activities, daily naps, mountain living, low stress). Moreover, Ikaria has eight super-hot, radioactive, saline springs, which flow at various points on the Island’s shores.

This survey aims at examining the existence of gene mutations related to longevity with the amount of cell surface lipids and oxidation stress in respect of lifestyle habits and biological, clinical, and genetic characteristics of people living on Ikaria Island, in order to gain insight on factors related to exceptional survival. Specifically, the purpose of this survey is to correlate dietary habits, lifestyle patterns, and behaviors with clinical and genetic characteristics and with the overall cardiovascular risk in middle-aged (i.e., 40–65 years) and elderly (i.e., 65–107 years) residents of Ikaria. Furthermore, the study will conduct epidemiological 5- and 10-year follow-up assessments to investigate cardiovascular and overall mortality and morbidity in both populations. For this purpose face-to-face interview with surviving participants and public data records from the National Statistical Service for the causes of deaths will be used.

## Design and Study Population

The baseline assessment of IKARIA Study is a cross-sectional survey that has been carried out in the Province of Ikaria Island, Greece, from June 2009 to October 2009. During this period, 673 elderly men and women (328 men, mean age  $75 \pm 7$  years, and 339 women, mean age

$75 \pm 6$  years) and 650 individuals (aged 40–64), all permanent inhabitants of the island, were voluntarily enrolled (the participation rate was high and included 673 out of the 800 elderly individuals). All participants were interviewed by trained personnel (i.e., cardiologists, general practitioners, and nurses) who used a standard questionnaire developed for the purposes of the study. Dietary assessment was based on a validated food frequency questionnaire (FFQ) (Tyrovolas et al. 2010). Physical activity was evaluated using the shortened version of the self-reported International Physical Activity Questionnaire (IPAQ) for the elderly (Craig et al. 2003). The survey also included basic demographic items, such as age, gender, financial status (average annual income during the past 3 years), educational level (years of school), and various clinical characteristics. Weight and height were measured to assess body mass index (BMI) scores ( $\text{kg}/\text{m}^2$ ). Resting arterial blood pressure was measured three times using the right arm, at the end of the physical examination, while participants were sitting. Fasting blood samples were collected in the morning between 08:00 and 10:00 AM, before physical examination. All the biochemical evaluation was carried out in the same laboratory that followed the criteria of the World Health Organization Reference Laboratories. Depressive symptomatology in the middle-aged individuals was assessed using a translated and validated version of the Zung Self-Rating Depression Scale (ZDRS), while in individuals above the age of 65, Geriatric Depression Scale (GDS) was used (Fountoulakis et al. 1999). Complete ECG measurements at rest were available for all participants, for whom a standard 12-lead ECG was recorded for a duration of 5 min. Echocardiographic assessment was performed for all participants during the initial examination, using standard procedures.

## Demographic Characteristics

The majority of the oldest old (above the age of 80 years old) men were married, whereas the majority of women were widowed, a fact that could be explained by an old Greek tradition for men to marry much younger women (i.e., usually

5–15 years younger). It is of interest that almost half of the oldest old participants of the IKARIA Study reported low income (i.e., below their annual average needs). There was also a large proportion of individuals, especially women, without any pension. Moreover, majority of people were found living together with other members of their families (i.e., children, relatives, etc.), in relatively small but owned houses. In addition, 3.3% of men and 4.1% of women of these oldest old individuals were still working (mainly self-employed). Furthermore, 3.4% of men and 27.6% of women were doing works in their houses (i.e., gardening). The education status of these oldest old was very low, with an average of  $7.4 \pm 3.4$  years of school; 20.3% of them had not completed primary school, and the illiteracy rate was 10.1%.

### Lifestyle Habits

Men compared to women were more physically active: about nine out of ten men and seven out of ten women reported daily (mainly occupational) activities. A large majority followed a traditional Mediterranean diet (i.e., average score was 38/55 or 69% adherence to the pattern), with no differences between genders (Lazaros et al. 2014; Siasos et al. 2013; Oikonomou et al. 2011; Tsiachris et al. 2011; Panagiotakos et al. 2011). Depressive symptomatology as assessed by the GDS was much higher in women as compared with men. Nevertheless, the average scores were very low (i.e.,  $<5$ ), suggesting low rates of depression in this advanced age group. According to mental health status, findings revealed that in these elderly individuals, cognitive function seems to be related with aortic elastic properties. In particular, increased aortic distensibility, as evaluated by echocardiographic measurement, was associated with increased likelihood of having a good mental function in advanced age. This was the case for both males and females, and the effect remained stable after various adjustments were made for the presence of cardiovascular disease, renal dysfunction, and other cardiovascular risk factors (Chrysohoou et al. 2013a, 2013b). Depressive symptoms constitute a frequent condition in aged people. N-3 polyunsaturated fatty

acids provide a promising approach in the treatment of depression. In the IKARIA Study we found a relationship between fish consumption and depression in the elderly population; thus, more frequent fish consumption seems to have beneficial effect on depressive mood in elderly individuals. This association remained significant even after various adjustments were made, including obesity, diabetes, lipidemia, smoking habits, hypertension, physical activity, sex, age, Mediterranean diet score, and cardiovascular disease. In particular, consumption of 300 g of fish on weekly basis was associated with about 66% lower likelihood of having depression levels above the median value of the GDS score for this population (Chrysohoou et al. 2010). Additionally, fish consumption was associated with improved kidney function among older adults, independent of other biochemical, lifestyle, and CVD risk factors, as well as the level of adherence to the traditional Mediterranean dietary pattern. This is the first study that evaluated the aforementioned association in a Mediterranean population. Moreover, the beneficial effects of long-term fish intake on kidney function were observed in elders suffering from several other comorbidities, extending the current scientific knowledge about the benefits of polyunsaturated fatty acids (PUFA) consumption on populations with chronic health problems (Chrysohoou et al. 2013c). The prevalence of hyperuricemia in the elderly population of the IKARIA Study was 34% in males and 25% in females. Similar to previous studies, it was observed that serum uric acid (UA) levels were higher in males than in females, a fact that has been attributed to the influence of sexual hormones. Among other therapeutic modalities, diet has been associated with the prevention of hyperuricemia, as consumption with purified purines increases serum UA levels in animal and humans. Purine-rich foods include animal meats (i.e., beef, pork, lamb, organ meats, and meat extracts); seafood (i.e., fish fillets, tuna, shrimp, lobster, clams, etc.); and plants (i.e., yeast extracts, peas, beans, lentils, asparagus, and mushrooms). By contrast, dairy products (i.e., milk, cheese, yogurt, ice cream), grains and their products (i.e., bread, pasta, cereals), vegetables, fruits, nuts, sugars,

and sweets are low in purines. Although the effects of a Mediterranean type of diet on the incidence of hyperuricemia have not been studied thoroughly up to now, there is experimental evidence indicating that diets enriched in both gamma-linolenic acid in plant seed oil and eicosapentaenoic acid in fish oil significantly suppress urate crystal-induced inflammation in animal models. Our findings revealed that long-term adherence to a Mediterranean type of diet decreases UA levels, in elderly population, without known cardiovascular disease, irrespectively of other traditional risk factors (Chrysohoou et al. 2011). This relationship was more evident in males. As elderly individuals show increased vulnerability for expressing hyperuricemia and gout, which is often related to other pathological conditions, it is essential to find alternative therapeutic solutions. Dietary interventions promoting consumption of patterns enriched with fruits, legumes, and vegetables and poor in animal protein, with moderate alcohol consumption, may be useful in lowering the burden of morbidity related to high levels of UA in elderly population.

### Testosterone Levels and Atherosclerosis

In other studies, the metabolic syndrome (MetS) has been found to increase in prevalence among elderly individuals and seems associated with pathophysiological conditions that involve increased inflammation and oxidation process and mitochondrial and endothelium dysfunction. In previous studies testosterone levels have been found to be linked with cardiovascular health, as low testosterone levels seem to accompany aging-related diseases, like vascular dysfunction and atherosclerotic disease. In the IKARIA Study, the prevalence of MetS was associated with serum testosterone levels, only in men; at the same time, such relationship was not observed in women. Furthermore, serum testosterone levels were inversely associated with components of the MetS in both genders. When categories of lipids, hs-CRP, BMI, and insulin resistance levels were taken into account, testosterone lost its significance in predicting MetS, suggesting a mediating effect of these markers on the relationship

between testosterone and the syndrome (Chrysohoou et al. 2013d).

### Environmental Radiation

Another issue that the IKARIA Study evaluated is the impact of environmental radiation on longevity. The island of Ikaria is located in the eastern Aegean Sea. It is dominated by a mountainous area divided, from the geological point of view, into two petrologically distinct equal parts: (a) the eastern part consisting of largely metamorphosed sedimentary formations and (b) the western part mainly consisting of granitic formations. The Laboratory of Archaeometry of the National Center for Scientific Research “Democritus” has measured the natural radioactivity at the surface of Ikaria Island. Following their findings, Ikaria Island can be separated in three major radioactive areas, with extremely different levels of gamma radiation: the western and west–north part with medium to high levels of radioactivity and the eastern part with low radioactivity levels, with the nuclide  $^{226}\text{Ra}$  as the main contributor to these dose rates. The annual dose equivalent ranged between 0.20 and 3.31 mSv per year, revealing the higher exposure in the west–north part of the Island. Based on the demographic information from the National Statistical Service of Greece (NSSG), significant differences were observed in the rate of persons aged 90+, as well as in the survival between the aforementioned areas. In particular in Ikaria, the rate of the permanent inhabitants, men above the age of 90 years old living in the higher radioactivity area, was twofold as compared with the nonagenarian living in low radioactive areas, while the respective percent of women was higher by one third. The biological effects of low-dose radiation have been found to be similar to that of moderate exercise in animal studies, as they stimulate the production of antioxidants and enhance the immune system. Low-dose radiation ( $<0.1$  Gy) seems to induce anti-inflammation by hampering leukocyte adhesion to endothelial cells and induction of apoptosis, by reducing the activity of the inducible nitric oxide synthase, and by lowering the oxidative burst in macrophages, reducing the endogenous DNA damage and increasing DNA

repair capacity. It seems that the U- or J-shaped dose–response curve of radiation to human health represents hormesis or a hormetic effect, which has been described as an evolutionary adaptation of human or animal models to environmental levels of toxins and other hazards such as radiation (Chrysohoou et al. 2013e; Stefanadis 2013; Trabidou and Florou 2010). Although, the maximum value of the dose rate observed in the case of sediment in Ikaria ( $26.8 \text{ mGy d}^{-1}$ ) did not reach the threshold reported for metabolic malfunctions in the exposed organisms, this report can be used as a perspective for further research on the effects of chronic exposure in nonintervention environmental radiation levels.

#### Four-Year Follow-up

During June–July 2013, the IKARIA Study’s investigators performed the 4-year follow-up. Vital status was recorded for all  $n = 676$  participants. In order to participate in the follow-up, all participants were appointed through telephone calls and then had face-to-face medical examination with the study’s investigators. During 2009–2013, 53 deaths were occurred in the study’s sample; i.e., the all-cause mortality rate was 790 deaths per 10,000 inhabitants. The gender-specific all-cause mortality rates were 580 per 10,000 women and 100 per 10,000 men inhabitants ( $p = 0.04$ ). Causes of death were acute myocardial infarction (21%), stroke (15%), cancer (21%), infection (10%), renal failure (4%), respiratory (2%), and the rest 27% from other causes (e.g., accidents, suicides). The 4-year incidence of hypertension was 900 new cases out of 10,000 inhabitants, the 4-year incidence of hypercholesterolemia was 650 new cases out of 10,000 inhabitants, and the 4-year incidence of diabetes was 690 new cases out of 10,000 inhabitants; no gender-specific differences were observed. A strongly significant trend was observed between baseline age of the participants and all-cause mortality ( $p$  for trend  $< 0.001$ ). In particular, men who were over 80 years at baseline examination had an about two times higher mortality risk compared to those aged between 65 and 80 years (2.07, 95% CI 1.04, 4.12). Women who were over 80 years at baseline examination had an

about eight times higher mortality risk compared to those aged between 65 and 80 years (8.27, 95% CI 3.00, 22.77). The probability of surviving after the age of 80 years increased, whereas the aforementioned probability showed a progressive reduction up to the middle of the eighth decade of life. This study illustrated that among individuals of mean age 75 years old, age, male gender, blood urea measurement, increased heart rate, decreased left ventricular performance, thyroid abnormalities, and pulse pressure were the most significant clinical predictors for mortality. Among lifestyle habits, nutritional aspects of daily olive oil consumption, less daily energy intake with smaller food portions, and moderate coffee intake were also associated with increased survival (Chrysohoou et al. 2015). Those lifestyle habits have been also described in other high longevity communities nowadays, but Hippocrates (400 BC) had first referred to behaviors promoting healthy aging: “*All parts of the body which have a function if used in moderation and exercised in labors in which each is accustomed, become thereby healthy, well developed and age more slowly; but if unused and left idle they become liable to disease, defective in growth and age quickly.*”

#### Conclusions

The IKARIA Study helped us to record and identify the clinical factors, lifestyle, dietary habits, genetic and biochemical markers and environmental factors associated with longevity and quality of life, morbidity, and mortality. This study illustrated the beneficial role of Mediterranean type of diet on several health aspects even in elderly individuals and the role of physical activity and long-term lifestyle habits in preserving quality of life in advanced age. Based on 4 years of observation in older individuals in Ikaria Island, age, depression, left ventricular hypertrophy, volume of left atrium, left ventricular ejection fraction, red blood cell distribution, olive oil consumption, and thyroid stimulating hormone were statistically significant predictors for all-cause death. Also, age, male gender, heart rate, serum urea levels, pulse pressure, plasma insulin levels, left

atrial volume, and coffee consumption were found significant predictors for CVD mortality. Moreover, the long-term adoption of a nutritional pattern close to the Mediterranean diet, the presence of physical activity, and the optimistic behavior seem to characterize the very old men and women who were alive at the 4-year follow-up.

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## Incontinence and Aging

Jean F. Wyman and Kristine M. Talley  
 School of Nursing, University of Minnesota,  
 Minneapolis, MN, USA

### Synonyms

For urinary incontinence: Urine leakage; Involuntary urination; Enuresis; Bedwetting; Nocturnal enuresis; Diurnal enuresis

For fecal incontinence: Accidental bowel leakage; Encopresis; Anal incontinence; Bowel incontinence

### Definition

The International Continence Society defines urinary incontinence as “the complaint of any involuntary leakage of urine” (Abrams et al. 2002). The International Consultation on Incontinence defines fecal incontinence as “the involuntary loss of liquid or solid stool that is a social or hygienic problem” (Norton et al. 2005). The term “incontinence” is used in this entry to refer to urinary incontinence (UI) and fecal incontinence (FI).

### Overview

Incontinence is a prevalent and costly health condition in older adults that contributes to significant

psychosocial morbidity including impaired quality of life. The annual cost of managing incontinence exceeds \$16 billion, with the majority of expenditures (70%) targeting the use of incontinence pads. Less than 10% of expenditures are for treatment (Wilson et al. 2001). The inability to control the bladder or bowel creates psychological distress and emotional burden and leads to social isolation and disability and, in some situations, institutionalization (Ory et al. 1986). The double stigma of being “old” and “incontinent” carries negative consequences that can affect overall well-being and influence the decision not to seek treatment. Many individuals who are affected with UI or FI do not report their incontinence to a health-care provider (Wagg et al. 2013). Along with demographic characteristics, incontinence type, and severity, the lack of reporting incontinence is strongly influenced by embarrassment, shame, and other psychological factors, lack of knowledge and erroneous beliefs about available treatments, and low expectation of treatment benefit. Some older adults may try to hide their incontinence for fear of nursing home placement. Although knowledge, awareness, and treatments have improved in recent years, incontinence continues to be underreported, under-detected, and undertreated in older adults.

This entry will provide an overview on urinary and fecal incontinence, their prevalence, and major types. The literature on whether psychological factors are a risk factor or consequence of incontinence is summarized, along with a brief discussion of the management of incontinence.

### Epidemiology and Subtypes of Incontinence

Urinary incontinence (UI) is more common than fecal incontinence (FI) or the combination of both UI and FI (known as dual incontinence) (Gorina et al. 2014). Prevalence estimates vary widely depending on the definition and type of incontinence, methodology used, and population studied. In general, the prevalence and severity of incontinence increases with aging, especially in older age

groups (75+ years), and varies by type of population (community vs. long-term care).

Prevalence rates from a representative sample of noninstitutionalized adults aged 65 years and over from the National Health and Nutrition Examination Survey (NHANES) found that 43.8% reported UI and 17.3% reported FI (Gorina et al. 2014). In this sample, older women were more likely to report UI than men (54.4% compared to 29.9%, respectively). UI severity increased with advancing age, with adults aged 75 years and over having higher UI severity scores than those in the 65–75-year-old age category. These same prevalence patterns are observed in older noninstitutionalized medically complex and vulnerable adults and in those living in long-term care settings (Gorina et al. 2014). Based on data from the 2009 Long-Term Care Minimum Data Set (MDS), 70.3% of long-stay nursing home residents had UI and 60.0% had FI (Gorina et al. 2014). A higher proportion of female nursing home residents had UI than men (73.5% vs. 64.9%, respectively), whereas there were no sex differences noted with FI. The 2010 National Survey of Residential Care Facilities indicated that 36.6% of older adults living in residential care facilities have UI. Women were 1.2 times more likely to have UI than men in this setting (39.4% vs. 32.7%); however, the prevalence of FI was similar between genders at 20.4% (Gorina et al. 2014).

Incontinence prevalence and its severity may also vary by racial and ethnic background. For example, in community-dwelling populations, non-Hispanic older white women have a 1.8 times higher rate of UI than non-Hispanic older black women (Gorina et al. 2014). In contrast, non-Hispanic black long-term nursing home residents have a higher rate of both UI and FI (73.1% UI, 66.9% FI) than non-Hispanic white (69.8% UI, 58.5% FI) or Hispanic (69.1% UI, 62.8% FI) residents. However, in residential care settings, no racial or ethnic disparities in UI prevalence were found (Gorina et al. 2014).

Although incontinence exerts a toll on psychosocial functioning, these effects vary based on incontinence subtypes. UI has several subtypes: (a) stress UI which refers to leakage on effort,

exertion, sneezing, or coughing; (b) urgency UI which refers to leakage accompanied by a sudden, intense desire to urinate; and (c) mixed UI which refers to symptoms of both stress and urgency UI (Abrams et al. 2002). The prevalence of the UI subtypes varies by age and sex. Typically, urgency and mixed UI are seen more frequently in older women and men (age 65+) compared to younger adults. In addition, a constellation of lower urinary tract symptoms (urgency, frequency, nocturia, with or without urgency UI) known as overactive bladder (OAB) syndrome is also quite distressing and debilitating.

FI and anal incontinence, while they share similar characteristics, are not completely synonymous. As most studies have focused on FI, this term will be used. FI can consist of gas, liquid, or solid stool. The characteristics of FI have sometimes been identified as: (a) passive incontinence or the involuntary soiling or leakage of stool without forewarning of the patient, (b) flatus incontinence or the inability to control flatus, and (c) urge incontinence or the inability to defer defecation once the urge is perceived, for long enough to find a toilet (Norton et al. 2005).

Incontinence in older adults is associated with multiple interacting factors, including age-related changes in the lower urinary tract and brain; lifestyle choices in diet and physical activity; chronic conditions such as diabetes, arthritis, stroke, and constipation; trauma with resulting damage to the muscles and nerves associated with bowel and bladder function; and certain medications (Wagg et al. 2013). In addition, functional deficits in cognition and mobility play a significant role in the development and exacerbation of incontinence as they can impair the individual's ability to perceive and respond appropriately to the awareness of bladder or bowel fullness and/or to reach the toilet in time before the loss of urine or stool occurs (Wagg et al. 2013).

A strong association between UI and FI has been documented in epidemiological studies (Halland et al. 2013) suggesting that one type of incontinence is a risk factor for the other. However, the complex physiology of urinary and gastrointestinal function is interrelated, and most likely the association between UI and FI reflects

a common neurophysiological etiologic pathway rather than either being a risk factor for the other.

### Psychological Risk Factors for Incontinence

The linkage between the brain and the bladder was first described in the late 1970s by Frewen, a British urologist, who identified that psychogenic factors in women were associated with bladder overactivity confirmed by cystometry and that a simple behavioral intervention, bladder retraining, was effective in resolving UI (Ory et al. 1986). Psychological variables such as anxiety, depression, and cognitive impairment have been correlated with incident incontinence, especially UI. However, studies have been limited by age, sex, and incontinence type, making it difficult to extrapolate to the entire incontinent older population, especially older men.

Case-control, cross-sectional, and longitudinal studies have identified a strong association between anxiety, depression, and incontinence in older women and men (Halland et al. 2013; Luo et al. 2015; Tenunissen et al. 2006; Lobchuk and Rosenberg 2014; Coyne et al. 2012; Heinrich and Wells 2004; Dugan et al. 2000; Melville et al. 2009; Perry et al. 2006; Xu and Kane 2013; Nygaard et al. 2003; Bogner et al. 2002; Asoglu et al. 2014; Lussier et al. 2013). Effects of anxiety on UI have been noted in older adults of both sexes (Tenunissen et al. 2006). When the effects of UI are severe enough to cause functional impairment, the prevalence of anxiety disorders increases fourfold (Bogner et al. 2002). Higher anxiety as measured by the Beck Anxiety Inventory was associated with urgency incontinence and mixed UI in women but not with stress UI (Asoglu et al. 2014). Depression raised the risk of developing incident UI in several studies (Heinrich and Wells 2004; Melville et al. 2009).

The association between depression and incontinence might be bidirectional; e.g., depression is a consequence as well as a cause of incontinence. In one large prospective study of women aged 40 years and over, incident cases of anxiety and depression were predicted by urgency UI at

baseline. In this study, 56.6% of respondents reported substantial and frequent anxiety, while 37.6% reported significant depression (Perry et al. 2006). In contrast, in a large longitudinal study of female participants (mean age  $59.3 \pm 0.5$  years) from the Health and Retirement Study, major depression predicted the onset of UI over a 6-year period (adjusted odds ratio, 1.46; 95% confidence interval, 1.08–1.97). However, incontinence did not predict the onset of depression (Melville et al. 2009). A separate 6-year longitudinal study of women with an average age of 73.3 years who were incontinent at baseline as well as developed UI over time found that both groups had lower levels of psychosocial functioning (Heinrich and Wells 2004).

A neurophysiological mechanism might explain how mood contributes to incontinence. Depression is associated with abnormalities in serotonin, an important neurotransmitter that affects bladder function (Wagg et al. 2013). Also, increased sympathetic nervous system activity associated with depression can increase circulating levels of cortisol and catecholamines and consequently lead to physical changes in the bladder and UI (Melville et al. 2009).

There has been increasing attention to the role of brain processes in voiding dysfunction. Previous research comparing incontinent to continent older adults has demonstrated changes in cognitive processing. In one study, women aged 60 years and over with mixed UI had poorer performance on measures of executive function than those who had stress UI or continent controls (Lussier et al. 2013). These findings were specific to the neurocognitive test performed and involved only those that had involuntary switching and sharing/dividing attention between two tasks. Recent studies on brain imaging in cognitively intact older adults have more clearly mapped out a model of brain-bladder control and the neural circuits that are associated with bladder sensation and voiding suppression. Functional magnetic brain imaging suggests that damage to the cortical pathways serving the frontal, midcingulate, and subcortical circuits, e.g., white matter hyperintensities, increases with age and is linked to voiding dysfunction, especially the severity of

urgency UI (Smith et al. 2015). Studies of brain processing in older women with and without urgency UI suggest that disordered brain processes are contributing more to lower urinary tract symptoms and incontinence than end-organ changes (Smith et al. 2015).

UI and FI and their severity are highly associated with dementia. In a recent systematic review of the association of dementia and lower urinary tract symptoms, UI was found to be related to the type of dementia and its disease progression. For example, UI occurs in late-stage Alzheimer’s disease, but lower urinary tract symptoms precede cognitive impairment in Lewy body disease and in vascular dementia (Averbeck et al. 2015).

In long-term care facilities, staff attitudes and expectations may reinforce incontinent over continent behavior or have disincentives to remain or regain continence (Ory et al. 1986). The physical labor of caring for an incontinent resident with frequent leakage is time consuming, stressful, and frustrating and can lead to negative staff behaviors and a poor relationship with the incontinent resident.

### Psychosocial Consequences of Incontinence

Incontinence results in profound psychosocial consequences that have been well documented in quantitative and qualitative studies (see Table 1) (Halland et al. 2013; Luo et al. 2015; Tenunissen et al. 2006; Lobchuk and Rosenberg 2014; Coyne et al. 2012; Heinrich and Wells 2004; Dugan et al. 2000; Melville et al. 2009; Perry et al. 2006; Xu and Kane 2013; Nygaard et al. 2003; Bogner et al. 2002; Asoglu et al. 2014). The majority of studies have been conducted in women with UI; less is known about the psychosocial consequences in men.

How individuals perceive and respond to incontinence is influenced by attitudes about self, aging, and their general life situation (Ory et al. 1986). Many older adults deny they are incontinent in an attempt to preserve their self-respect and dignity. One-third to one-half of older adults experience feelings of embarrassment, frustration, and anxiety and limit or adjust their social activities because of the “fear of an accident.”

**Incontinence and Aging,**

**Table 1** Psychosocial consequences of incontinence in older adults and family caregivers

Older adult	Family caregiver
Embarrassment	Embarrassment
Shame	Frustration
Worry about having an accident	Anger
Feeling of worthlessness	Revulsion (especially fecal incontinence)
Feeling out of control	Resentment
Anger	Caregiver burden and stress
Hopelessness/futility	Depression
Anxiety	Social isolation
Depression	Role change
Impaired relationships	Decreased physical activities
Decreased life satisfaction and purpose	Sleep disruptions/fatigue
Loss of self-esteem/self-confidence	Decreased intimacy/sexual activity
Burden of always taking precautions to prevent or manage incontinence	Impaired relationships
Restriction of physical activities	Potential for abuse or neglect
Sexual difficulties/decreased intimacy	Decision to institutionalize
Decreased travel	
Social isolation	
Potential for institutionalization	

Constant worry about the possibility of the loss of bladder or bowel control in public causes psychological distress, leads to activity restriction, and impairs social functioning. Sufferers can experience loss of self-esteem and confidence, as well as have sexual difficulties (Coyne et al. 2012; Asoglu et al. 2014). Even older nursing home residents with UI experience decreased quality of life scores in mood, dignity, and autonomy (Xu and Kane 2013).

Some studies suggest that incontinence has a major impact on well-being, although most studies report a more modest impact, with only a subsample experiencing significant distress. These inconsistent results might be explained, in part, by different definitions of incontinence, incontinence severity and subtypes, and use of different instruments to measure well-being and psychosocial impact. Men tend to report greater social impact than women and may experience more emotional burden including anxiety and depression (Tenunissen et al. 2006; Coyne et al. 2012).

Psychosocial consequences tend to vary based on the type of incontinence and its severity, although studies are not consistent. In a large population-based study of women aged 50–59 years, women with severe UI were 80% more likely to experience significant depression, whereas women with mild to moderate UI were 40% more likely to experience depression (Nygaard et al. 2003). In some studies, the presence of more than one type of UI compared to one type alone was associated with significantly higher psychological burden in both men and women (Coyne et al. 2012). Urgency and mixed UI tend to have a greater impact affecting social, psychological, and sexual function (Tenunissen et al. 2006; Coyne et al. 2012). One explanation for why individuals with urgency UI may experience greater impact on psychosocial functioning is that it is associated with bothersome lower urinary tract symptoms such as urgency (sudden, compelling urge to urinate), urinary frequency (increased urination), and nocturia (awakening at night to empty the bladder). Although there are fewer studies on the consequences of FI, its impact is believed to be greater

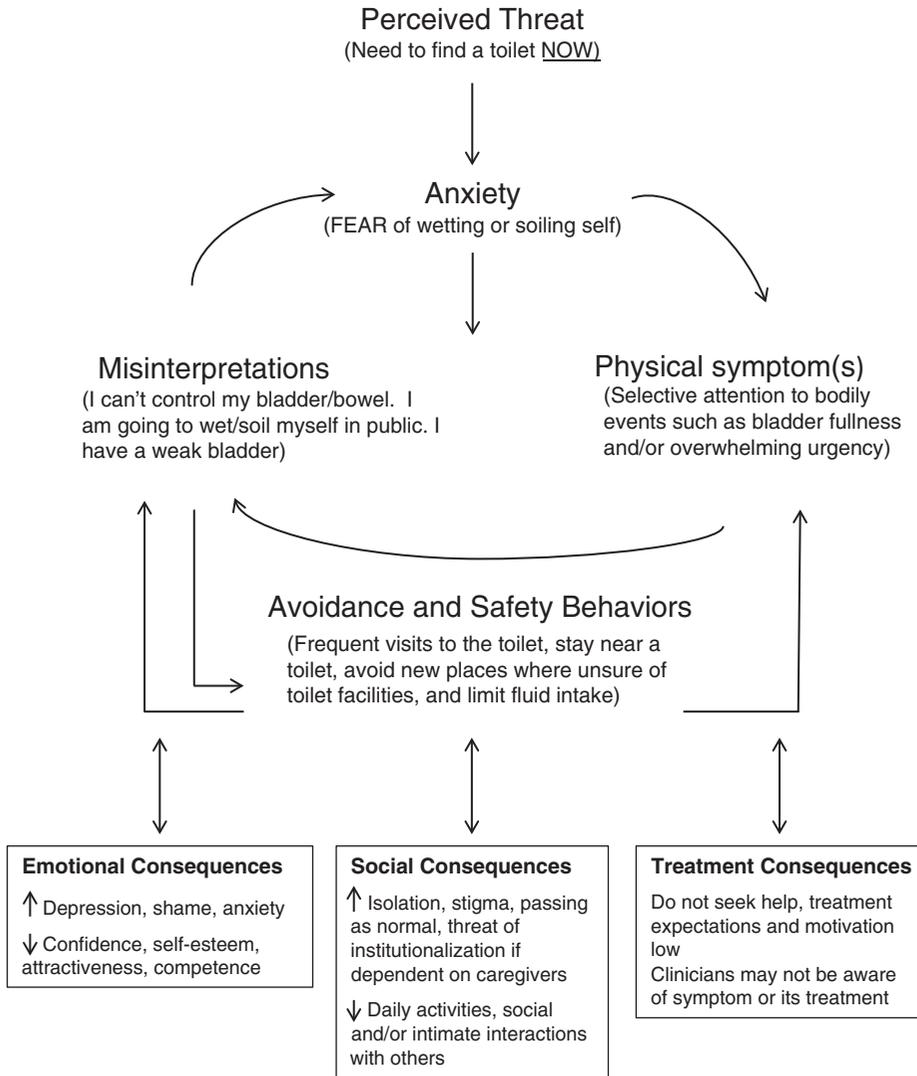
than UI (Norton et al. 2005; Wagg et al. 2013; Halland et al. 2013).

Perry and colleagues (Perry et al. 2006) proposed a model which integrates behavioral, cognitive, emotional, and social aspects of incontinence. While initially proposed for women with urgency UI, it has applicability to FI as well. In Fig. 1, an adapted psychological model for both UI and FI highlights how differences in perceptions, feelings, and behaviors lead to emotional and social consequences as well as decisions on treatment-seeking, expectations, and adherence. Interventions that provide active problem-oriented coping strategies may help individuals feel more “in control” of their bladder or bowel function and decrease the emotional and social consequences.

Family caregivers of affected individuals experience significant negative effects on their overall well-being and functioning (Ory et al. 1986; Wagg et al. 2013; Lobchuk and Rosenberg 2014). Feelings of embarrassment, frustration, anger, and revulsion are commonly reported. Consequences of caring for an incontinent individual, especially if there is cognitive impairment, can lead to psychological stress, sleep disruptions, fatigue, depression, and social isolation. Over time, sexual activity decreases, and intimate relationships become impaired. In families with preexisting poor relationships, the potential for abuse or neglect exists. The decision for nursing home placement is more likely if the individual cared for has frequent incontinence.

## Management of Incontinence

The goals for effective management of incontinence in older adults involves reducing or eliminating incontinent episodes, improving quality of life, preventing complications (negative psychosocial consequences, pressure ulcers, nursing home placement), and minimizing adverse treatment consequences and cost. A comprehensive evaluation should be conducted initially to exclude chronic diseases and local pathology that might be contributing to the incontinence (Wagg et al. 2013).



**Incontinence and Aging, Fig. 1** Psychological model for incontinence (Adapted with permission from Perry et al. (2006). John Wiley and Sons License)

Nonpharmacological, nonsurgical intervention, preferably behavioral intervention, is the first-line treatment for incontinence in patients with and without dementia. This approach is ideal for the older adult who is at higher risk for adverse effects from more invasive interventions such as drugs and surgery. Nonpharmacological treatment options for UI are summarized in Table 2. These include behavioral interventions (lifestyle modifications, scheduled toileting regimens, pelvic floor muscle rehabilitation,

and complementary therapies), external neuromodulation, anti-incontinence devices, and supportive interventions. Nonpharmacological treatment options are similar for FI. They include establishing a regular bowel regimen, dietary modifications to include a high-fiber diet, use of bulking agents using methylcellulose or psyllium, pelvic floor muscle exercises, and biofeedback.

Pharmacological therapy may be considered for patients whose incontinence is not adequately controlled by behavioral intervention and who

**Incontinence and Aging, Table 2** Nonpharmacological management of urinary incontinence in older adults

Intervention	Description	Patient characteristics
<b>Lifestyle modifications</b>		
Behavioral changes (e.g., fluid and caffeine modifications, smoking cessation, weight loss, constipation prevention)	Self-management strategies targeted toward reducing or eliminating risk factors that cause or exacerbate UI	Used as first-line therapies or in combination with other treatments
<b>Scheduled toileting regimens</b>		
Timed voiding	Toileting on a fixed schedule where interval does not change, typically every 2 h during waking hours	Used for patients with cognitive or physical impairments
Habit retraining	Scheduled toilettings with adjustments of voiding intervals (longer or shorter) based on patient's voiding pattern	Used for institutionalized or homebound patients with cognitive or physical impairments
Prompted voiding	Scheduled toilettings that require prompts to void from a caregiver, typically every 2 h; patient assisted in toileting only if response is positive; used in conjunction with operant conditioning techniques for rewarding patients for maintaining continence and appropriate toileting	Used for patients who are functionally able to use toilet or toilet substitute, able to feel urge sensation, and able to request toileting assistance appropriately; primarily used in institutional settings or in homebound patients with an available caregiver
Combined toileting and exercise therapy	Prompted voiding combined with functionally oriented, low-intensity endurance and strength exercises	Used for frail, inactive, or deconditioned nursing home residents. Nursing staff implement during toileting care routine
Bladder training	Scheduled toilettings with progressive voiding intervals; includes teaching urgency suppression strategies using relaxation and distraction techniques, self-monitoring, and use of reinforcement techniques; sometimes combined with drug therapy	Used for stress, urgency, and mixed UI in patients who are cognitively intact, able to toilet, and motivated to comply with training program
<b>Pelvic floor muscle rehabilitation</b>		
Pelvic floor muscle exercises (e.g., Kegel exercises)	Regular practice of pelvic floor muscle contractions; may involve use of pelvic floor muscle contraction for prevention of stress leakage and urge inhibition	Used for stress, urgency, and mixed UI in patients who can isolate and correctly contract pelvic floor muscles; requires cognitively intact and highly motivated patient
Biofeedback	Use of electronic or mechanical instruments to display visual or auditory information about neuromuscular or bladder activity; used to teach correct pelvic floor muscle contraction or urge inhibition; home trainers available	Used for stress, urgency, and mixed UI in patients who have the capability to learn voluntary control through observation and are motivated; used in conjunction with pelvic floor muscle exercises
Vaginal weight training	Active retention of increasingly heavy vaginal cone weights; typically used in combination with pelvic floor muscle exercises at least twice per day	Women with stress UI who are cognitively intact, can correctly contract pelvic floor muscles, able to stand, and have sufficient vaginal vault and introitus to retain cone and are highly motivated; contraindicated in patients with moderate to severe pelvic organ prolapse

(continued)

**Incontinence and Aging, Table 2** (continued)

Intervention	Description	Patient characteristics
<b>External neuromodulation</b>		
Nonimplantable electrical stimulation	Application of electrical current through vaginal, anal, surface, or fine-needle electrodes; used to inhibit bladder overactivity and improve awareness, contractility, and efficacy of pelvic floor muscle contraction; handheld stimulators for home use are available	Used for stress, urgency, and mixed incontinence in patients who are highly motivated; contraindicated in patients with diminished sensory perception; urinary retention, history of cardiac arrhythmia, cardiac pacemakers, implantable defibrillators, pregnant or attempting pregnancy; vaginal or anal electrodes are contraindicated in moderate or severe pelvic organ prolapse
Percutaneous tibial nerve stimulation	Application of a pulsed electrical current through a fine-needle electrode placed externally near the tibial nerve	Used for treatment of overactive bladder with urinary urgency, frequency, and urgency incontinence; contraindicated in patients with pacemakers or implantable defibrillators, prone to excessive bleeding, or women who are pregnant
<b>Complementary therapies</b>		
Acupuncture	Involves insertion of disposable sterile fine stainless steel needles into points on the skin that are thought to suppress or stimulate spinal and/or supraspinal reflexes to the bladder and/or urethra	Used for stress, urgency, and mixed UI and UI due to spinal cord injury
Mindfulness-based therapy	Combines meditation with more traditional aspects of cognitive behavioral therapy; preliminary evidence suggests benefit	Used for stress, urgency, or mixed UI in women and incontinence associated with depression and anxiety
Yoga	Combines body movements (yoga postures), breathing techniques, and meditation; preliminary evidence suggests benefit	Used for stress, urgency, and mixed UI in women
<b>Anti-incontinence devices</b>		
Bed or pant alarms	Sensor devices that respond to wetness; used to awaken or alert individuals via noise or vibrating mechanism	Can monitor incontinence in home care and institutional environments
Pessaries	Intravaginal devices designed to support the bladder neck, relieve minor to moderate pelvic organ prolapse, and change pressure transmission to the urethra	Used for female stress UI and mild to moderate pelvic organ prolapse; in postmenopausal women
Urethral or intravaginal device (women only)	Nonabsorbent, removable products inserted within urethra or vagina to prevent leakage	Used in female stress UI who are cognitively intact and have good manual dexterity
Urethral compression device (men only)	Penile clamp	Used in men patients with stress UI who are cognitively intact and have good manual dexterity
External collection devices (men only)	Condom catheter with leg bag	Used in men with functional impairments

(continued)

**Incontinence and Aging, Table 2** (continued)

Intervention	Description	Patient characteristics
Catheters	Disposable, intermittent urethral catheters and indwelling urethral and suprapubic catheters	Used for patients with urinary retention and overflow UI and patients who are bed-bound or with significant mobility impairments, with terminal illness, or with sacral pressure ulcers until healing occurs
<b>Supportive interventions</b>		
Toileting substitutes and other environmental modifications	Female and male urinals, bedside commodes, elevated toilet seats, grab bars	Used for patients with mobility impairments that make reaching toilet in timely fashion difficult
Absorbent products	Variety of reusable and disposable liners, pads, male drip collectors, male guard, collector undergarment, fitted brief, and pant systems; some products contain a polymer that absorbs and wicks urine away from the body	Used for all types of incontinence
Physical and occupational therapy	Gait and/or strength training, toileting skills training	Used for older patients with mobility impairments that make reaching a toilet in timely fashion difficult

have no major contradictions to drug treatment. In general, pharmacological therapy provides a better response when combined with behavioral interventions. Surgery is considered a third-line intervention and is considered when the degree of bother or lifestyle impairment is sufficient and other nonsurgical interventions are undesired by the patient or ineffective.

**Future Directions for Practice and Research**

**Practice.** The psychosocial impact of incontinence, while relatively minor for many older adults, can impose a significant emotional and social burden and affect treatment-seeking. This suggests the need to implement regular screening programs for incontinence in patients seen in primary care or long-term care settings. Brief screening instruments are available that can help facilitate the detection of incontinence. If detected, health-care providers should use a focused history and physical examination to diagnose incontinence subtype. Further evaluation of how incontinence is affecting the patient’s quality

of life and mental health should be conducted using interview questions or standardized condition-specific quality of life questionnaires. Men, in particular, may need to be questioned about possible feelings of shame and frustration to provide psychological support during treatment. Patients with complex symptomatology or who have failed empirical treatments should be referred to an incontinence specialist (e.g., urologist, urogynecologist, or gastroenterologist continence nurse specialist). For patients with family caregivers, attention should be given to assessing the impact of the incontinence on the caregiver, along with their needs for information about appropriate methods of management. The treatment decision-making process must take into consideration not only the bothersomeness of symptoms but also their impact on psychosocial functioning (Ory et al. 1986).

Treatment should be patient centered, involving the patient’s preferences and goals, and be targeted to the particular type of incontinence (Ory et al. 1986). If appropriate and preferred, first-line therapies such as behavioral interventions that carry the lowest risk of adverse side effects should be used initially. Multicomponent

therapies may be more effective than any single treatment focused on the bladder or bowel. For frail older adults with functional impairments or who are dependent upon caregivers, combining scheduled toileting regimens with functional exercise may reduce UI severity and caregiver burden associated with toileting. The key to success with behavioral intervention for incontinence is motivation of patients or caregivers. Regular follow-up is needed to help motivate patients and caregivers, provide reassurance and support, and monitor treatment outcomes, including impact on psychosocial functioning and quality of life.

**Research.** There is relatively limited research on the psychosocial consequences of incontinence and the role of psychosocial factors in the development and exacerbation of both UI and FI, especially FI and their effect on treatment-seeking. Longitudinal studies using multivariate analyses are needed to explore how psychological factors such as anxiety, depression, and cognitive processing are associated with the incidence of incontinence. Further study of how psychological factors influence treatment-seeking and moderate the success of behavioral and pharmacological treatments is needed. In addition, quantitative studies are needed to explore the effects of incontinence in family caregivers, including the decision to institutionalize the incontinent individual. The impact of incontinence on health-care staff, especially those working in long-term care facilities, is known to be especially frustrating but warrants further investigation. Attitudes, expectations, and care processes need improvement, and staff interventions directed toward helping staff cope with the heavy demands of caring for incontinent patients and residents might help to improving the quality of incontinent care. Clinical trials are also needed to explore promising interventions such as mindfulness-based therapy and yoga for their effect on psychosocial functioning, as well as tailoring multicomponent interventions most effectively to those individuals who have significant anxiety and depression in combination with incontinence or those with varying types and stages of dementia.

## Cross-References

- ▶ [Aging and Psychological Well-Being](#)
- ▶ [Assessment of Functional Abilities in Older Adults \(BADLs, IADLs\)](#)
- ▶ [Behavioral and Psychological Symptoms of Dementia](#)
- ▶ [Burden of Disease and Aging](#)
- ▶ [Caregiving and Carer Stress](#)
- ▶ [Clinical Issues in Working with Older Adults](#)
- ▶ [Depression in Later Life](#)
- ▶ [Mental Health and Aging](#)
- ▶ [Psychosocial Well-Being](#)
- ▶ [Quality of Life in Older People](#)
- ▶ [Sexuality and Aging](#)

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## Individual Differences in Adult Cognition and Cognitive Development

Christopher Hertzog

School of Psychology, Georgia Institute of Technology, Atlanta, GA, USA

### Definition

Individual differences refer to differences between persons in level or organization of cognition. With regard to aging, it also can entail between-person differences in rates of age-related cognitive change. Developmental differences can be due to normal aging, environmental context and lifestyle, or age-related disease and pathology.

### Introduction

A key question regarding aging and cognition is whether individuals differ in their patterns of growth, maintenance, and/or decline across the adult life span. Implicitly, the concept of “successful aging,” with its emphasis on preservation of cognitive function in old age (e.g., Martin et al. 2015), builds on the assumption that there are individual differences in the extent to which cognition remains functionally intact into old age.

One can view adult individual differences in cognition and performance from several different vantage points (Hertzog 2008). A major theme in cognitive aging has been the differing approaches and interpretations encountered in studies emphasizing differential approaches to cognition as opposed to experimental approaches to cognition. The latter approach often uses sophisticated techniques from cognitive psychology to measure multiple cognitive processes relevant to a particular type of cognitive function. The former approach may use complex sampling designs to evaluate age differences in performance on standardized or widely accepted tests, emphasizing the importance of obtaining measures of individual differences. Arguably, both approaches have strengths and weaknesses, and integrative approaches that capture the strengths of both traditions are needed to understand individual differences in cognitive aging.

A focus on individual differences in cognitive and adult cognitive development has generated a large literature that enables several inferences about aging.

First, individual differences are a hallmark of human behavior at every stage of the human life span. Since the work by Galton in the nineteenth century, it is well established that elemental and complex aspects of the human thought show substantial variability in the general population.

Second, individual differences at different points in the adult life span provide a means of framing individual differences in rates of aging. To a large extent, individual differences in cognitive abilities are well preserved across much of the adult life span, with high test-retest stability of cognitive variables over long time spans (Gow, ► [Intelligence and Aging](#)). Longitudinal studies of intelligence and other cognitive abilities paint a very clear picture of individual differences across the adult life span. Whenever correlations of a variable with itself can be computed over some span of years, from relatively short to extremely long, there is an impressive degree of stability of individual differences in the sample. Simple correlations of a variable with itself are attenuated by measurement error. Corrected for measurement error, the stability of individual differences in psychometrically

measured intellectual abilities is on the order of 0.9 over a span of 10–20 years (Schaie 2013) and remains high over longer age epochs. Some reviewers contend that the degree of stability is so high as to merit the inference that change in adulthood is predominantly about rates of decline that are relatively uniform or what might be termed preserved differentiation (Salthouse 2006). This is an overstatement; longitudinal studies detect individual differences in change at the construct level (e.g., Tucker-Drob 2011).

Nevertheless, the impressive degree of stability based on dozens of longitudinal studies is that individual differences in cognitive changes are, on average, relatively small in magnitude until the sixth decade of life. Normatively speaking, mean changes are probably most pronounced in perceptual speed but stronger in fluid intelligence, executive function, and episodic memory tasks than in tests of crystallized intelligence (Nilsson and Lövdén, ► [Normative Cognitive Aging](#); Rönnlund et al. 2005; Schaie 2013). These changes are small, however, in relation to the magnitude of preexisting individual differences, as are individual differences in rates of cognitive change. An inference that can be drawn, then, is that cognitive aging is a slow and subtle process, such that cognitively able persons in early adulthood are likely to be cognitively able older adults, relative to their same-age peers.

Third, even in the face of stability of individual differences, longitudinal studies of age changes in cognition in adulthood have detected individual differences in rates of cognitive and intellectual change in midlife and old age (e.g., Schaie 2013; Hultsch et al. 1998). A critical question is whether a decline in one domain of cognition implies changes in most if not all other domains. The answer appears to be that changes are often correlated across abilities but that there are reliable construct-specific individual differences in change as well. This pattern indicates that general or overall changes in rates of age-related change can be observed but that cognitive aging effects must involve multiple processes (see Salthouse 2006 for a different perspective). Furthermore, individual differences in rates of cognitive aging do emerge as a function of individual differences in health (and disease; see Anstey, this volume), lifestyle, and other factors.

Fourth, variability in human cognition can be seen in long and short time scales, with individuals differing both in long-term change and in short-term fluctuations (intraindividual variability, Nesselrode 1991). Individual differences in mood states, stress reactions, and physiological variables like the circadian rhythm can both affect cognitive performance and be a marker variable signifying future aging-related changes. An excellent example of the importance of this issue comes from a work by Sliwinski et al. (2006), who showed that within-person fluctuation in stress and stress-related effect was coupled with within-person fluctuation in working memory capacity.

Fifth, individual differences in cognitive performance across different constructs can be leveraged to evaluate whether there is a qualitative functional reorganization of cognition with aging and how it is structured or organized. Instances of qualitative reorganization are rare and are typically more likely in the presence of major neuronal pathology (e.g., macular degeneration (Alzheimer's disease)). Such findings suggest that aging effects in the main are more about altering level of cognitive performance than about generating a wholesale shifting of the underlying psychological and neurobiological bases of cognition. Developmental differences in patterns of correlations among variables are more likely to be discovered in domains like the creation of new complex skills (where (1) the mode of processing qualitatively changes from one of novice discoveries to automated skills and (2) adults of different ages differ in how and whether automated skills develop; see Rogers et al. 2000) than in fundamental aspects of cognition like working memory or divided attention that appear to change in level but not the structure of performance.

Sixth, qualitative differences in the mechanisms and processes applied to solve cognitive problems may generate different patterns of correlations among cognitive tests. Variation in the strategic approaches taken to achieve cognitive outcomes can occur within or between persons, depending on factors such as motivation, task demand, and availability of relevant knowledge and expertise (Lemaire 2010; this volume).

Developmentally, shifts in strategies used to solve cognitive problems can reflect learning and experience, or they can signify compensation for age-related changes in underlying cognitive mechanisms that necessitate functional reorganization of behavior.

Seventh, psychologists develop empirical measures of cognition in the form of psychometric tests, cognitive tasks, and scales taken from questionnaire and interviews. Individual differences in these empirical measures may stem from individual differences in the target constructs of interest, but they may also arise from variability that is specific to how performance is measured (or captured) by the task at hand. Multiple studies in different cognitive domains have demonstrated that individual differences are influenced by test- and task-related behaviors that are not actually generated by the cognitive construct of interest. In developmental science, such violations of measurement equivalence (equivalent measurement properties at different parts of the life span or for different groups of persons) can generate incorrect conclusions about why adults differ in cognitive performance.

Eighth, there is an important distinction between cognition as measured in experimental tasks or psychometric tests and the extent to which individual differences in such measures predict problems in cognition in everyday life. On the one hand, individuals who are experiencing cognitive challenges related to aging may be more likely to engage in effective compensatory behaviors that offset the changes (e.g., Bäckman 1989). On the other hand, it is an open question as to how much everyday tasks draw on the kinds of cognitive mechanics (Baltes et al. 1999) emphasized in cognitive research. To a great degree, people select themselves into behavioral niches in which knowledge, expertise, and habitual behavioral routines may matter far more for success in cognitively demanding tasks than fluid intelligence per se. One should not generalize from evidence about, say, age differences in a laboratory task measuring a construct like prospective memory (e.g., Kliegel, ▶ [Prospective Memory, New Perspectives for Geropsychological Research](#)) to presume age deficits in everyday prospective memory, such as remembering to take medications

(e.g., Park et al. 1999). In real life, successful goal pursuit is influenced by many variables, including motivation and personality, that are separable from the relevant cognitive processes. Furthermore, cognitive demands may not exceed an individual's cognitive capacity, even if that individual has experienced cognitive decline from early adulthood.

## Methodology and Individual Differences

A critical issue for assessing individual differences in cognitive aging is how applied developmental research design and multivariate statistics can be employed to scale individual differences in adult cognition and cognitive change across the adult life span. In the 1960s and 1970s, the life-span developmental psychology movement championed the application of quasi-experimental design principles to the study of adult development, to good effect (Baltes et al. 1988). This approach and parallel efforts in gerontological science led to a focus on a number of critical methodological issues, including (1) differentiating cohort differences from age changes, (2) how population definition, sample selection, and sampling practices affect inferences about aging, (3) the importance of longitudinal data for capturing individual differences in cognitive change, (4) influences of practice effects in longitudinal studies, and (5) the consequences of selective mortality and attrition in biasing estimates of individual differences in change. More recently, the field has emphasized applications of advanced statistical models for scaling individual differences in change, including structural equation models, growth curve models, and growth mixture models (e.g., Ferrer and McArdle 2010). Indeed, one might claim that advances in statistical applications have papered over problems of developmental design. It is also the case that methodological sophistication and attention to rival explanations for age-related effects are more predominant in longitudinal studies of cognitive change than it is in typical cognitive aging

studies deriving from an experimental cognitive psychology perspective, where scientists are likely to treat age differences in cognitive dependent variables as unambiguous indications of the effects of development and aging (Hertzog 1996). With respect to statistical applications, interesting new developments in growth mixture models and related approaches have the potential to invigorate the search for subtypes of persons showing qualitatively different developmental patterns.

Historically, an important methodological concern has been to address the question of measurement equivalence, the idea that cognitive tests or tasks measure the same underlying constructs with the same measurement properties for people of different ages (e.g., Labouvie 1980). Confirmatory factor analysis is often used to test the idea of equivalence and to evaluate whether there are interpretable changes in phenomena such as the correlations among latent cognitive ability factors (e.g., Brickley et al. 1995). A common finding is that factor correlations increase in old age samples, although this inference can be biased by including wide age ranges in samples drawn from different parts of the life span (e.g., Hofer et al. 2006). For instance, using a 20-year span to define young (20–40), middle-aged (40–60), and old (60–80) subgroups might inflate correlations in the older group because there are greater individual differences in cognitive change after age 60. Aggregating the data across wide age intervals would risk an artifactual increase in correlations.

## Individual Differences Arising from Performance-Specific Confounds

There are multiple strands of evidence that age comparisons of cognitive task performance are complicated by age differences in task-related behavior that can be misunderstood as age differences in the construct the research was attempting to study.

Sensory and perceptual deficits can create performance deficits in older adults that can be misattributed to other constructs (e.g., Davis

et al. 2002; see Schneider and Pichora-Fuller 2000). It is also well known that the speed of behavior slows with advancing age (Verhaeghen, ► [Age-Related Slowing in Response Times, Causes and Consequences](#)). Slowing of cognitive task performance can occur because of fundamental changes in information transmission rates or because of response conservatism in the decision stages in a speeded discrimination task or both. As a consequence, slowing in speed of processing can impact older adults' intelligence test performance. Many intelligence tests are heavily influenced by the speed of response, and slowing in response speed will result in fewer items solved correctly in a fixed time limit. Hertzog (1989) showed that slowing in the marking of old-style answer sheets accounted for substantial proportions of variance in the tests used by Schaie (2013) in his longitudinal study. It appears that similar longitudinal gradients in Schaie's (2013) study could be in part due to contributions of speed to different tests (in particular, the speeded nature of the vocabulary test probably overestimated the degree of decline in test performance between ages 60 and 75 on this test). Furthermore, the correlations of these components across multiple tests accounted for a large part of the increase in correlations among ability factors in old age (Hertzog and Bleckley 2001). However, performance speed confounds cannot account for all of the age changes in intelligence, nor can they be a sufficient explanation of dedifferentiation in intellectual ability factors observed in old age (deFries et al. 2007).

Likewise, gerontologists have studied age differences in learning-related shifts in some skill-based tasks, for example, changing from numeric computation to memory retrieval when calculation problems are repeatedly presented. The repetition of items allows for responses based on remembering the correct answers without the need to compute the solution. However, a number of studies have demonstrated that delayed shift to memory retrieval by older adults is also influenced by a reluctance to rely on memory, in part because of a distrust of memory as a function of lower memory self-efficacy (Touron 2015). For

instance, monetary incentives to respond quickly, forcing the use of memory retrieval strategy, substantially alter the shift to memory strategy used by older adults. One therefore cannot estimate age differences in the rate of performance improvements and then treat the estimated slopes as unbiased measures of the cost of associative learning deficits on rates of skill acquisition. The work by Ratcliff and colleagues (e.g., Ratcliff et al. 2011), applying the diffusion model for response times and response accuracy, similarly suggests that age differences in a response time task are also influenced by age differences in decision criteria (how much evidence is needed to respond), for some tasks (e.g., item recognition memory) to a greater extent than age differences in how rapidly information is accumulated (drift rate).

Such findings emphasize that it is hazardous to interpret age differences in cognitive tasks as necessarily reflecting age differences in the cognitive processes the task was designed to measure without a more complete understanding of the cognitive processes evoked by the task. Sadly, more careful measurement and construct validity work are required than is the norm in the field.

## Conclusions

The work on individual differences in adult cognitive development has produced a rich set of findings that implicate heterogeneity in cognition that is well preserved across the human life span. There is also evidence that people vary in the nature and magnitude of cognitive changes in old age. The next decades are likely to witness major advances in our understanding of who ages more gracefully and why.

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## Insomnia and Clinical Sleep Disturbance

Erin L. Cassidy-Eagle  
Research and Evaluation, ETR, Scotts Valley,  
CA, USA  
Department of Psychiatry and Behavioral  
Sciences, Stanford University School of  
Medicine, Stanford, USA

### Synonyms

Restlessness; Sleeplessness; Somnolence;  
Wakefulness

### Definition

Broadly speaking, insomnia is defined as a person's dissatisfaction with the quality or quantity of their sleep. Specifically, the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders (5th edition; DSM-5; APA 2013) describe the characteristics of insomnia as including one or more of the following over three or more nights per week for a period of at least 3 months: difficulty falling asleep, frequent and extended nighttime awakenings or waking up earlier than planned. These symptoms occur despite the opportunity for adequate sleep and cause the individual distress and/or other symptoms of impairment, such as feelings of fatigue, excessive daytime sleepiness, and decreased motivation to keep up normally planned activities.

### Prevalence and Magnitude

With advancing age, both men and women experience higher rates of insomnia. Disturbed sleep is frequently associated with a range of medical and mental health problems. Insomnia symptoms negatively impact one's quality of life but also, in turn, put the individual at increased risk of declining health and psychiatric functioning over time, such as heart disease and depression. Over 50% of

older adults over the age of 65 report that they have problems sleeping (Foley et al. 1995). In particular, women and individuals with other medical or psychiatric conditions are at a significant risk of developing problematic sleep patterns. Age-related changes in sleep architecture include increased time to fall asleep, an increase in the amount of time spent awake after falling asleep, and a lower percent of the total time spent actually asleep while in bed (i.e., sleep efficiency). In addition, older adults are likely to spend less time in deep or slow-wave sleep, which contributes to a greater sleep fragmentation and the lack of feeling restored upon waking, which is even further complicated by, medical, psychological, environmental, and behavioral factors.

Nonpharmacological treatments, such as a multicomponent cognitive behavioral therapy for insomnia (CBT-I), are an effective primary treatment or adjunct therapy to sleep medication. CBT-I has also been shown to positively impact other psychiatric and social factors in addition to improving sleep. It can be implemented individually or in groups by sleep specialists or other trained interventionists. Furthermore, there is growing evidence that treatments, such as CBT-I, adapted for older adults in residential settings or those with mild levels of cognitive impairment are also effective in improving other aspects of functioning in addition to the symptoms of insomnia. Insomnia is an ideal target for change in older populations given its high prevalence, impact on functioning, and the availability of effective treatments that do not put the older individuals at risk of other complications, such as the side effects experienced from prescription medication.

### Sleep and Residential Settings

Across the continuum of long term care, from home-based care, to assisted and independent living facilities and onto skilled nursing settings, sleep problems are an incredibly common complaint of older adults. Due to declining health, acute and chronic stressors (e.g., loss of loved ones, moving into new residence, logistics

involved in the management of health conditions), as well as the characteristics of the settings themselves (e.g., lighting, noise, scheduling), insomnia is one of the first signs of such change and stress. One of the most frequent strategies employed by those with sleep difficulties is to spend more time in bed trying to make up for a bad night's sleep. In addition, many individuals worry intensely about the consequences of their sleep problems and its potential impact on their health. There are many messages transmitted through media and word of mouth about how much sleep one "should" be getting. Unfortunately, all of these efforts, pressure and messaging only serve to further exacerbate the difficulties of getting a better quantity and quality of sleep.

One of the most detrimental consequences of impaired sleep is the increase in reports of daytime sleepiness. This issue is exacerbated in the residential setting and affects one's ability to engage in daytime social activities (Martin et al. 2006). When individuals become less socially engaged, less physically active and more prone to planned and unplanned napping, their sleep becomes even more disrupted across the entire 24-h day. In addition, there are other consequences fueled by disengagement, such as increased rates of comorbid medical illnesses and additional prescription medication added onto an already complicated clinical picture. Other primary sleep disorders, such as sleep apnea and restless leg syndrome are diagnosed at much higher rates in older adults and also compound the risk of experiencing an overall decline in functioning. Unfortunately, even though it is recognized that older adults in residential settings have high rates of fragmented sleep, appropriate treatment options are not yet commonly available (Ancoli-Israel et al. 1989).

### **Sleep and Cognitive Impairment**

Cognitive impairment resulting from various, progressive neurological conditions, such as Alzheimer's or Lewy Bodies Dementia, increase in prevalence with age. Sleep disruption is a troublesome and common symptom associated with such conditions. In addition to being one of the

consequences of neurological disorders, research has also revealed that sleep problems may precede the identification of the neurological disorder. Pursuing efforts to support and improve the quality of life of those with cognitive impairment is critical and efforts to improve their sleep are one path to do so. An example of a successful intervention includes the work of McCurry et al. (2005) in which Alzheimer's patients exhibited improvements in their sleep as a result of a behavioral intervention that has been effective in other nondemented, noninstitutionalized populations. Another study by Alessi and colleagues (2005) illustrated the benefits of a similar nonpharmacological, behavioral intervention focused on sleep at decreasing daytime sleep and improving social functioning.

### **Evaluation**

When an older adult presents with sleep difficulties, a comprehensive assessment approach that determines the presence of other medical and psychiatric causes is advised. Because it is common for sleep problems to co-occur with other disorders, such as depression or post-traumatic stress disorder, the historical approach was to focus the initial clinical treatment on the "primary" disorder and assume that the sleep problems will resolve during the course of this intervention. Current scientific knowledge and experience has revealed that such an approach often leaves the individual improved, but still experiencing symptoms of problematic sleep and with a higher chance of relapse for the "primary" disorder (e.g., depression). As such, the current recommended approach is to treat both conditions simultaneously unless there are reasons not to, such as the patient is experiencing an acute medical crisis, lack of available treatment providers, or avoidance of over scheduling a medically fragile patient, patient preference.

When evaluating and treating older adults, it is also important to investigate the possible presence of other sleep disorders, such as sleep apnea and RLS, which increase greatly with age. Also, the shifts in sleep patterns, common with advancing

age and often related to changes in circadian rhythms are important to ask about. Such shifts often manifest as feeling sleepy earlier in the evening and rising earlier in the morning, as known as an “advanced sleep phase.” Shifts in sleep schedules aren’t necessary disruptive or pathological, and questions about the problems caused in an individual’s schedule or social calendar will reveal whether such shifts are having a negative impact on their maintenance of health or quality of life. Assessment of the older adult’s environment can also reveal causes of sleep disruption that may reveal more simplified intervention target. As mentioned earlier, the timing of light exposure, time spent in bed, irregular sleep schedules across the course of the 24 h day, tendencies towards being a morning or an evening person, changes in their circadian rhythm and their coping styles (e.g., levels of worry) with advancing age can impact one’s ability to sleep well. Finally, it is important to rule out other medical conditions that could be at the core of the sleep problems, such as thyroid problems leading to daytime fatigue, medication side-effects or the possibility that another primary sleep disorder, such as sleep apnea or restless leg syndrome are present.

Sleep measures include easy to administer self-report instruments to more complicated, objective, and computer scored tools, such as wrist actigraphy. One of the simplest measures is also the probably the most powerful: a sleep diary. This straight forward recording of various sleep parameters, such as time in bed, time spent awake, recording of alcohol intake can be incredibly useful in identifying the specific patterns and struggles that an individual has during their “sleep window.” Individuals can use these tools independently in order to track and better understand the ebbs and flows of their sleep functioning. When possible, a review of this information by someone familiar with the principles of behavioral sleep medicine can result quickly in an understanding the presenting concerns. Employing the use of other assessment tools, such as polysomnography, is particularly useful if another primary sleep disorder, such as sleep apnea or restless leg syndrome, is suspected. There are several popular

scales that can be used to rate the nature and severity of sleep problems, such as the Insomnia Severity Index (Morin 1993), which also parallels the questions that you would ask to verify diagnostic classification. Questions regarding the consequences of sleep loss, such as symptoms of daytime sleepiness, avoidance of planned daily activities, and time spent worrying, are useful elements to fill out the clinical picture. Sleep evaluations can be supplemented by the use of actigraphs. These wearable devices are accelerometers typically attached to one’s wrist or ankle to estimate sleep patterns as measured by the body’s position and amount of physical movement. Although use of these devices are most common in research studies, less sophisticated versions of these devices (e.g., commercially available devices worn on wrists that compute estimated time spend sleeping) are becoming increasingly popular as individuals become interested in their sleep functioning. Professionally administered and scored actigraphs provide an objective estimate of several sleep parameters, such as time in bed, number and length of nighttime awakenings and sleep efficiency (proportion of sleep time relative to intended sleep time). Using actigraphy in combination with a standardized version of a sleep diary (Carney et al. 2012) can be a powerful combination to assess sleep across the lifespan.

## Treatment Options

Insomnia represents a modifiable source of disability in older adults. Multicomponent CBT-I and hypnotic medications (e.g., benzodiazepines, such as Halcion, and nonbenzodiazepines, such as Ambien) are the only treatments with sufficient evidence of treatment efficacy (NIH state of the science 2005). Due to the risks associated with the use of hypnotic medications in the elderly, such as confusion, increased fall risk, and polypharmacy concerns, alternative treatments are in great demand. Morin and colleagues (1993) have studied nonpharmacological sleep interventions focused on an older adult population extensively and have found treatments, such as CBT-I, are

incredibly efficacious in this older age group. Identifying new ways to further the dissemination of CBT-I, and variations thereof, is a crucial next step. For one, CBT-I is cost-effective and fairly straightforward to administer given the multiple treatment protocols currently available. It can also be implemented by frontline staff, such as advanced practice nurses, if given adequate training. Therapy can target individuals, groups, or the caregivers of more impaired older adults. The different components commonly included in a CBT-I package, include providing the theoretical basis for sleep-related recommendations, general information about sleep, and may also include education about the age-related changes in sleep. Suggestions for creating sleep promoting practices, such as minimizing alcohol consumption, exercising at an optimal time, or keeping the room at a cool temperature, is typically clustered under the recommendations associated with “Sleep Hygiene”; a necessary but not sufficient approach to improving sleep that is frequently included in standard sleep treatment. In addition, there are components with considerable empirical support, such as the behavioral approaches of stimulus control and sleep restriction. These include using procedures like setting a consistent wake time and sleep opportunity window as well as recommending that the individual get out of bed if unable to sleep, in addition to other instructions. For those who spend a significant amount of time worrying about the consequences of lost sleep or their ability to achieve a good night’s sleep, there is also a component of therapy which focuses exclusively on challenging and replacing these dysfunctional cognitions with ones that are more conducive to bringing on sleep. Morin and colleagues (1993) have described older insomniacs as succumbing to a vicious cycle that perpetuates insomnia, with emotional distress fueling dysfunctional beliefs and attitudes that serve to worsen and extend their sleep problems.

In summary, effective treatments are available for insomnia in older patients. Recognizing, assessing, and effectively treating sleep problems in older adults have the potential to reduce the burden of a significant public health problem. Sleep is an ideal intervention target due to the

potential influence one’s sleep has on a wide range of common disorders experienced in old age. Increasing the awareness of this disorder and furthering the dissemination of treatment approaches is a crucial part of maintaining high levels of medical and psychiatric functioning and preventing premature disability and declining health of older adults.

## Cross-References

- ▶ [Anxiety Disorders in Later Life](#)
- ▶ [Assisted Living](#)
- ▶ [Cognitive Behavioural Therapy](#)
- ▶ [Comorbidity](#)
- ▶ [Pain and Pain Management](#)

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variance remains. There are characteristic age-related changes in intelligence, such that performance on tests of cognitive ability generally decline with age. However, longitudinal research suggests cognitive abilities show marked stability across midlife, with some aspects of intelligence being less susceptible to age-related declines; verbal abilities, for example, may continue to develop through midlife and be maintained into old age, while declines in processing speed-type abilities may be observed many decades earlier. Furthermore, there are marked individual differences in the timing and degree of decline experienced. A focus of research on intelligence and aging is therefore to define the content and structure of the broad domains underlying general intelligence; to characterize how and when those general and more specific domains decline on average; to examine individual differences in both the level of, and change in, intelligence across the lifecourse; and to identify the determinants of both level and change.

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## Intelligence and Aging

Alan J. Gow  
Department of Psychology, Heriot-Watt  
University, Edinburgh, UK

### Synonyms

General cognitive ability; General intelligence (g); General mental ability; Intelligence

### Definition

Intelligence has been described as a “very general mental capability that, among other things, involves the ability to reason, plan, solve problems, think abstractly, comprehend complex ideas, learn quickly and learn from experience” (Gottfredson 1997, p. 13). This “general intelligence” is conceptualized as the peak of a hierarchy describing the positive associations that exist among all cognitive abilities; it is the common variance among broad cognitive domains – for example memory, executive function, processing speed – though important domain-specific

### Intelligence and aging

What is intelligence, and how does it change with age? Most people would likely provide overlapping or at least complementary definitions of what makes a person intelligent. It is likely there would also be a consistency of opinion in the expected course of age-related changes in intelligence, with inevitable decline perhaps being the overarching theme. The loss of thinking and memory skills, or cognitive aging, is one of the greatest fears people have about growing older. Researchers have therefore sought to better understand intelligence and how it changes with age, so that it might be possible to identify the factors that underlie those changes, explain why some individuals experience greater decline than others, and ultimately translate that knowledge into interventions that might reduce, delay, halt, or even reverse age-related declines in intelligence.

The current entry will explore intelligence and aging by focussing on how we define intelligence

and how it changes with age, before touching on a series of key questions, including:

- How stable are individual differences in intelligence across the lifecourse?
- When it goes, does it all go together?
- What role do genes play in age-related changes in intelligence?
- Is age kinder to the initially more able?
- Can we alter the course of age-related changes in intelligence?

In exploring these questions, a general overview of intelligence and aging will be provided with examples to highlight and illustrate specific concepts or findings. By no means an exhaustive series of questions in the field of intelligence and aging (the overview will not detail neuroscientific explanations for what might account for the development of, or age-related changes in, intelligence, for example), the intention is to briefly introduce selected topics, many of which can be explored in greater depth elsewhere in the *Encyclopedia of Geropsychology*.

## What Is Intelligence?

In order to clarify misunderstandings and potentially misleading claims about the “knowns and unknowns” of intelligence, in the mid-1990s the American Psychological Association assembled a task force to report on the fundamental issues, whose aim was to clearly articulate what was understood scientifically by the term intelligence (Neisser et al. 1996). The report stated:

individuals differ from one another in their ability to understand complex ideas, to adapt effectively to the environment, to learn from experience, to engage in various forms of reasoning, to overcome obstacles by taking thought. (p. 77)

This general characterization covers both what a lay and expert conception of intelligence might amount to; beyond this, however, it is important to understand the way in which these observed differences in intelligence might be structured and determined. “Because there are many ways to be

intelligent, there are also many conceptualizations of intelligence” (Neisser et al. 1996, p. 95).

For present purposes, the psychometric approach will be taken, being the prevailing form of research in the area of intelligence, bringing with it over 100 years of research and development (Neisser et al. 1996). This approach to intelligence attempts to rank individuals according to their performance on a number of psychometric tests (Deary 2000). These can assess a specific ability using one form of item (such as verbal or numerical) or may be structured in a larger battery of many tests to form a composite measure of overall test performance. These general scores are traditionally, though not always, reported as IQ (intelligence quotient) scores using a standardized scale with a mean of 100 and a standard deviation of 15. People can differ on their scores for both the numerous specific tests and on their overall level of performance. Throughout, when the terms intelligence, cognitive ability, or mental ability (or combinations thereof) are used, they refer only to psychometric intelligence as assessed by psychometric measures. This methodology necessarily involves interpreting these scores on standardized tests as reflecting underlying differences in some actual intellectual capacity, though no direct correspondence to brain structure or function is implied (Deary 2000).

One of the most important initial findings across research with these varied tests was the discovery of a “positive manifold” (Spearman 1904): an individual’s score on one test is positively associated with their performance on a range of other, often disparate measures. This ever-present positive interrelatedness led many, most notably Spearman (1904), to propose the existence of a general factor of intelligence (conventionally annotated *g*, with synonyms including general ability, general mental ability, general cognitive ability, and similar). Performance on each measure of mental ability can be accounted for to varying degrees by *g* (Neisser et al. 1996). Thus, one way to view cognitive function is as *g*: the shared variance across a number of abilities. This paradigm was not, however, universally accepted (although, as will be

discussed, it now sits within the most widely accepted models of cognitive ability) and initiated research leading to conceptions of intelligence which highlighted varying numbers of specific factors or abilities, often to the exclusion of a superordinate *g* factor. Models of intelligence often favored different levels of description, consequently making them appear seemingly incongruent or contradictory. Such competing models were, in fact, in far greater agreement than was often manifestly apparent (Deary 2000). J. B. Carroll is frequently cited as the consensus maker, providing empirical support to effectively place this general factor at the apex of a hierarchy of ability: *g* forms the peak, below which are found more specific abilities (Carroll 1993).

Carroll's (1993) efforts were based on reanalyzing the corpus of data that had amassed concerning the structure of intellectual abilities as a necessary "review and critique of the extant literature on the identification, characteristics, and interpretation of cognitive abilities" (Carroll 1993, p. 73). This included surveying the available factor analytic and correlational studies of mental ability over the previous half century. From his initial list of around 1500 references – containing all or virtually all the important and classic factor analytic studies – 477 datasets were selected for reanalysis. Just over 460 led to satisfactory solutions. The complex procedure utilized exploratory factor analysis in order to determine the number of common factors present within each dataset, resulting in the production of simple-structure first-order factors, which were subsequently analyzed for the presence of higher-order factors, at the second, and sometimes, the third order. The 2850 factors produced across the different datasets reanalyzed by this process were inspected and given appropriate names. This allowed an examination across the datasets to "determine how many different factors [were] represented among them, preparatory to interpreting them as basic dimensions of individual differences in cognitive abilities" (Carroll 1993, p. 135).

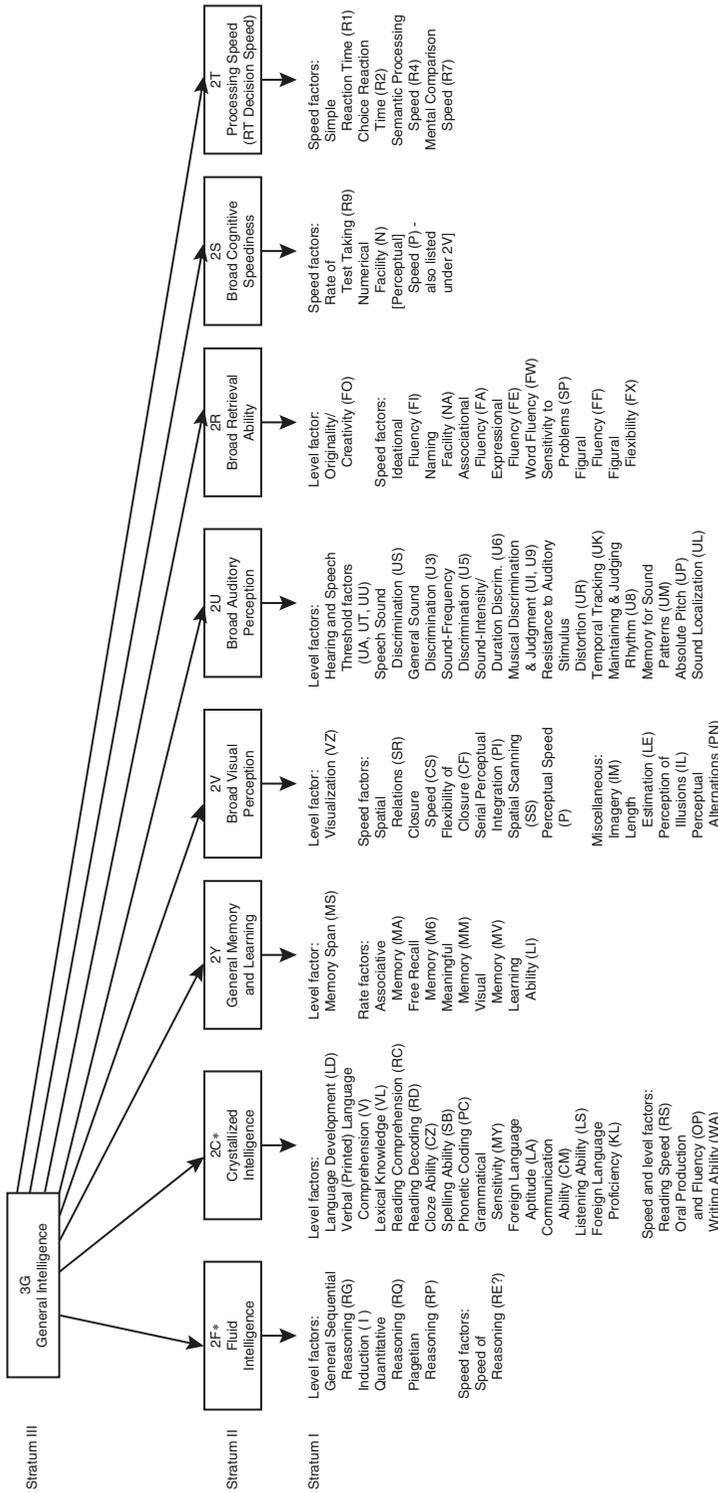
Carroll (1993) suggested that mental abilities could be described by a three-strata hierarchical model (Carroll's model is reproduced in Fig. 1). It was an essentially syncretic model, fusing the

"opposing" blocs of previous intelligence theory and research. At the highest level, stratum III was situated, a general intelligence factor (much like Spearman's *g*, although labeled *G* in Carroll's analysis). Below this, a number of distinct broad ability factors (stratum II) were located, including fluid intelligence, crystallized intelligence, general memory ability, broad visual perception, broad auditory perception, broad retrieval ability, broad cognitive speediness, and processing speed. Finally, stratum I consisted of the narrower, more specific lower-order factors underlying appropriate stratum II factors. For example, induction and quantitative reasoning factors would lie below fluid intelligence; memory span and free recall memory factors would fall under general memory (Fig. 1). While general intelligence is placed firmly at the peak of the cognitive ability hierarchy, the "possible importance of more specialized abilities cannot and should not be ignored" (Carroll 1993, p. 27).

Due in no small part to the comprehensive efforts of Carroll (1993), the *g*-centric, hierarchical concept of intelligence came to be described as "the most widely accepted current view of the structure of abilities" (Neisser et al. 1996, p. 81). A broad consensus has emerged around this hierarchical structure; however, it is imperative to distinguish between this as a description of the structure of psychometric test performance and an explanation of why people differ in intelligence (Deary 2000). That said, as the "job of mapping the structure of psychometric intelligence differences is done to a sufficient degree" (Deary 2000, p. 32), it is possible to begin asking how age affects intelligence.

### **How Does Intelligence Change with Age?**

On the whole, older people do less well on some tests of cognitive ability compared with younger adults (Deary 2000; Salthouse 2010; Hedden and Gabrieli 2004; Schaie 2013; Hertzog et al. 2009); that is, with age, cognitive decline is apparent. This general trend towards poorer psychometric test performance with increasing age has been



\* In many analyses, factors 2F and 2C cannot be distinguished; they are represented, however, by a factor designated 2H, a combination of 2F and 2C.

**Intelligence and Aging, Fig. 1** The three-stratum structure of cognitive abilities. Note. A general ability factor defines stratum III, followed by broad and specific ability factors respectively (Reproduced from Carroll (1993). Reproduced with permission from Cambridge University Press)

reported by a number of international research teams cross-sectionally and by following a diverse range of cohorts longitudinally. Longitudinal studies are rarer, relative to cross-sectional designs, due to the logistics involved in following a large enough sample over time and the length of follow-up required to observe changes in cognitive ability. Cognitive aging studies also vary greatly in their design, in the nature of the tests employed or in the characteristics of the actual individuals tested (Hertzog et al. 2009). Nevertheless, to illustrate the nature of the changes in cognitive ability that can be expected with increased age, results from one major study, the Seattle Longitudinal Study (SLS), are discussed in detail. Descriptions of a number of other longitudinal studies can be found in the *Encyclopedia of Geropsychology*.

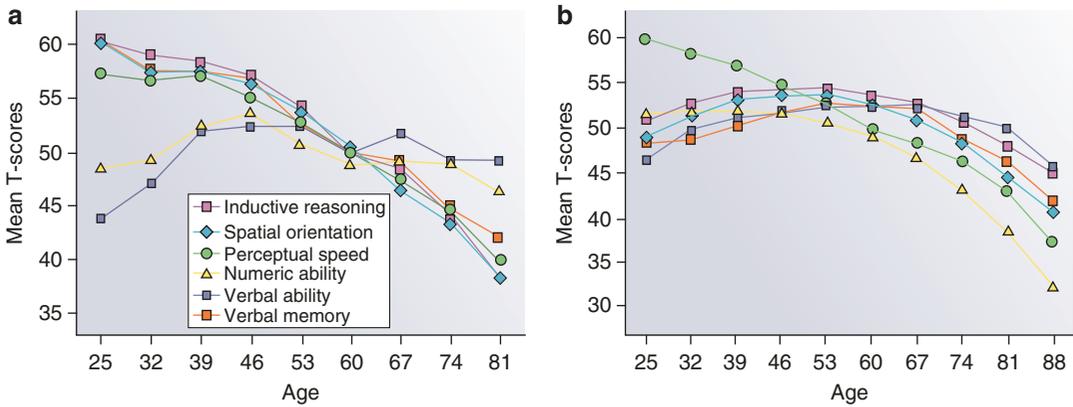
In 1956, the Seattle Longitudinal Study (SLS) was initiated by K. W. Schaie (constituting his doctoral dissertation), a study which has since become a key reference in the domain of cognitive aging research. The study consisted of seven further waves of testing and remains a significant source of information regarding the changes in cognitive ability across almost the full human adult lifecourse (Schaie 2013). The purpose of the study was to explain not only differences in the actual level of ability at a given age but also the differences observed in the rates of change with increasing age. The latter aim could potentially suggest interventions whereby it may be possible to reduce or reverse cognitive aging.

The design of the study was complex. At the first wave in 1956, 500 participants were recruited for baseline cognitive examination from the Seattle area. They were randomly selected from a potential pool of 18,000 individuals registered at a Health Maintenance Organization (HMO) stratified by sex and age such that there were 25 men and 25 women born in each year from 1889 to 1939 (aged 21–70 at baseline). Seven years later, these participants were recalled for repeat cognitive testing. At the same time, a new sample numbering 996 individuals was also recruited. This process of retesting the survivors of previous waves and recruiting a new sample was repeated

every 7 years, resulting in 9476 complete records for 4857 participants. The cross-sequential design of the SLS allowed a simultaneous investigation of cohort and cross-sectional differences in cognitive aging, and importantly, a comparison between individual paths of change in cognitive function longitudinally. Over the waves of the SLS, participants completed measures of verbal meaning, space, reasoning, number and word fluency (based on Thurstone's primary mental abilities), and in the fifth cycle (1984), multiple markers for different abilities were added (Schaie 2013). Analyzing these data allowed Schaie and colleagues to investigate some of the most fundamental questions in cognitive aging research.

Differences noted across cohorts varied by the particular ability under investigation; for instance, word fluency appeared to be poorer in the more recent, and hence younger, samples, although these participants generally possessed better inductive reasoning ability. Schaie and colleagues therefore cautioned fellow researchers: If abilities in which performance is generally improving in younger cohorts are only considered cross-sectionally, these abilities may be described as being more susceptible to age-related decline than is actually the case (Schaie 2013). That is, at a single time point, older people would be observed performing poorly relative to younger individuals on the particular measures. This difference, however, is partly attributable to the improved performance in the younger group rather than wholly being the result of any cognitive decline in the older individuals. Likewise, those abilities exhibiting a performance bias for older cohorts would be characterized as showing less change with age than is the case. Longitudinal studies allow the analysis of actual changes with age, and reduce the potential for misinterpretation of results as a consequence of possible generational changes in ability, though other methodological considerations mean longitudinal studies present their own issues in interpreting age-related changes (Salthouse 2010).

To illustrate this, consider Fig. 2. In the first graph (a), cross-sectional data are shown from the SLS and would appear to show steady, linear



**Intelligence and Aging, Fig. 2** (a) Cross-sectional data from the Seattle Longitudinal Study. Declines are evident in all domains, with the exception of preserved verbal and numeric ability. (b) Seven-year longitudinal data from the same study. Declines are evident in all domains after age

55, with only processing speed displaying declines before 55 (Reproduced by permission from Macmillan Publishers Ltd (*Nature Reviews Neuroscience* (Hedden and Gabrieli 2004), copyright 2004); reproduced with permission from Cambridge University Press)

declines in inductive reasoning, spatial orientation, perceptual speed, and verbal memory across the lifespan (numeric and verbal abilities show relative stability). Contrast this with longitudinal data gathered over 7-year periods (b). The patterns observed here would suggest that abilities are relatively stable in young and mid-adulthood, with declines becoming apparent from around 60 years of age (Schaie 2013). Examining cognitive abilities either cross-sectionally or longitudinally can therefore produce quite different models of change. Cross-sectional studies may overestimate changes associated with increasing age due to cohort effects. Longitudinal studies, however, are not immune from bias, and may underestimate cognitive changes due to nonrandom attrition, or practice and retest effects over numerous testing sessions (Salthouse 2010; Hedden and Gabrieli 2004; Tucker-Drob and Salthouse 2011). Bearing in mind such methodological caveats, it appears in general that certain cognitive abilities may be relatively preserved up to, and in some cases into, old age before declining from that point onward. Different abilities begin to show marked decline at different ages, and this decline occurs at different rates, though debate continues in the field on the precise timing of such changes (Tucker-Drob and Salthouse 2011). As a result, any study with only a general

measure of ability may be insufficient for exploring the totality of age-related changes in cognitive ability.

Fluid abilities, “concerned with basic processes of reasoning and other mental activities that depend only minimally on learning and acculturation” (Carroll 1993, p. 624), are seen to decline at an earlier age than crystallized abilities, “concerned with mental processes that reflect not only the operation of fluid intelligence but also the effects of experience, learning, and acculturation” (p. 624), although the latter may show more rapid decline after about 70 years of age. Returning to the SLS example, noticeable declines were generally apparent across the range of diverse abilities tested when individuals reached 50–60 years old, and by the mid-70s, declines in all abilities were evident. Perceptual speed exhibited almost linear decline from young adulthood onwards (Schaie 2013). Data from another study, the Kungsholmen Project (a population-based study with individuals aged 75 years and over comprising assessments on five occasions over 13 years) indicated “a clear age-related deterioration from the mid 70s through the mid 90s for tasks in which performance [is] contingent on new learning, speed, and flexible adjustment to new situational demands. . .small or non-existent age-related differences were observed in tasks that draw on

pre-experimental experience, have limited speed demands, and are highly automated” (Backman et al. 2004, p. 217).

In summary, the illustrative examples highlight key findings in intelligence and cognitive aging research. Cognitive changes observed cross-sectionally and longitudinally may differ, with longitudinal studies suggesting many cognitive abilities may be sustained into old age. When marked decrements become apparent in later life, the rate of change is greater with increasing age. In addition, “ageing...influences certain cognitive functions disproportionately” (Hedden and Gabrieli 2004, p. 88); distinct domains (for example, memory, reasoning, or verbal ability) exhibit unique patterns of change, with deterioration beginning at different ages and occurring at different rates. As suggested, however, longitudinal studies may overestimate the stability of intelligence for a number of reasons, including differential attrition and practice effects with repeated test administration (Tucker-Drob and Salthouse 2011).

### **How Stable Are Individual Differences in Intelligence Across the Lifecourse?**

When discussed above, both change and stability referred to “mean level” change or stability. Cognitive ability scores from individuals of different ages, or from repeat measures in individuals followed over time, are interpreted to indicate when different cognitive abilities might begin to show reliable decline on average. However, it is also possible to consider individual differences in the stability of intelligence (Deary 2014). In terms of the stability of individual differences, it is a person’s ranking relative to others that is of interest: If a person performs well on one occasion, how likely are they to perform as well on future occasions relative to the others tested? Given that intelligence across the lifecourse may be characterized by both stability and change, studies of individuals who have completed the same measure or measures of cognitive ability over long periods of time have been able to estimate the stability of individual differences in intelligence.

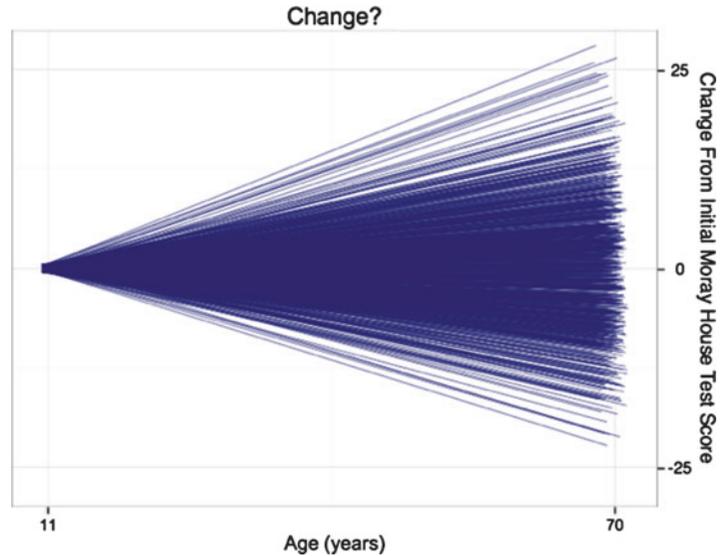
For example, participants in the Lothian Birth Cohort studies (Deary 2014) completed a test of cognitive ability when aged 11 and repeated the same test when aged 70 or 79 years old. The older cohort (recruited in later life at age 79) took the test a further twice, at ages 87 and 90. The latter follow-up – from age 11 to 90 – is believed to be the longest test-retest period in the field and produced a correlation of 0.45 from a sample of 99 participants (before the exclusion of seven participants with dementia or possible dementia, the correlation was 0.54).

With any cohort study, there is likely to be a restriction in the range of possible scores compared with the larger population from which they were drawn (Salthouse 2010; Hertzog et al. 2009; Deary 2014). That is, they are unlikely to be truly representative. In the Lothian Birth Cohort studies, the cognitive ability scores at age 11 were drawn from larger population-wide surveys, and so it was possible to correct the childhood to old age correlations for the observed restriction of range. In the younger of the cohorts (with a sample of over 1000), the raw test score correlation between ages 11 and 70 increased from 0.67 to 0.78 after this correction. As correlations can be squared to estimate shared variance, it was suggested that “about half of the differences in intelligence at age 70 can be traced back to age 11, and about a third of the differences in intelligence at age 90 can be traced back to age 11” (Deary 2014, p. 243). With data on intelligence across the lifecourse, it has also been possible to visualize the individual differences in lifetime change in intelligence. Figure 3 shows the test scores from the cohort standardized at age 11. The scores at age 70 therefore reflect the relative change from that point. Of particular interest was the normal distribution of relative lifetime change in intelligence.

Other studies including repeat cognitive assessments across many decades have provided similar results on the stability of intelligence; two independent samples with about four decades of follow-up both produced correlations of 0.78, for example (Deary 2014). Understanding the stability of intelligence is important as this “gives a baseline from which to reckon the amount of

### Intelligence and Aging,

**Fig. 3** Individual differences in change in intelligence from age 11 to 70 in the Lothian Birth Cohort 1936 (Reproduced with permission of the copyright holders Ian Deary and Stuart Ritchie)



change, and then to start the process of finding the contributors to that change” (Deary 2014, p. 243).

### When It Goes, Does It All Go Together?

Considerations of the stability of individual differences in intelligence across the lifespan, while of interest, are perhaps of more importance in quantifying the portion that might be open to change (and therefore perhaps to intervention). Regarding change, a key area of interest is whether change in one domain of cognitive ability is associated with changes in other domains. If changes are found to be related, researchers would therefore be seeking to identify a common cause or causes; if the changes across domains are largely unrelated, it would suggest more specific developmental processes (Tucker-Drob and Salthouse 2011).

As another illustrative example, the Religious Orders Study, conducted by Wilson and colleagues (2004), has been following older Catholic nuns, priests, and brothers, with the aim of examining the aging process (and specifically Alzheimer’s disease) in a group believed to be relatively homogenous with respect to lifestyle and living conditions from early adulthood (Wilson et al. 2004). The participating individuals underwent an annual clinical examination (and

agreed to a brain autopsy after death), allowing the level and change in cognitive ability to be assessed. The study began in 1994, and by the end of 2002, there were 958 participants, with a mean age at baseline of 75.3 years. As part of the annual evaluation, each participant completed 21 cognitive tests, the scores from which were summed to give a global score. The tests were also scored according to the main domain they assessed (episodic memory, semantic memory, working memory, perceptual speed, and visuospatial ability).

With increasing age, the rate of decline in performance recorded across each of these domains was greater. Interestingly, the results further suggested that “part of the age-related cognitive decline is global in nature but another specific proportion appears to be domain specific” (Wilson et al. 2004, p. 287); about 30% of the variance in the rate of change was shared across cognitive domains.

The Religious Orders Study investigated a group who showed potentially limited variation in their lifestyles but was not intended to be representative of older people in general. Yet similar results have been reported in community-dwelling samples, suggesting that part of age-related decline is specific to a given domain, while part is global and shared across all domains (Hedden and Gabrieli 2004; Tucker-Drob and

Salthouse 2011; Backman et al. 2004; Wilson et al. 2004). In summarizing the findings from a number of independent studies, Tucker-Drob and Salthouse (2011) suggest the data are consistent with “a single common factor accounting for between approximately 35–60% of individual differences in cognitive change” (pp. 250–251). Thus, while cognitive abilities display unique and independent changes with increasing age they also decline partly in concert due to some common process or processes.

### What Role Do Genes Play in Age-Related Changes in Intelligence?

Understanding the genetic determinants of intelligence, or the age-related changes experienced in this, may increase both our understanding of the structural and functional mechanisms underlying complex and diverse cognitive processes, and indeed, identify targets for either pharmacological or lifestyle based interventions designed to reduce or delay any decline. Heritability estimates for intelligence appear to vary across the lifecourse, rising from about 20% in early childhood to 60% by adulthood (Plomin and Deary 2015). However, studies indicate the same genes are associated with intelligence across the lifecourse. This “apparently contradictory finding” may be the outcome of a developmental pathway in “which small genetic differences are magnified as children select, modify and create environments correlated with their genetic propensities” (Plomin and Deary 2015, p. 100). Increasingly sophisticated techniques, for example, genome-wide scans, have also suggested that there are unlikely to be any single genes with large effects on intelligence, but rather that many thousands of genes are likely to each contribute very small effect sizes (Plomin and Deary 2015).

In exploring the genetics of intelligence, an important objective has been to quantify the extent of the genetic and environmental contributions to change across time. In analyses utilizing data from the cohorts tested in childhood and again in later life described above, genome-wide data on almost 600,000 common single nucleotide

polymorphisms (SNPs) accounted for about 0.24 of the variation in relative cognitive change across the lifespan (Deary et al. 2012). That is, about one quarter of the variation appeared to be accounted for by genetic factors, suggesting lifestyle and environmental factors may have a larger influence on individual differences in relative lifetime change in intelligence. While in need of replication – the analyses were based on just under 2000 participants – these initial estimates provide an impetus to identify what those environmental determinants might be.

### Is Age Kinder to the Initially More Able?

Before briefly concluding by considering some potentially malleable determinants of later life intelligence and change, it is necessary to take into account a predictor which, by later adulthood, cannot be altered: prior intelligence. This is a central issue in research on intelligence and aging and is related to the stability of intelligence discussed above. Consider the Nun Study, a research project examining members of the School Sisters of Notre Dame (Midwestern, Eastern, and Southern United States). Six hundred and seventy-eight sisters were examined at baseline in 1991–1993, with annual evaluations and brain autopsy upon death. Importantly within this group, 180 individuals had written autobiographies at a mean age of 22. From these, it was possible to derive a measure labeled idea density, defined as “the average number of ideas expressed per ten words, computed for the last ten sentences of each autobiography” (Riley et al. 2005, p. 342). An average of 58 years elapsed from the sisters writing their autobiographies to being enrolled in the Nun Study, when they completed a battery of cognitive tests. The mean age at baseline was 80 years old and at the seventh follow-up examination was 86.

The percentage prevalence of low idea density was greater in the more cognitively impaired groups. For the sisters with a memory impairment at the first exam, those showing mild cognitive impairment were 5.3 times more likely to have written autobiographies scoring poorly on idea

density (with those having intact cognition as the reference group). The results suggested that lower idea density displayed in an autobiography written in young adulthood was associated with poorer cognitive function in later life, supporting “a strong inverse relationship between early-life linguistic ability and late life cognitive function, including mild cognitive impairments” in those groups showing memory impairments (Riley et al. 2005, p. 345).

Within the sample, participants covered the complete continuum of cognitive functioning, from intact, through mild impairment, to global impairment and dementia. The authors therefore stated that the “relative homogeneity of the sisters’ adult lifestyles and environments suggests that those with low linguistic ability [as assessed by idea density, related to vocabulary and general knowledge] in early life brought risk factors with them when they joined the religious congregation at an early age” (Riley et al. 2005, p. 346). A measure of early ability was therefore shown to be a major predictor of later life ability, consistent with the stability of intelligence discussed above. The Nun Study results might suggest that those of higher initial ability experience less decline in later life and are therefore less likely to become cognitively impaired. This would be consistent with the concept of cognitive and brain reserve capacity, whereby those of higher ability have a higher tolerance for “the amount of damage that can be sustained before reaching a threshold for clinical expression” (Stern 2002, p. 449). This reserve could be expressed as some brain parameter, such as overall size or the number and density of synapses for example, or via the use of alternative cognitive processes or structures after damage to “normal” pathways. The latter model of reserve is often defined as active as alternative routes or networks need to be sought in order to cope with some insult or decline, compared with the former passive models (Stern 2002). Individuals who develop a greater “reserve” might therefore be spared the process of cognitive aging until a later age compared with their peers who developed less reserve across the lifespan.

Another possibility, however, is that those of higher initial ability experience later life decline at

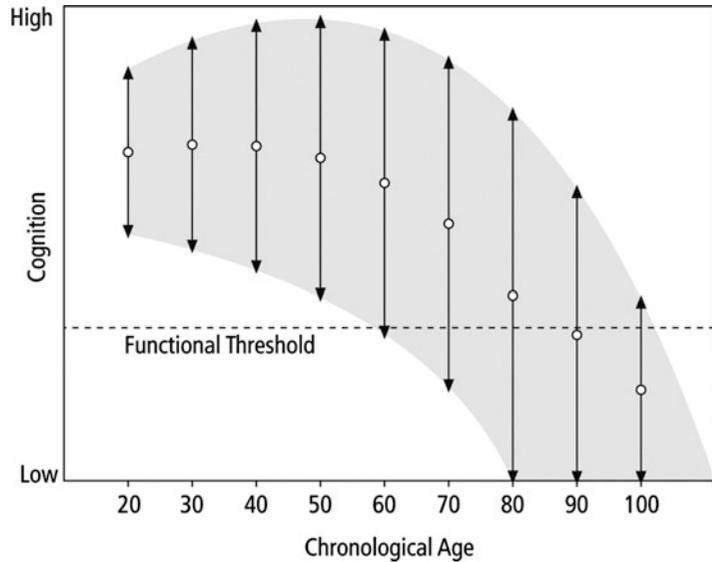
the same rate as those of lower initial ability, but simply have a greater distance to fall before reaching any “impairment threshold,” however that is defined. In this explanation, the concept of reserve may still be relevant. In the studies that have asked the question, “Is age kinder to the initially more able?,” the results appear to be inconsistent; some suggest individuals with higher initial ability experience less decline across time, while others show no association between initial ability and subsequent trajectories of change, and others still have reported greater decline in those initially at a higher level (Deary 2014). While there are clear individual differences in level, rates of change in intelligence may exhibit far smaller or according to some studies no differences according to initial level (Salthouse 2010).

### **Can We Alter the Course of Age-Related Changes in Intelligence?**

While initial ability may or may not account for individual differences in change, as the cognitive trajectories recorded across persons are variable, it is likely that a number of other factors are responsible. As described above, perhaps up to three quarters of the variance in lifetime change in intelligence could be accounted for by environmental factors (Deary et al. 2012). A key goal would be to determine if mutable factors accounting for this change could be identified, such that these could be promoted or discouraged as appropriate, or manipulated as part of delivered interventions, to delay, reduce, or indeed reverse this decline.

Before highlighting some candidates, consider the conceptual model illustrated in Fig. 4. Here a hypothetical individual’s level of cognitive function is shown by the white dots, with stability across midlife and decline in old age. However, the shaded area highlights the range of their possible functioning, that is, the individual could do both better or worse than their current level given the influence of protective and detrimental factors respectively (Hertzog et al. 2009). Indeed, the search for determinants of cognitive aging relies

**Intelligence and Aging, Fig. 4** Depiction of the zone of possible cognitive development across adult life for a given individual (Reproduced with permission of the authors (Hertzog et al. 2009))



on the possibility of plasticity across the lifespan and within old age, and while supported by intervention studies, the boundaries of this are yet to be fully defined.

Factors associated with differences in level and change in cognitive ability would first be identified from observational studies (by exploring what factors are associated with better or worse performance either cross-sectionally or longitudinally), before their influence could be directly tested in more controlled intervention studies. The potentially cognitively beneficial effect of activity participation – in the intellectual, social, and physical domains – has been a key focus for research and, indeed, has been summarized as favoring “the hypothesis that maintaining an intellectually engaged and physically active lifestyle promotes successful cognitive aging” (Hertzog et al. 2009, p. 1).

For many, the intellectual stimulation resulting from increased activity is intuitively central to the protective effect of activity. That is, activities which are specifically cognitive, or those from other domains also necessitating some level of cognitive engagement, may act through a shared pathway. These suggest that the beneficial effects of intellectually stimulating activity may be the result of a “use it or lose it” scenario (Tucker-Drob and Salthouse 2011). An engagement model of

cognitive level and decline has therefore emerged, whereby those who show a greater degree of engagement with their environment are less likely to suffer the adverse effects of cognitive aging or at least delay the onset of such age-related cognitive decline. Use or disuse of mental abilities (via engagement in activities) may therefore lead to actual structural or functional changes in the brain (number of synapses, speed of dendrites, etc.) which will then determine an individual’s future engagement with their environment (Hertzog et al. 2009). If disuse is a major predictor of cognitive decline, the suggestion would be that cognitive aging may be reversible, to a degree (Schaie 2013).

However, there are issues of causality which can rarely be addressed in longitudinal research whereby those of higher ability are also more likely to be active in, and engaged with, their environment (Tucker-Drob and Salthouse 2011; Gow et al. 2012). Less cognitive decline in these individuals may not be due to some greater buildup of reserve but rather due to their initial ability. Evaluating this, Salthouse (2006) stated:

the relation [between mental exercise and mental ageing] could occur because, as proposed by the mental-exercise hypothesis, the amount of mental activity throughout one’s life contributes to the level of mental ability at later periods in life, but

the relation could also originate because the amount of mental activity at any age is at least partially determined by one's prior, and current, level of mental ability. More generally, although it is tempting to attribute some of the variability in cognitive performance apparent at any given age to individual differences in prior rates of age-related change in cognitive abilities, it is important to consider the possibility that much of that variability was present at earlier ages, and may have little or nothing to do with differential aging. (p. 70)

While a number of psychosocial, behavioral, and environmental factors have been associated with age-related changes in intelligence, this important caveat remains. Are those associations evidence of differential preservation, or are they rather the result of preserved differentiation (Tucker-Drob and Salthouse 2011; Gow et al. 2012)? Even in studies with assessments of cognitive ability across years or decades, distinguishing between the two remains difficult. It is, however, an important endeavor as many lifestyle or behavioral factors are confounded by reverse causation, that is, many factors of interest (education, occupational complexity, activity participation) are strongly associated with earlier intelligence. It is necessary to better understand how the association between any given factor and cognitive aging might be attenuated once the stability of intelligence has been accounted for. While efforts to address this remain somewhat limited (Gow et al. 2012), intervention studies where participants are randomly assigned to groups remain the clearest test of whether specific factors can alter the course of age-related changes in intelligence. It has been suggested that relatively consistent benefits have been reported from physical activity interventions, for example, though by no means universal (Salthouse 2010; Hertzog et al. 2009).

While the preserved differentiation-differential preservation debate needs to be more fully accounted for, the most recent review of those factors likely to affect cognitive decline suggested that the strongest evidence for cognitively protective factors included a higher number of years of

education and physical activity, while brain injury, obesity and hypertension in midlife, smoking, and diabetes appear to be detrimental (Baumgart et al. 2015). The conclusion to that report is a fitting conclusion here also:

“it is clear that there are still many unanswered questions and significant uncertainty with respect to the relationship between individual risk factors and dementia [cognitive decline was also considered] (for example, to what degree there is a causal relationship). There is a clear need for more research on risk reduction, prevention, and brain health – both more longitudinal, population-based cohort studies and randomized controlled trials on the effectiveness of specific interventions that address modifiable risk factors. . . The evidence has now reached a point that it can no longer remain simply an exercise in academic discussion. The public should know what the science concludes: certain healthy behaviors known to be effective for diabetes, cardiovascular disease, and cancer are also good for brain health and for reducing the risk of cognitive decline.

## Cross-References

- ▶ [Activity Theory, Disengagement Theory, and Successful Aging](#)
- ▶ [Age and Intraindividual Variability](#)
- ▶ [Cognitive and Brain Plasticity in Old Age](#)
- ▶ [Cognitive Neuroscience of Aging](#)
- ▶ [Crystallized Intelligence](#)
- ▶ [History of Cognitive Aging Research](#)
- ▶ [Individual Differences in Adult Cognition and Cognitive Development](#)

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## Interdisciplinary Longitudinal Study on Adult Development and Aging (ILSE)

Christine Sattler<sup>1</sup>, Hans-Werner Wahl<sup>2,9</sup>, Johannes Schröder<sup>3,4</sup>, Andreas Kruse<sup>10</sup>, Peter Schönknecht<sup>5</sup>, Ute Kunzmann<sup>6</sup>, Tina Braun<sup>6</sup>, Christina Degen<sup>3</sup>, Ina Nitschke<sup>7</sup>, Wiebke Rahmlow<sup>5</sup>, Peter Rammelsberg<sup>8</sup>, Jelena S. Siebert<sup>2</sup>, Benjamin Tauber<sup>2</sup>, Britta Wendelstein<sup>3,4</sup> and Andreas Zenthöfer<sup>8</sup>

<sup>1</sup>Department of Industrial and Organizational Psychology, Institute of Psychology, Heidelberg University, Heidelberg, Germany

<sup>2</sup>Department of Psychological Aging Research, Institute of Psychology, Heidelberg University, Heidelberg, Germany

<sup>3</sup>Section of Geriatric Psychiatry, Heidelberg University, Heidelberg, Germany

<sup>4</sup>Institute of Gerontology, Heidelberg University, Heidelberg, Germany

<sup>5</sup>Department of Psychiatry and Psychotherapy, University of Leipzig, Leipzig, Germany

<sup>6</sup>Life-Span Developmental Psychology Laboratory, University of Leipzig, Leipzig, Germany

<sup>7</sup>Clinic for Gerodontology and Special Care Dentistry, University of Zurich, Zurich, Switzerland

<sup>8</sup>Department of Prosthodontics, University Hospital Heidelberg, Heidelberg, Germany

<sup>9</sup>Network Aging Research (NAR), Heidelberg University, Heidelberg, Germany

<sup>10</sup>Institute of Gerontology, University of Heidelberg, Heidelberg, Germany

### Synonyms

Cohort study; Holistic approach; Interdisciplinary approach; Longitudinal study

### Definition

The Interdisciplinary Longitudinal Study of Adult Development and Aging (ILSE) is characterized

by a multidisciplinary longitudinal study design investigating the aging process of two German birth cohorts born between 1930–32 (C30) and 1950–52 (C50), respectively.

## Overview

The main objective of the Interdisciplinary Longitudinal Study on Adult Development and Aging (ILSE) is to investigate individual, societal, and sociostructural preconditions for aging well. Aging well is seen as achieving the best physical and mental health as well as the highest autonomy and well-being possible. ILSE is designed as a multidisciplinary longitudinal study investigating the aging process of German birth cohorts born in 1930–1932 (C30) and 1950–1952 (C50), respectively. This cohort design offers the opportunity to explore the potential impact of different childhood conditions (before and after World War II) on lifespan development. Moreover, the study sample includes participants from the former Western (Heidelberg region, HD) as well as Eastern (Leipzig region, LE) parts of Germany, allowing for the analysis of East/West Germany differences in developmental trajectories and outcomes. Given its first measurement wave at the beginning of the 1990s and its fourth measurement wave, initiated in 2013, ILSE is now also able to contrast development in mid versus late adulthood. At the applied level, ILSE also strives to contribute to the promotion of health and well-being, as well as to the prevention of disease and functional loss as people age.

## Guiding Conceptual Ideas of ILSE

ILSE was initiated at the beginning of the 1990s by two key figures of German developmental and aging research: Ursula Lehr and Hans Thomae. Given the special emphasis these scholars put on the critical role of subjective appraisal of life situations for human development (“biographical approach”; Lehr and Thomae 1987; Thomae 1979) as well as their ambition to include the established psychometric approach in

longitudinal aging research, ILSE is rather unique in its striving to combine and reconcile these different world views in developmental and lifespan research. A major conceptual step toward this goal has been the introduction of the model of developmental adaptation by two scholars affiliated with ILSE at the end of the 1990s/early 2000s, i.e., Peter Martin (now Iowa State University) and Mike Martin (now University of Zurich; see (Martin and Martin 2002)).

The biographical approach, as used in ILSE, emphasizes the importance of considering the full life course of individuals in order to understand their current motivations, concerns, and behaviors. In this context, recent events as well as past experiences (e.g., adverse childhood experiences) are taken into account. According to Thomae (1998), biographical approaches are well grounded in various developmental theories that argue for a causal relationship between early and more recent life events on late-life outcomes, particularly in the area of mental health. Emphasis is also put in accordance with acknowledged life-course research (e.g., Settersten 2003) on the impact of subjective turning points in individual biographies, as well as driven by the *cohort flow argument*: the significance of political and societal circumstances as constantly changing, driving forces of lifespan development.

The model of developmental adaptation (Martin and Martin 2002) purports six developmental factors, which are all assumed to be related to core developmental outcomes (e.g., health and well-being), i.e., past life events and biography, family of origin, individual resources, social and economic resources, and individual coping strategies (Fig. 1).

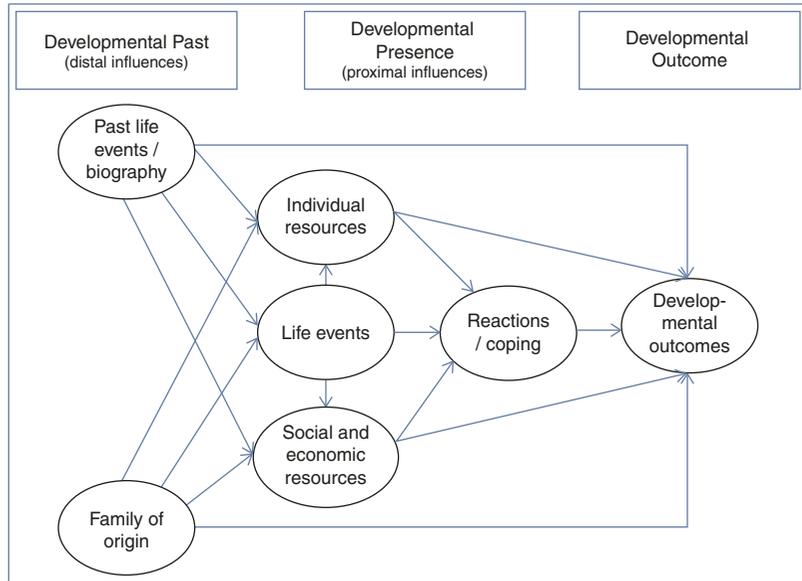
In addition to these fundamental conceptual cornerstones, ILSE also relies on core assumptions now widely accepted as essential for productive longitudinal aging research:

- *Combining mid- and late adulthood and focusing on the transitions from mid-adulthood to young old age and from young old age to old-old age*

With few exceptions, middle adulthood has often been neglected in studies focusing on development later in life. Due to its research

**Interdisciplinary Longitudinal Study on Adult Development and Aging (ILSE),**

**Fig. 1** Model of developmental adaptation across the lifespan (Adapted from Martin and Martin 2002)



design (see below), ILSE allows for in-depth analyses concerning developmental trajectories of key constructs and variables, such as cognitive performance, dementia, well-being, personality, and social relationships from middle to late adulthood. Given longer observation intervals conducted (which now approach 20 years in ILSE), ILSE also makes it possible to focus on trajectories from middle adulthood into early old age (Willis and Martin 2005) and from early old age into what has been labeled the fourth age (Baltes and Smith 1999); these two transitions have been described as highly significant for development in the second half of life.

- *Theory-driven cohort approach*

The consideration of birth cohorts allows for an in-depth examination of long-term effects on adult development and aging with respect to socialization and historic events. ILSE examines the aging development of two birth cohorts, which grew up under very different historical, economic, and political conditions. The elder birth cohort (born 1930–32: C30) experienced childhood and adolescence in National Socialist Germany. After the World War II, members of C30 spent their early and mid-adulthood within different political systems (German Democratic Republic [GDR] vs Federal Republic of Germany [FRG]);

when Germany was reunified, the members of this cohort were already in their 60s. By contrast, the younger birth cohort (born 1950–52: C50) experienced their childhood and adolescence in divided Germany (GDR vs. FRG) and were only middle-aged adults when Germany was reunified. Additionally, the consideration of two regions (HD vs. LE) offers the opportunity to examine potential long-term effects of heterogeneous ideological, societal, and economic circumstances on various developmental outcomes, e.g., life expectancy, health, and quality of life. ILSE assumes that such East/West comparisons provide unique empirical insights concerning the potential impact of severe economic, political, and social changes on individual (longitudinal) adjustment and well-being from middle to old age.

- *Interdisciplinary approach to aging*

ILSE follows an interdisciplinary approach in order to answer a variety of scientific questions related to aging and development. Questions about the processes and outcomes of successful aging can thus be addressed from different disciplinary angles. The set of disciplines considered in ILSE includes (developmental and gero-) psychology, sociology, psychiatry, dentistry, nutritional science, and sports science.

Consistent with these conceptual and methodological metaideas, ILSE's assessment protocol covers a wide range of domains of functioning and includes biographical data, critical life events, person-related resources and environmental resources, attitudes, physical and mental health, and various indicators of subjective and objective well-being (see below for a more detailed description of ILSE's main data areas). In addition to semistructured procedures to assess biographical development and subjective appraisal processes, a multidimensional package of established cognitive and neuropsychological test procedures and self-report instruments has been completed by participants at each measurement wave. In addition, a clinical assessment regarding physical and mental health conducted by study psychogeriatricians is part of ILSE's assessment package.

## Methodology

### Study Design

ILSE is based on a 2 (cohort)  $\times$  2 (region)  $\times$  2 (measurement point) study design. ILSE participants have been followed since 1993 for an average time period of 12 years and assessed at three measurement waves (t1: 1993–1996; t2: 1997–2000; t3: 2005–2008). After completion of the ongoing fourth examination wave in 2016, ILSE will cover a total observational period of about 20 years in each cohort. This measurement wave is particularly important because the younger cohort (C50) will have reached the age of the older birth cohort (C30) at the beginning of the study, allowing us to begin disentangling the effects of age and cohort on processes and outcomes of successful development. The first three examination waves of the ILSE study were funded by the Federal Ministry for Family, Senior Citizen, Women, and Youth, Germany (Bundesministerium für Familie, Senioren, Frauen und Jugend - BMBFSJ) and the Ministry of Sciences, Research, and Arts Baden-Württemberg, Germany (Ministerium für Wissenschaft, Forschung und Kunst, Baden-Württemberg - MWK). Additional financial support was provided by the Mar-silius Kolleg (center of advanced studies),

Heidelberg University, Germany. The currently conducted fourth examination wave is funded by the Dietmar Hopp Foundation, Germany (Dietmar Hopp Stiftung).

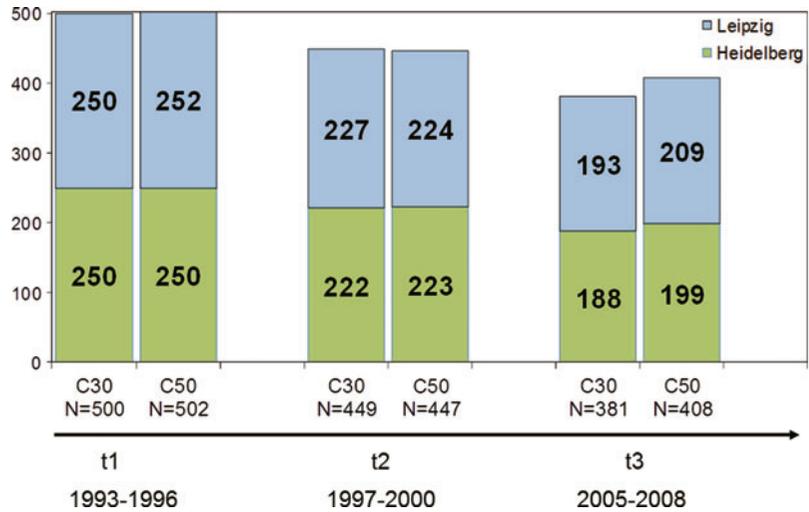
### Recruitment and Sample Characteristics

Participants were randomly selected and recruited on the basis of city registers, which comprise data on all inhabitants of German communities. A random address sample ( $N = 4000$ ) was drawn for each study center (HD vs. LE). This sample was stratified by gender and birth cohort in order to assure an approximately equal distribution of male and female participants, as well as participants from the older (C30) and younger (C50) birth cohort. Potential participants were invited to take part in the ILSE study via a respective invitation letter sent by mail, followed by a short telephone interview concerning relevant sociodemographic data. Those who agreed to come to the study center located at the universities of Heidelberg and Leipzig first received a comprehensive description of the study and then underwent a written informed consent procedure. Each of ILSE's data waves was approved by the ethics committee of Heidelberg University's medical faculty.

Assessment of the random address sample continued until the envisaged sample size of 500 per birth cohort was reached. Recruitment efforts finally resulted in a sample of 1002 participants. This initial study sample was equally distributed in terms of birth cohort (C30:  $N = 500$ ; C50:  $N = 502$ ) and research center location (HD: 49.9%; LE: 50.1%). According to ILSE's stratification procedure, men were initially overrepresented (Male: 52%; Female: 48%). Apart from a slightly higher educational level, comparative analyses revealed that the respective birth cohorts were adequately represented in terms of relevant sociodemographic data (e.g., marital status, household net income).

At the first examination wave (t1), 500 subjects from Heidelberg and 502 subjects from Leipzig participated in the ILSE study. At the second measurement point (t2), 896 subjects (89.4%) were re-examined. The third examination wave (t3) was completed by a total number of

**Interdisciplinary Longitudinal Study on Adult Development and Aging (ILSE), Fig. 2** Development of ILSE sample from t1 to t3



789 participants, resulting in a high longitudinal response rate of 78.7% of the initial sample (see Fig. 2).

Seen in more detail for each cohort, t1 included 500 subjects from C30. Half of the study participants were located in HD and LE, respectively. At t2, 449 subjects (89.8%) were reinvestigated (HD: N = 222; LE: N = 227), resulting in 51 dropouts between t1 and t2. A total number of 23 subjects died (HD: N = 10; LE: N = 13), while 28 subjects refused their participation for various reasons (see dropout analysis given below). Finally, the third examination wave (t3) was completed by a total number of 381 subjects, resulting in 68 dropouts between t2 and t3. During this time period, 37 participants died (HD: N = 23; LE: N = 14). Moreover, 38 subjects who took part at t2 refused to participate at the third examination wave. However, 7 subjects who had not participated at t2 were rerecruited for the examinations at t3. In summary 119 subjects of the older birth cohort dropped out between t1 and t3. Out of these dropouts, 60 participants died. Other dropout reasons were relocation (N = 13), health problems (N = 19), lack of time or interest (N = 15), and other reasons (N = 12; e.g., nursing care of spouse). Subjects that dropped out were significantly less educated than those who finished t3. However, participants who left the study did not differ concerning other

sociodemographic characteristics (e.g., gender, age, socioeconomic status).

Of the younger birth cohort (C50) 502 subjects were recruited for the ILSE study at t1. Altogether, 250 subjects were located in HD and 252 subjects in LE, respectively. At t2, 447 subjects were reinvestigated, resulting in a high response rate of 89% of the initial sample. Between t1 and t2, 5 subjects died. Another 50 subjects decided not to take part in the investigations for various reasons (see dropout analysis given below). At t3, 408 subjects were re-examined (81.3% of the initial sample). Between t2 and t3, 8 subjects died. Another 45 participants refused to take part in the investigations for several reasons. However, 14 subjects who had not participated at t2 were rerecruited for the third examination wave. In summary, 94 participants of the younger birth cohort dropped out between t1 and t3. Out of these dropouts, 13 participants died. Other main reasons included relocation (N = 20), health problems (N = 10), lack of time due to professional obligations (N = 15), and loss of interest (N = 7). Another 29 participants mentioned other reasons for their nonparticipation (e.g., personal reasons).

Overall, as to be expected, the number of participants who died during the 12-year period was significantly higher for the older as compared to the younger birth cohort (C30: N = 60; C50: N = 13).

**Assessment Program**

ILSE’s comprehensive data collection has been accompanied by an interdisciplinary research team at all measurement occasions. In light of ILSE’s conceptual fundament, main assessment areas included a semistandardized biographical interview as well as medical/dental and psychogeriatric examinations (see Table 1).

Moreover, in psychometric terms, participants underwent a multidimensional cognitive testing procedure, as well as were asked to complete a wide range of questionnaires addressing a broad range of demographic, educational, social, psychological, and medical variables (e.g., personality traits, values, attitudes, personal lifestyle, oral quality of life). Examination also included a state-of-the-art assessment of neuropsychological status (e.g., MMSE, *Trail Making*

*Test*) and physical health and functioning. Moreover, neuroimaging-based assessments (MRI of the brain (t2, t3), as well as genotype analyses (Apo-E, COMT), were performed for a subsample of ILSE.

**Biographical Exploration by Means of Semistandardized Interviewing**

The main objective of the semistandardized interviews has been to obtain a comprehensive understanding of the participants’ appraisal of their past and present life situation and their future expectations. The first examination wave included a detailed set of in-depth questions on the participants’ biographical development in all major life domains (see Table 1), ranging from early childhood to present; the interview questions at t2 and t3 then focused on experienced changes since the last measurement point in these life domains. Interviews were all audiotaped and are in the process of being digitalized for long-term preservation and forthcoming analysis (e.g., linguistically). Also, part of the interview material found a state-of-the-art transcription for qualitative data analyses.

**Medical and Psychogeriatric Assessment**

Medical and psychogeriatric assessments were performed by professional psychiatrists. Assessments included a thorough medical history, physical assessment, and blood sampling. Moreover, psychiatric disorders were assessed clinically as well as based on the Structured Clinical Interview for *DSM-III-R* (SKID).

**Structured Questionnaires/Self-Report Data**

ILSE’s structured and psychometrically driven assessment focused on *sociodemographic characteristics* (e.g., education, socioeconomic status), *attitudes* and *values* (e.g., toward the aging process, religion, politics), *personality* (e.g., Big Five assessment via NEO-FFI, control beliefs), indicators of subjective well-being (e.g., aging satisfaction, positive affect), and *social relationships* (e.g., social support). Additional questionnaires refer to *leisure activities* (e.g., physical

**Interdisciplinary Longitudinal Study on Adult Development and Aging (ILSE), Table 1** Overview of ILSE’s main areas of investigation

Biographical exploration by means of semi-standardized interviewing Biographical exploration of: Family relationships Social relationships Educational pathways Occupational pathways Health and disease Living environment Well-being (general and domain-specific) and future time perspective	Medical and psychogeriatric assessment Medical history (anamnesis) Physical assessment Blood sampling Structured clinical interview according to <i>DSM-III-R</i> (SKID) Dental health Magnetic resonance imaging (MRI) in a subsample (since t3)
Structured questionnaires/self-report data Sociodemographic data Leisure activities Physical activities Personality Well-being and affect (affect only since t3) Social support Attitudes and values Nutrition Assessment of physical environment (only t2) Media use Activities of daily living	Examination of normal cognitive aging and neuropsychological assessment General intelligence (fluid and crystallized) Memory Attention Dementia screening (MMSE) Depression screening

activity involvement), *volunteer work, nutrition, perceived home and neighborhood, and media use.*

### Examination of Normal Cognitive Aging and Neuropsychological Assessment

ILSE's cognitively oriented and neuropsychological test battery was administered by professional psychologists. Tests able to assess normative cognitive aging were mainly derived from the "Nürnberger-Alters-Inventar" and the "Leistungsprüfungssystem," which are commonly used test batteries in Germany with high similarity to the Wechsler scales. Sample subtests include *visuospatial functioning* (spatial orientation, block design), *verbal comprehension, abstract thinking, speed* (number-connection test, digital-symbol test), *attention/concentration* (D2), and *memory* (immediate word list recall, delayed word list recognition). Severity of cognitive deficits was assessed by the *Mini Mental State Examination* (MMSE). The *Wechsler Memory Scale* (WMS) and the *Trail Making Test* (TMT) were applied to address memory and learning, as well as attention and cognitive flexibility. A depression screening (Zung scale) is also part of the neuropsychological assessment program.

As is usually the case in longitudinal studies, part of the assessment battery was adjusted and changed over the years. In particular, the fourth measurement wave covers, in addition to the core measures of ILSE, a performance and film-based test of empathy (Wieck and Kunzmann 2015), a workplace-related assessment, and an assessment of awareness of age-related change.

### A Selection of ILSE Results

Due to the high number of disciplinary as well as interdisciplinary research activities (publications and presentations) that took place within ILSE during the last 20 years ([www.psychologie.uni-heidelberg.de/ae/apa/forschung/ilse.html](http://www.psychologie.uni-heidelberg.de/ae/apa/forschung/ilse.html)), we can only selectively present a few of the major findings.

### Cognitive Development, Cognitive Health, and Disease Processes

The maintenance of cognitive performance and the prediction and possibly prevention of cognitive deficits play a decisive role with respect to quality of life in old age as well as respective intervention efforts. The huge amount of cross-sectional data in this area worldwide is valuable but obviously comes with a number of serious limitations, when maintenance and prevention issues are the target of analysis. Therefore, it was clear from the start that cognitive development and detailed analyses of cognitive health and disease processes must be a major focus of ILSE. In this context, age-related cognitive disorders – such as mild cognitive impairment (MCI) and Alzheimer's disease (AD) – were of special interest. We consider in what follows only the older cohort (C30) and its so far three measurement waves. Participants from the younger cohort (C50) are not considered because the prevalence and incidence of cognitive disorders was, as to be expected, very low for this cohort due to their low calendar age.

Prevalence of cognitive disorders significantly increased over time. At t1, 13.4% of the C30 participants were diagnosed with MCI, while 5.8% received a diagnosis of mild cognitive disorder (MCD). According to the relatively low mean calendar age of the sample ( $M = 62.9$ ;  $SD = 0.9$ ), dementias were not prevalent at this measurement point. Four years later, at t2, the prevalence of MCI and MCD increased to 23.6% and 7.8%, respectively. Dementias in considerable magnitude were not diagnosed until t3, when participants had reached a mean calendar age of 74.3 years ( $SD = 1.2$ ). At this measurement point, 6.8% of participants were diagnosed with Alzheimer's Disease (AD), and 1.1% fulfilled criteria for vascular dementia (VD). Prevalence of MCI increased to 28.6%, while the proportion of MCD remained relatively stable (7.6%).

Additional analyses showed that the risk of developing AD at t3 was significantly higher for those subjects who already exhibited cognitive deficits at t2. More than 80% of AD patients were previously diagnosed with MCI (73.1%) or

MCD (7.7%). In other words, only 19.2% of AD patients at t3 did not exhibit any cognitive deficits 8 years prior to diagnosis (t2). Overall, ILSE's findings support that cognitive disorders show a rather high prevalence rate, affecting about one-third of the older population in community dwellings. Moreover, results clearly underscore a significant association between MCI and an increased risk of developing subsequent AD.

From the vantage point of prevention, an important body of work targeting protective factors able to counteract cognitive disorders refers to the concept of "cognitive reserve." The concept states that cognitive impairments do not directly result from neurobiological changes but are modified by a full set of heterogeneous risk and protective factors. ILSE offers the opportunity to investigate the immediate and longer-term effects of such risk factors and resources using longitudinal data from different assessment waves. Respective longitudinal analyses of ILSE's older birth cohort revealed the following major findings: participants who engaged in a high number of cognitively demanding leisure activities (e.g., investment in educational activities, solving crossword puzzles) at t1 showed a 62% reduced risk of developing MCI or AD at t3. Furthermore, cognitively active participants at t1 exhibited better neuropsychological test results over time (t1, t2, t3). Protective effects concerning MCI/AD development were also detected for high levels of education (85%), socioeconomic status (69%), and physical fitness (65%) (Sattler et al. 2011, 2012).

In summary, the longitudinal analyses of ILSE data concerned with cognitive development support the existence of several protective factors with respect to cognitive impairments in older adults. Results also point to important practical implications concerning prevention and as-early-as-possible intervention strategies. For example, in accordance with the established evidence in this area worldwide (Hertzog et al. 2009), intensive promotion of physical fitness as well as cognitively challenging leisure activities might result in successful behavioral prevention measures, able to reduce and delay cognitive disease processes to a remarkable extent.

### Findings from Additional Domains of Functioning

Due to its large number, we only provide here (without any aspiration of being comprehensive) a highly selective overview of additional ILSE findings. In addition to what has been described above, a number of publications addressed measurement invariance of cognitive assessment as well as the detection of stability and change of cognitive development in both cohorts across 12 years (Martin and Zimprich 2005). Similar analyses were also performed with respect to personality in both cohorts (Allemand et al. 2008). With the lifespan-oriented developmental adaptation model as a background, research questions regarding connections among early life and more distal experiences and developmental outcomes such as subjective well-being (e.g., Heyl and Schmitt 2007; Jopp and Schmitt 2010) were also examined in a set of papers. Predictors of oral quality of life in old age were identified in a joint effort of dental medicine and geropsychology (Hassel et al. 2011). Recently, attitudes toward own aging were analyzed in terms of measurement invariance issues as well as predictors; this analysis again, similar to cognitive findings of ILSE, supported the need to start interventions toward more positive views on aging early in life (Miche et al. 2014).

### Outlook and Future Potential of ILSE

As already mentioned, the fourth examination wave of ILSE started in 2013 and will be completed by 2016. At this point, ILSE will cover a longitudinal investigation period of 20 years, which will bring the analysis of all of the abovementioned domains to a new dimension. For example, data of the fourth examination wave will provide the opportunity to investigate the concept of cognitive reserve in still more detail and long-term dynamics. In particular, analyses of C30 data (t1-t3) suggest a protective effect of high education concerning MCI/AD development in old age. It will be interesting to examine if similar effects can be confirmed for the younger birth cohort (C50), which enjoyed enhanced

educational opportunities. In fact, participants of C30 reported 12.9 years of education, while participants of C50 enjoyed 14.0 years of education on average ( $t = -6.88, p < .001$ ). According to cognitive reserve theory, a higher level of education leads to a more effective compensation of cognitive deficits associated with neurodegenerative disorders. Consequently, participants of the younger birth cohort (C50) should exhibit a lower prevalence rate of cognitive disorders at the beginning of their 60s (t4), compared to the older birth cohort (C30) at the same age (t1). We also generally expect that the observational interval available with the fourth measurement wave will considerably increase ILSE's empirical potential to inform preventive measures in different domains (e.g., cognitive, educational, physical activity, views of aging). Finally, new research designs are planned to be added to ILSE's long-term, intraindividual change design, such as a short-term, intraindividual variability measurement burst design.

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## Cross-References

- ▶ [Australian Longitudinal Study of Aging \(ALSA\)](#)
- ▶ [Canadian Longitudinal Study on Aging, A Platform for Psychogeriatric Research](#)
- ▶ [Chinese Longitudinal Healthy Longevity Study](#)
- ▶ [English Longitudinal Study of Aging \(ELSA\)](#)
- ▶ [History of Longitudinal Studies of Psychological Aging](#)
- ▶ [Irish Longitudinal Study on Ageing \(TILDA\)](#)
- ▶ [Korean Longitudinal Study of Ageing \(KLoSA\): Overview of Research Design and Contents](#)
- ▶ [Life Span Developmental Psychology](#)
- ▶ [Longitudinal Aging Study Amsterdam](#)
- ▶ [Psychological Theories of Successful Aging](#)

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## Intergenerational Relationships

Jori Sechrist<sup>1</sup> and Karen Fingerman<sup>2</sup>

<sup>1</sup>Department of Sociology, McMurry University, Abilene, TX, USA

<sup>2</sup>Human Development and Family Sciences, Population Research Center, The College of Liberal Arts, University of Texas-Austin, Austin, TX, USA

### Synonyms

Intergenerational relations; Parent–child relationships; Parent–child ties

### Definition

Intergenerational relationships are ties between adult family members in different generational positions within the family of which the parent–child relationship is the most widely studied.

## Introduction

Intergenerational relationships have played a central role in families throughout history and across cultures. Nonetheless, these ties have risen to heightened importance over the past few decades, both to the people who experience these ties and to the scholars who study them. Scholars point to many demographic and social shifts related to the growing significance of intergenerational relations, three of which dominate the literature in the area: (a) delayed marriage and increasing divorce rates, (b) declining birthrates, and (c) increased longevity and active life expectancy. These trends create opportunities for interaction and dependence across generations, in particular, between parents and their adult children. In fact, intergenerational relationships may be just as, if not more, important to individuals than nuclear family relationships (Bengtson 2001). Throughout adulthood, these relationships serve different functions, though the strength of the tie is evident from early adulthood to late life.

Throughout the twenty-first century, young adults have become increasingly close to and dependent on their parents. The transition to adulthood has become prolonged, with young adults completing education and finding serious romantic partners and/or marrying later (Fingerman et al. 2012a; Schwartz 2009). Cell phones and computer technologies make communication easy, nearly instantaneous, and relatively cheap. As such, most young adults are in contact with their parents several times a week. Moreover, parents provide a wide range of support to grown children – from advice to providing a listening ear or giving money – more often than was the case in the twentieth century. A small, but meaningful, proportion of young adults lack contact with one parent (most often a father), due to divorce, parental incarceration, parents' never marrying or, in rare instances, death. But most young adults in the USA maintain ties to parents involving greater intimacy and support than was the case 20 or 30 years ago (Fingerman et al. 2012a).

Increases in longevity allow for sustained interaction between parents and children well

beyond early adulthood, and the relationships that are forged with parents in young adulthood continue to be central as adult children make transitions in employment, marriage, and parenthood. Not only are parents living longer, but parents maintain high levels of activity and low levels of disability much longer as well. This increased active life expectancy allows for noncaregiving based interactions between older adults and their middle age children that extend for several decades and greatly influence the lives of both generations. In fact, older parents and adult children remain in frequent contact; many speaking on the phone or seeing each other every week (Fingerman et al. 2012a). Further, despite the increased mobility of individuals, many children remain in proximity to parents (Schwartz 2009). This proximity and frequent contact fosters intimacy between the parties and provides opportunities for the parties to help one another. Thus, the focus of this entry centers on the emotional ties and support exchanges between generations.

### **Emotional Ties of Parents and Adult Children**

For over four decades, scholars have studied emotional aspects of the parent–child tie, focusing first on closeness and then on conflict and ambivalence within these relationships. Not only do the emotional ties of parents and children influence the well-being of both generations, but these factors are associated with other aspects of the relationship including contact and support.

### **Generational Stake and Intergenerational Solidarity**

In the late 1960s and early 1970s, scholars examining the family observed an interesting phenomenon in which older generations and younger generations reported different attitudes. For example, Bengtson and Kuypers (1971), studied college-aged children and found that, compared to their parents, young adult children perceived larger differences between the generations with regard to political, religious, and family values.

Further, children reported lower levels of closeness to their parents than their parents did to them. Bengtson and Kuypers termed this phenomenon the *generational stake*. The generational stake pertains to the idea that both generations are invested in the relationship, but their level of investment is different. The older generations are invested in the intergenerational bond to foster continuity and stability. Therefore, parents view greater similarity in values and report high levels of closeness with grown children. On the other hand, the younger generations seek to establish independence from their families of origin, thus emphasizing differences in values and reporting slightly less closeness to the older generation. Based on the dynamics of the intergenerational relationships observed in this study, Bengtson went on to develop one of the most widely used frameworks for the study of intergenerational relations, the Intergenerational Solidarity Model (Bengtson 2002).

Much of the literature on intergenerational relations, particularly during the 1980s and 1990s, was shaped by the Intergenerational Solidary Model (Bengtson 2002; Suito et al. 2011). This model emphasizes cohesion between a parent and an adult child as captured through six dimensions: emotional closeness, frequency of contact, similarity of values, exchange of support, and shared expectations for familial behavior. These dimensions are associated with factors such as number of children within the family and geographic proximity between the parties. Although this theoretical framework focuses on several dimensions of the intergenerational relationship, the affective component, which centers on the degree to which a parent or adult child feels intimate to or distant from the other, receives a great deal of attention in the literature.

Consistent with the generational stake hypothesis, many studies over the past three decades have confirmed that, although both parents and adult children rate relationships with each other as close, parents tend to rate their relationships with adult children as closer than do adult children (Schwartz 2009; Suito et al. 2011; Sechrist et al. 2012). In addition to generational position, children and parents alike indicate that mothers

have closer relationships with their children in comparison to fathers. Likewise, daughters have greater closeness with their parents in comparison to sons. The only other factor related to closeness in the parent–child relationship as consistent as generation and gender is value similarity. Both parents and adult children report greater closeness in relationships when they also perceive greater similarity in their values.

The Intergenerational Solidarity Model received considerable attention, but also suffered a great deal of criticism. Critics of the model highlighted the lack of attention to negative aspects of intergenerational relations, particularly conflict and disagreement between generations. Proponents of the theory explain that the model recognizes variation in level of closeness, but scholars argue that emotional distance in a relationship is not the same as conflict in a relationship (Bengtson 2002; Lowenstein 2007). Thus, the model was revisited with these issues in mind (Bengtson 2002). Yet, these critiques inspired a new line of investigation in the late 1990s focusing on the presence of both positive and negative emotions experienced in the parent–child relationship.

### **Conflict and Intergenerational Ambivalence**

Although ties between adults and parents are typically characterized by affection and warm regard, parents and grown children also may experience irritation, annoyance, worry, and overt conflict in their tie. Scholars have examined the conflict perspective to assess tensions and negative experiences in this tie (Birditt et al. 2009). Researchers also have referred to mixed experiences in the parent/child tie as “intergenerational ambivalence.” This construct is premised on the idea that people can experience both positive and negative feelings towards the same partner (Lowenstein 2007).

Researchers who study intergenerational ambivalence measure it in a variety of ways; each type of measurement taps a distinct type of ambivalence. Some researchers measure parents’ and children’s positive and negative feelings about one another in separate indices. These measures can be mathematically combined to give an index of “ambivalence,” whereby reports of

considerable positive and considerable negative feelings together constitute greater ambivalence. Other researchers categorize relationships as absent (i.e., the parties have little contact or feelings for the other), mostly positive, mostly negative, or ambivalent. Finally, researchers sometimes ask parents and grown children to report whether they feel subjectively torn or conflicted in their relationships. These different approaches to assessing ambivalence yield a continuous sense of mixed feelings, a distinct categorization of different types of relationships, or a sense of whether parents and grown children are themselves aware of their own ambivalence (Fingerman et al. 2012a).

Ambivalent feelings may arise for a variety of reasons. At a societal level, relationships between adults and their parents have unclear “norms” – that is a lack of clarity regarding what each party is supposed to do for the other party. Is it OK and normal for grown children to live in their parents’ basement? Are grown children supposed to take off from an important work meeting when their parent needs a ride to the doctor? These types of issues can give rise to conflicted feelings when parents and grown children are unsure what they are supposed to be doing and feeling.

From an individual perspective, parents and grown children may experience positive and negative feelings when the other party is dependent on them or they have to turn to the other party for help. Americans typically value independence and autonomy. Parents may experience ambivalence when their grown children turn to them due to problems in their lives (e.g., the grown child has lost a job or is going through a divorce). This ambivalence reflects love and affection and a sense that the child has not succeeded in adult roles. The parent may partially blame him or herself and also empathize with the child’s distress. Similarly, grown children incur ambivalence when their parents’ health fails in part due to shared distress and in part, due to the sense of loss that comes with watching a parent age.

### **Within-Family Differences**

The vast majority of the work examining relationships between parents and grown children has

focused on a single relationship, focusing on affection between one parent and one child. Clearly, these studies have provided important understanding of intergenerational relationships. However, a focus on just one relationship fails to take into account the complexities of family ties. Thus, recent studies of intergenerational relations emphasize the importance of viewing these ties in the context of other family relationships. Within-family differences studies that have grown in prominence in the last decade focus on the variations in relationship quality between parents and children within the same family, and how each relationship is influenced by relationships with other family members (Suitor et al. 2008).

Findings in these studies indicate that parents do not have the same level of intimacy with all children in the family. Despite a belief that parents should love all their children equally, most mothers and fathers studied can identify one child in the family with whom they feel the closest (Suitor et al. 2008). Parents typically choose daughters and children who share the parent's outlook on life. Child age also plays a role, in that younger children are most frequently named as the closest child to parents. Interestingly, children are likely to concur that parents have a child to whom they feel most close, but are less likely to be able to decipher accurately which child in the family it is. The variation in closeness between parents and children within a single family influences other family relationships including other parent-child ties as well as relationships among siblings (Suitor et al. 2011; Sechrist et al. 2012).

### **Emotional Ties and Well-Being**

Given the life long, involuntary nature of the relationship between parents and children, it is no surprise that the emotional aspects of the intergenerational relationship have been tied to the well-being of both parents and children. Distant, highly conflictual and ambivalent relationships are related to lower psychological well-being of parents and adult children (Carr and Moorman 2011; Fingerman et al. 2008). Further, parental well-being is also tied to children's experiences of problems such as divorce, physical or mental illness, and drug and alcohol problems.

The effects of children's problems on parents' well-being may be in part due to parents feeling disappointment or failure, but may also be due to empathy for a child. Similarly, parents react to their grown children's successes with positive feelings and pride; though parents' tend to be more sensitive to their children's troubles than they are to their children's triumphs (Fingerman et al. 2012b). Thus both intimacy and distance in a parent-child relationship has important psychological consequences for parents and children.

### **Exchanges of Support Between Parents and Children**

Another aspect of intergenerational relations that has received considerable attention is the exchange of support between generations. Early investigations of support focused on caregiving that adult children provided to an ill or disabled parent in later life. However, as noted earlier, the increase in life expectancy, in particular active life expectancy, has extended the period in which older parents do not require intensive caregiving and are active in the lives of their adult children. Thus, the flow of support both up and down the generational ladder outside of caregiving has received a great deal of attention.

Exchanges of support are complex and scholars have focused on several aspects of these exchanges including: (a) types of support parents and adult children exchange, (b) the flow of support to parents or to grown children, and (c) the factors that predict when and why parents and grown children give and receive support. Though the terms for different types of support vary to some extent in the literature, researchers commonly examine the following dimensions of support: emotional or expressive support; instrumental support; and financial support (Schwartz 2009; Davey et al. 2005). Emotional support includes listening to a problem or offering empathy when someone is distressed. Researchers have also examined confiding or listening, advice, and companionship under the general rubric of expressive support (Fingerman et al. 2009). Instrumental support includes practical help with

housework, home maintenance, transportation, shopping, cleaning and child care. Financial support includes monetary and other material transfers across generations. Recently, researchers also have examined technical support between generations; that is, assistance with electronic devices, software, and apps (Fingerman et al. 2009). Parents and grown children often provide and experience emotional support which, in most cases, is given to a high degree and sustained throughout the course of the relationship. Although most parents and children can turn to each other for help, the provision of instrumental, technical, and financial support tends to be more sporadic (Schwartz 2009). Indeed, as discussed later, these latter types of support typically reflect need more than affection.

### Support Exchanges Between Adults and Parents

The flow of support across generations has been of widespread interest. Despite the fact that the preponderance of literature prior to the 1980s focused on children providing care to aging parents, it is now widely accepted that in Western countries, parents disproportionately provide many types of support to their children throughout adulthood (Fingerman et al. 2012a; Schwartz 2009; Suito et al. 2011).

The Multidimensional Intergenerational Support Model elaborates several mechanisms that help account for the support that parents provide to grown children (Fingerman et al. 2012a). This model suggests that structural factors such as children's needs and parental resources shape the provision of support, as do psychological factors such as the parties' beliefs about support and their affection for one another. Structural factors may include family structures and life course events. Similarly, beliefs about support may vary by culture and ethnicity.

According to this model, family members' needs evoke support. For example, parents respond to life course transitions and their children's everyday needs with several types of support including advice, money, housing, and practical help (Fingerman et al. 2009). As mentioned in the introduction, educational, economic,

and marital transitions in young adult children's lives create greater dependency on parents into adulthood. Extended education and delays in marriage lead many parents to provide direct financial support and housing for their grown offspring, particularly for young adult offspring (Schwartz 2009; Suito et al. 2011). Once adult children begin to have children of their own, parents, and mothers in particular, are likely to provide childcare, which can mean occasional babysitting to caring for grandchildren full time with or without a parent present. This assistance qualifies as financial assistance (as well as practical support), given that grandparents' providing childcare saves adult children money on formal childcare services (Schwartz 2009; Suito et al. 2011). Parents are likely to respond to children's problems with instrumental and financial support as well. Parents are more likely to support children who experience divorce, unemployment, physical or mental health problems, or engage in deviant behavior such as drugs (Suito et al. 2011; Sechrist et al. 2012; Fingerman et al. 2009).

Other factors associated with the child also tend to evoke support. Younger grown children are more likely to receive parental support than older grown children. Parents respond to a variety of needs as young adults finish education, start jobs, and search for permanent romantic partners (Sechrist et al. 2012; Fingerman et al. 2009). Parents also give more support to grown children when they feel greater affection for those children, perhaps because they spend more time with them and enjoy helping them more (Davey et al. 2005; Fingerman et al. 2009).

Cultural factors play a role in the level and types of support parents give to children. In general, White parents provide financial and material support to their children, whereas ethnic and racial minority parents tend to provide more housing and practical support to their children (Fingerman et al. 2012a; Suito et al. 2011; Sechrist et al. 2012). Moreover, the flow of support may differ in White and ethnic or racial minority families. For example, studies find that Black families tend to provide greater support to aging parents, whereas non-Hispanic White families tend to provide greater support to their grown

children. Similarly, Asian families tend to place greater value on support to aging parents than do families outside of Asia.

Nonetheless, studies point to the greater importance of economic resources than ethnicity in determining the support older parents give (Suitor et al. 2011). Clearly, parent's material and nonmaterial resources or socioeconomic status (SES) play a role in the extent to which they can provide practical and monetary support to their adult children. Not surprisingly, parents with higher income levels tend to provide greater financial support and parents in poverty provide less financial support (Davey et al. 2005). Recent research shows that there are nuances in these patterns, however. Grown children whose parents have more income and higher education typically receive more emotional and financial support. Yet, with the exception of money, lower SES parents provide more total support across all of their children. That is, families where the parents have less education and lower income suffer two disadvantages: (a) grown children, on average, receive less support and (b) resources are stretched trying to meet more needs from a greater number of children (Fingerman et al. 2015).

Family structures also play a role in exchanges of support. Divorced parents, both mothers and fathers, tend to provide less financial and practical assistance to their grown children. Yet, because divorced fathers often experience infrequent contact and more distant relationships with their adult children, they are the least likely to provide support to adult children when compared with married fathers, married mothers and divorced mothers (Schwartz 2009). Divorced fathers also receive less practical support from their adult children than do divorced mothers. Fathers who divorced early in their child's life and noncustodial fathers receive the least support from their children; likely due to less frequent contact and more distant relationships over the life course (Suitor et al. 2011; Davey et al. 2005). Similarly, widowhood appears to negatively affect the provision of support from parents to grown children, whether mothers or fathers are widowed (Davey et al. 2005). Yet, studies suggest widowhood may increase the likelihood that adult children provide

practical support to parents, and also the likelihood that mothers will live with an adult child (Davey et al. 2005).

In late life, when parents experience health declines, the flow of support may reverse. In general, as parents age, children's support increases, particularly in response to the needs of the parents. When parents' health begins to decline, the balance of support tends to shift toward parents receiving more support than they provide. Only a few grown children provide financial support to parents (Schwartz 2009). Yet, children often provide instrumental support or emotional support in response to parents' needs. As those parental needs increase, grown children may gradually increase support, even becoming full time caregivers if the parents incur disability due to extreme physical or cognitive declines.

### **Exchange of Support Across the Life Course and in a Family Context**

It is important to consider support in the context of the relationship across time as well as in the context of the family. Theorists have discussed the idea of a support "bank" in the parent-child tie that carries over time (Antonucci 1990). That is, exchanges of support are often reciprocal in nature across time. When a parent provides support to a young adult child, it is common and often expected that the child will provide support to the parent in late life. Thus, another factor in predicting receipt of support at any given time is whether the respondent *provided* support in the past. Reciprocity can be an exchange of the same type of support within a relatively short time period such as when a middle-aged parent helps a young adult child move and the child reciprocates by helping the parent paint a room in his house a few weeks later. More often, however, reciprocal exchanges occur across the duration of the relationship. Thus, the emotional, financial, and practical help parents provide in a child's young adulthood and midlife results in practical support and caregiving in the parent's later years (Schwartz 2009; Suitor et al. 2011).

Just as with emotional aspects of intergenerational relations, examining support within the family is important as well, though evidence

regarding within family support is limited. In examining support provided by parents within families, studies reveal that in larger families, parents provide more support to children than parents in smaller families. Yet, each child in a larger family receives less support in comparison to children from smaller families. In other words, a parent with many children tends to give some support to each child, but because that parent's resources are spread out over more children, children in that family do not receive as much support as their counterparts in smaller families. Further, children who experience greater need, who have closer relationships with their parents or who provide support to their parents receive more support than their siblings (Fingerman et al. 2012a; Davey et al. 2005; Silverstein and Giarrusso 2010).

On the other hand, parents may benefit from having more children. Parents who have more children or at least one daughter have a higher likelihood of receiving support from a child. Despite this, a child with a greater number of siblings is less likely to provide support to a parent than a child with few siblings (Davey et al. 2005), perhaps because the siblings are filling the parents' needs. Though research is still limited, these within family studies indicate that exchange relationships between parents and adult children vary within a family.

### Exchange and Well-Being

The interplay between support exchanges and well-being is complex. It is logical to assume that support is costly for the provider and beneficial for the recipient, but this is not always the case. In general, providing support to adult children is not detrimental to parent's well-being unless that support is required because of problems in an adult child's life, the parent views the child as too needy, or the parent is experiencing a stressful situation like retirement or widowhood (Suitor et al. 2011; Fingerman et al. 2012b). In contrast, children who provide intensive support or caregiving for a parent often experience stress, but also report positive outcomes as well (Suitor et al. 2011).

Yet, parents in Western cultures who receive support from adult children may experience lower levels of psychological well-being due to beliefs that parents should provide for their children, rather than the reverse (Suitor et al. 2011). Thus, exchanges of support in the parent-child relationship have a complex association with well-being that researchers continue to explore.

### Conclusion

Intergenerational ties continue to be a central relationship for parents and children alike. Over the past half century, knowledge regarding this important relationship has flourished identifying the important patterns in relationships between parents and adult children. It is clear that both parents and children enjoy close and supportive relationships with each other over the life course; relationships which influence the well-being of each generation. However, social, economic, and demographic shifts continue to create new contexts in which to study these relationships. Continued advances in theory and methodological techniques will allow scholars to examine these relationships in an ever increasing depth and complexity.

### Cross-References

- ▶ [Social Support and Aging, Theories of](#)
- ▶ [Stress and Coping in Caregivers, Theories of](#)

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## Interpersonal Psychotherapy

Gregory A. Hinrichsen

Department of Geriatrics and Palliative Medicine,  
Icahn School of Medicine at Mount Sinai, New  
York, NY, USA

### Synonyms

Evidence-based treatment

### Definition

Interpersonal psychotherapy (IPT) is an evidence-based, time-limited psychotherapy originally developed for the treatment of depression. IPT focuses on interpersonally relevant issues that are the apparent precipitant or consequence of depression. These include role transitions, interpersonal role disputes, grief, and interpersonal deficits. In the treatment of depression, IPT is typically delivered in 16 sessions over three phases of treatment: the initial sessions, intermediate sessions, and termination. IPT requires relatively little adaptation for older adults.

### History and Overview

IPT was developed in the 1970s by Gerald Klerman, Myrna Weissman and their colleagues (Weissman 2006). Its development was informed by research on attachment behavior, the adverse emotional consequences of life stresses, and the negative consequences of depression on interpersonal relationships. Theoretically, IPT was

influenced by the work of the interpersonal school of psychiatry (best known by the writings of Harry Stack Sullivan) and the field of social psychiatry. IPT was first developed as an individual psychotherapeutic treatment for depression. In the 40 years since its development IPT has been adapted for mental health problems other than depression, varied age groups, nonwestern cultures, and treatment formats different from its original design as a 16-week individual psychotherapy (Weissman et al. 2000).

Numerous research studies have demonstrated the efficacy of IPT. IPT or an adaptation of it has been found efficacious in the treatment of depression, bipolar disorder, eating disorders; adolescents, adults, and older adults; mental health and medical settings; individual, conjoint, and group formats; brief or sessions extended beyond the original 16 sessions; and different countries and cultures (Weissman et al. 2000). In the treatment of depression, IPT is recommended in depression treatment guidelines in the United States, UK, and New Zealand/Australia (Hinrichsen and Iselin 2014). IPT along with other evidence-based psychotherapies has been disseminated within national health care delivery systems including the UK National Health Service and the U.S. Department of Veterans Affairs (Stewart et al. 2014). Members of the International Society for Interpersonal Psychotherapy include researchers and practitioners throughout the world.

### Structure and Goals of IPT

As originally developed, IPT is delivered in three phases of treatment: The initial sessions (sessions 1–3), intermediate sessions (4–13), and termination (14–16). One or two interpersonally relevant problem areas are the focus of IPT treatment. These include role transitions (a change in life circumstances), interpersonal role disputes (conflict with another), grief (death of an important person), and interpersonal deficits (individuals who lack skills to initiate or sustain relationships). Therapeutic goals and strategies are outlined for each of the four problem areas. Therapeutic techniques are used in IPT to help the patient achieve goals and strategies relevant

to the identified problem area(s). Commonly used techniques include communication analysis (engagement in a detailed review of a recent interaction), decision analysis (engagement in a process for taking action to address an issue of concern), role-play (enactment of a planned conversation), interpersonal skill building (enhancement of ability to successfully interact with others), and work-at-home (encouragement to make efforts to address problems between therapy sessions).

In the initial sessions, the therapist engages the patient in a discussion of his or her symptoms of depression, administers a depression rating scale (and at later points in therapy), provides psychoeducational information about depression and its treatment, and encourages the patient to be hopeful that depression will likely improve during the course of treatment. Apparent precipitants and consequences of the current episode of depression are identified. Through use of IPT's interpersonal inventory the patient's current and past important relationships are broadly reviewed. One or at most two interpersonal problem areas are identified and will be the focus of treatment. The patient is provided with an interpersonal formulation, which is a succinct statement of the therapist's understanding of the likely precipitant(s) of the patient's depression and interpersonal problems that may have resulted from the depression. A therapeutic contract is discussed with the patient that includes a statement of therapeutic goals, review of the format and duration of treatment, conveyance of expectations about attendance at sessions, and practical matters such as fees.

In the intermediate sessions, goals and strategies for the identified problem area(s) are implemented. As noted, techniques are used to facilitate achievement of goals and strategies. Throughout the intermediate sessions, the status of the patient's depression is monitored. The link between changes in the patient's symptoms and events from the prior week is discussed. Briefly, the goals of each of the four problem areas are the following: For role transitions, the therapist works with the patient to come to emotional terms with how life has changed and facilitates the development of new skills to better manage new life circumstances. In the treatment of interpersonal

role disputes, the therapist aids the patient to better understand issues in the dispute, clarifies expectations about what he or she would like to change, and then helps the patient to change expectations and/or improve capacity to deal with the dispute. For grief, the therapist engages the patient to mourn the loss of the deceased and find ways to establish or reestablish activities and relationships with others that are sustaining. For those with interpersonal deficits, the therapist helps the patient to develop skills to enlarge the scope of interpersonal involvements. Achievement or partial achievement of goals for each of the problem areas is typically associated with reduction in depressive symptoms. Improvement in depression will likely make it easier for the patient to better manage issues associated with the IPT problem area. Throughout the intermediate sessions, the patient is periodically reminded of the remaining number of sessions.

In the termination phase of IPT, the ending of therapy is discussed including feelings that the patient may have about its ending. Changes in depressive symptoms over the course of IPT are reviewed with the patient as well as changes in the identified problem area(s). Therapeutic gains are attributed to efforts that the patient has made. For patients who have not made gains, other treatment options are reviewed. For some patients, less frequent (“maintenance”) sessions may be recommended. Possible future triggers of depressive symptoms are discussed, and the patient is engaged in a review of what efforts might be made to effectively respond to them. The overall therapeutic ethos of IPT includes active collaboration, encouragement, conveyance of hope, and facilitation of problem solving. The IPT treatment manual for depression is *Comprehensive Guide to Interpersonal Psychotherapy* (Weissman et al. 2000). Other IPT treatment manuals exist for other mental health problems, populations, and treatment formats.

### **IPT in the Treatment of Late Life Depression**

Early in the history of IPT, researchers commented that IPT seemed especially well suited to

the problems confronted in later life (Sholomskas et al. 1983). A series of research studies has generally supported the efficacy of IPT in the treatment of late life depression (Hinrichsen and Iselin 2014). IPT is one of the recommended evidence-based treatments for older adults with depression by the Substance Abuse and Mental Health Services Administration (2011). Two published clinical treatment manuals for IPT with older adults exist: *Interpersonal psychotherapy for depressed older adults* (Hinrichsen and Clougherty 2006) and *Clinician’s guide to interpersonal psychotherapy in late life: Helping cognitively impaired or depressed elders and their caregivers* (Miller 2009).

Clinical reports on the use of IPT with older adults have appeared over the last 15 years (e.g., Hinrichsen 2008; Hinrichsen and Iselin 2014; Miller and Silberman 1996). For cognitively intact older adults, IPT can be used without substantive adaptation from its original formulation as an individual psychotherapy for depressed younger adults. However, IPT should be more broadly informed by knowledge and skills recommended for those providing clinical services to older adults (American Psychological Association 2014). The four IPT problem areas encompass many of the issues seen among older adults who seek treatment for depression. The collaborative, problem-focused approach of IPT is consistent with general guidance in the provision of psychotherapy with older adults (Knight 2004). IPT, in the treatment of late life depression, can be taught successfully to psychology trainees and postlicensure mental health care professionals. Older adults treated with IPT appear to have clinical outcomes similar with those found in research studies (Hinrichsen and Clougherty 2006). Consistent with this observation is a recent report from the U.S. Department of Veterans Affairs (VA) national dissemination of IPT to mental health clinicians (Stewart et al. 2014). Large and significant decreases in depressive symptoms were evident among veterans treated with IPT, almost half of whom were older adults.

Clinical and research reports indicate that the following are common issues treated within each of IPT’s four problem areas. The most frequent

problem area is role transitions for older adults. Examples of role transitions for older people include assumption of care for a relative with health or cognitive problems or care for a grandchild; onset or exacerbation of health problems in self; retirement or loss of employment; and residential transition. The second most common problem area is interpersonal role disputes which include onset or exacerbation of longstanding conflict with a spouse or partner; adult child; in-law; sibling; or institution (hospital, service delivery system). Grief typically includes loss of spouse/partner, adult child, sibling, or grandchild. Among the four problem areas, interpersonal deficits are least frequently the focus of IPT among older adults seen in outpatient clinical practice. Interpersonal deficits may include individuals with longstanding problems in making interpersonal connections as well as those who confront new life circumstances for which they do not possess needed skills.

### **Illustrative Examples of IPT with Older Adults**

*Role Transitions.* Mrs. Washington is a 70-year-old African American woman with a 1-year history of severe depression (Note: All names are fictitious and identifying information has been changed in this and other examples). Her primary care physician had repeatedly asked her to take an antidepressant medication or to see a psychotherapist. Mrs. Washington refused since she had never had mental health problems in the past and felt that seeing a mental health professional would be stigmatizing. Finally she agreed to see a therapist. In the last few years the patient had been diagnosed with several medical problems that increasingly limited her mobility. Prior to the onset of her depression she had reluctantly agreed to have a medical procedure, which did not go as she had hoped and which left her with functional limitations she had not anticipated. She told the therapist she did not believe psychotherapy would help but agreed to do it because of the persistence of her physician. The problem area was role transitions – a transition from an individual who

was in relatively good health to someone with health problems and associated physical limitations. The goal of therapy was to help her to come to emotional terms with how her life had changed and find ways to make her current life more meaningful.

Therapy involved ongoing discussion of depression and depressive symptoms. She attributed depressive symptoms to a lack of will and failure of character. Ongoing monitoring of depression helped clarify that her depressive symptoms fluctuated with issues tied to her health problems, how she managed them, and efforts she made to expand the range of meaningful activities. During the course of the intermediate sessions, the patient expressed regret that she had not cared for her health in younger years and felt that she was to blame for her current health problems. Even when she began to have significant health problems, initially she did not comply with medical recommendations. As noted, reluctantly she had agreed to undergo a medical procedure that had unexpected side effects and which further impaired her ability to function. It was at this point Mrs. Washington became depressed. During therapy she began to make small efforts to complete neglected household tasks, see friends, and resume some social activities. Her physician recommended another medical procedure. The therapist facilitated a discussion about what she needed to know about the procedure. She decided to speak with her physician about both the potentially favorable and unfavorable outcomes of the procedure – in a way she hadn't done previously. Finally she agreed to undergo the procedure but negotiated with the physician how, when, and where the procedure would be completed. The procedure had a favorable outcome. She felt empowered that she had been an active participant in her medical care and was less depressed. She continued to increase involvement with friends and activities, which further decreased her depression.

*Interpersonal Role Disputes.* Mr. Fort is an 85-year-old widowed European American man with multiple health problems. He sought treatment because of depression and associated conflict with his daughter. Mr. Fort was encouraged by his daughter to live with her and her family

following the death of Mr. Fort's wife. He had moved in with his daughter 2 years prior to seeing the therapist. At first things went well with his daughter and her family. Increasingly, however, he felt disappointed that he was not "really part of the family," that his daughter did not spend enough time with him, and that his grandson seemed disinterested in him. He grew increasingly depressed and intermittently expressed anger and disappointment toward family members that he felt made them even more distant from him. The identified problem area was interpersonal role disputes, and the goal of therapy was to help him to clarify the issues in the dispute, his expectations of his daughter and her family, and options to improve the dispute.

At the beginning of the intermediate sessions, Mr. Fort expressed criticism, anger, and disappointment toward his daughter. The therapist engaged him in a detailed discussion of what transpired before, during, and after conflicts with his daughter or her family members. It became evident that he had different expectations than his daughter about what it would be like to live together. He expected his daughter to make him an integral member of her household in the same way that he felt he did with his aged mother when she moved in with him. The therapist asked Mr. Fort to think of different options to deal with the unsatisfactory and conflictual living arrangement. He made efforts to try to get his daughter to change her family routines so that they would spend more time with each other. This effort did not work to his satisfaction. In the end, Mr. Fort decided that because of his declining health, there were advantages to living with his daughter's family. He remarked, "I'll just have to change my expectations." He did change his expectations and accepted that he would not have the living arrangement he had first envisioned. The result was reduced frustration and depression and more congenial relations with his daughter and her family.

*Grief.* Mr. Garcia is a 78-year-old Hispanic American man whose wife died about 10 years prior to starting therapy. He remarried shortly after his wife died. He had had depressive symptoms since the death of his wife, and in the last year his

symptoms grew worse. He was referred by his primary care physician for since he did not show substantive reduction in depression after being prescribed several antidepressants. Mr. Garcia did not feel that he ever fully grieved the death of his wife. Although he and his wife had a congenial relationship, he felt distant from her. Further, he had recurrent thoughts about his deceased wife and actively missed her. Notably he retained his deceased wife's ashes in his home. The identified problem area was grief with the goal of facilitating the mourning process and helping the patient to more fully engage in his current life. Many of the intermediate sessions focused on recollections of his deceased wife and their relationship. At first, the patient resisted discussion of his deceased wife, and it was apparent that it was painful for him to talk about her. He was encouraged to bring in pictures of his wife and other memorabilia. The therapist persisted in facilitating discussion of both positive and negative aspects of his relationship. Mr. Garcia talked about the early years of his marriage during which he said he was unfaithful, insensitive, and, at times, cruel toward his wife – actions which he deeply regretted. The therapist pressed the patient to talk in detail about specific incidents that he found most difficult to discuss. He said that he did not feel that he deserved someone as caring as his wife. He recounted the circumstances surrounding his wife's illness and the pain of seeing her physically deteriorate. He acknowledged that despite regrettable behavior during the early years of their marriage, he provided reliable help to her at the end of her life. As therapy was ending, Mr. Garcia said that he wanted to bury his wife's ashes since "Now I can release her." He arranged a ceremony with family members at which they buried his wife's ashes. By the end of psychotherapy, the patient's depression was significantly improved, and he felt closer with his current wife.

*Interpersonal Deficits.* Mr. Carl is a 78-year-old European American man who had been widowed for about 1 year. His primary care physician referred him because he appeared depressed, lonely, and evidenced difficulties adjusting to the loss of his wife. In the initial sessions, he reported that his grief lessened over

the past year and he appeared to have come to emotional terms with the loss of his wife. However, he complained of social isolation and depression. He had four children, three of whom lived in another part of the country. One son lived near him, but he never felt close to him and they had little contact. A review of his social history revealed that Mr. Carl heavily depended on his wife to arrange social engagements with friends and family. During her lengthy illness, both he and she became more socially isolated as she was less capable of reaching out to others. During the months following his wife's death, family and friends paid condolence calls, but those visits lessened in frequency. A year after his wife's death, he felt he had little to do and limited contact with others despite a desire for social contact. He appeared to lack knowledge and skills of how to initiate, sustain, and respond to social invitations with others. Interpersonal deficits were the IPT problem area, and goal of therapy was to reduce Mr. Carl's social isolation.

During the intermediate sessions the therapist worked with Mr. Carl to clarify past efforts on his part – independent of those initiated by his wife – to socially connect with others. He had some work friends, but after he retired contact with them lessened especially when his wife became sick. He casually mentioned that after his wife's death his work friends had called and invited him out a number of times. He said he refused the invitations because he was grieving and did not want to be with people. He had received other invitations. Couples with whom he and his wife had previously socialized repeatedly asked him for dinner, but he did not respond to their messages on his answering machine. He said he was not comfortable socializing with couples without his wife. His children had invited him for visits to their homes, but he did not feel up to traveling after his wife's death. He understood that people stopped calling him because he repeatedly said no to their invitations. Now he was feeling lonely and wanted contact but did not know how to initiate it. "My wife always did that." Most of the intermediate sessions were

devoted to engagement of Mr. Carl in reviewing options for increasing social contact, building skills around how to connect with others, discussing the unwritten rules of social protocol, rehearsing conversational skills, role playing anticipated conversations with others, and reviewing his experience of being with others. By the end of treatment, Mr. Carl had rekindled a work relationship, responded to an invitation by a couple to come to their home for dinner, and agreed to a visit with an out-of-town child. He was less depressed and felt more confident of his ability to further rebuild his social world.

### Future Directions

The rapid growth of numbers of older adults will mean that many mental health providers will be seeing older people in clinical practice. Depression is a common presenting clinical problem of older people seeking treatment and interpersonally relevant issues are often a precipitant of depression. IPT is useful and well suited for depression in older adults and can be effectively taught to graduate students and postlicensure professionals. The challenge for mental health care providers is that many did not learn IPT or other evidence-based psychotherapies in their training. Even today, they are not substantively taught in graduate education or in internship or practicum placements (Weissman et al. 2006). The US Department of Veterans Affairs Healthcare System (VHA) is a model of how to train postlicensure clinicians in evidence-based treatments and integrate them into practice (Stewart et al. 2014). Sustained efforts for accountability in health care will likely create incentives for graduate programs to substantively teach and for practitioners to deliver evidence-based psychotherapies since better clinical outcomes are tied to reduced health care costs. IPT researchers will continue to adapt and test this psychotherapy's utility for additional problems and population including subpopulations of older adults such as those with cognitive impairment and in long-term care (Miller 2009).

## Cross-References

- ▶ [Aging and Psychological Well-Being](#)
- ▶ [Caregiving and Carer Stress](#)
- ▶ [Clinical Issues in Working with Older Adults](#)
- ▶ [Depression in Later Life](#)
- ▶ [Late Life Transitions](#)

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## Interprofessional Care

Veronica L. Shead

South Texas Veterans Health Care System, San Antonio, TX, USA

### Synonyms

Collaborative care; Interdisciplinary; Multidisciplinary; Transdisciplinary; Treatment teams

### Definition

Interprofessional care consists of the ways in which providers across multiple disciplines collaborate to provide comprehensive care and care planning for patients. This method of care management provides an opportunity for more holistic care as the treatment team is able to address the biopsychosocial needs of the patients in a more efficient and effective manner.

### Population Aging and the Need for an Interdisciplinary Care

In developed nations over the past century, we have seen an increase in life expectancy and the number of adults aged 65 and older. It is believed that this increase in life expectancy has a great deal to do with improved sanitation and more efficacious treatment of infectious disease. Therefore, people are simply living longer. In the USA, for example, it is estimated that by the year 2020 older adults will account for more than 20% of the entire population. Nevertheless, this increase in life-span brings along an increased likelihood of developing chronic medical conditions. Over the

life-span, people in developed nations are seeing increasing rates of hypertension and diabetes, which are chronic conditions that also pose as risk factors for a number of more serious illnesses. Also, as the likelihood of having multiple medical conditions increases, so does debility. For minority and immigrant older adult populations, the rates of multiple chronic conditions are even greater. Minority and immigrant elders are thought to be at much greater risk due to experienced health disparities related to access, race and ethnicity, and quality of healthcare (Wegner et al. 2003; Gauthier and Serber 2005).

With multiple comorbidities, debility, and accompanying functional decline, management of one's healthcare becomes more complex. Older adults, who are no longer able to manage their complex care, need additional support from a caregiver and in some cases institutionalization. All of these factors combine to create very complicated profiles for the geriatric patient population. From a biopsychosocial perspective, the interrelationship between physiological, psychological, and social statuses must be addressed in older adults to provide adequate care in these complex cases. Therefore, older adults require more comprehensive and holistic care from multiple providers. The method identified to address the many issues faced by those with complex medical issues is interprofessional care. Interprofessional care requires professionals to come together across disciplines to collaborate in assessment, treatment planning, and interventions. These treatment teams not only provide more efficient care but more efficacious treatment. Numerous gerontological and other professional organizations have identified interprofessional care as the recommended method of care delivery for older adults due their complex care needs (Partnership for Health in Aging 2014). Nevertheless, the structure of the current healthcare system does not always facilitate interdisciplinary management, and more often than not if there are interdisciplinary teams, psychology is not involved. Therefore, this chapter looks to explore the need for interdisciplinary care, the structure of care teams, the role psychologists play on interprofessional teams,

training needs, policy, and barriers to care provision.

The current healthcare system is characterized as fragmented and disconnected, with providers across multiple settings. This requires those already burdened with illness, and their caregivers, to manage and navigate a fractured system often with little support. In addition, prevention is the most powerful tool in healthcare, yet our healthcare system remains primarily focused on treatment of disease. This focus on treatment often is not inclusive of palliative care options or patient-focused care. The provision of value based care with a focus on improving quality of life throughout and not simply at the end of life. In many instances the majority of patient care is managed in primary care. Unfortunately, with the low numbers of practicing geriatricians, this poses numerous problems for many older adults as they tend to rely on primary care to not only address their physical issues but also their mental healthcare needs (American Psychological Association and Presidential Task Force on Integrated Health Care for an Aging Population 2008). Often primary care providers lack adequate training in geriatric issues and may make ageist assumptions about disability, chronic illness, and cognitive impairments. Therefore, geropsychologists must join with other providers to address the unique issues facing the geriatric population across treatment settings by becoming members of interdisciplinary teams.

## **Integrated Care**

Ideally, integrated care would focus on a single setting for the provision of care in a clinic, a home care team, or a consultation team working in a hospital. Next, the idea of looking at care in a holistic manner where there are multiple aspects of the patient is considered and each patient is approached as a unique individual. Therefore, integrated care focuses on providing holistic care that is patient centered. With integrated care the team has a broader reach and can therefore assess, intervene, and manage a much broader range of problems. There are a number of team models, but

ideally the team will work toward developing a comprehensive and cohesive plan of care. This is probably the most important aspect of integrated care and why it is the preferred method for managing complex patients and specifically older adults. In order to develop this plan, all individuals must collaborate and continually work together to manage and modify the plan of care with ongoing assessment. Such collaboration requires fluid communication and information sharing across disciplines.

In order to truly note the benefits of collaborative integrated care, the focus of treatment must be seen through a biopsychosocial framework. There must be respect for and understanding of the usefulness of the work done by all disciplines. Members of a treatment team must understand that there is not only value in the work done by others, but that there is multidirectional influence from one area to the next. There should be clear understanding by all members of the team that physiological changes can influence a person's psychological state which in turn will change their social situation and vice versa. Although patient care often takes place in primarily traditional medical-focused settings, all members of the team must understand that each aspect of care is of great significance. Older adults tend to present with physiological symptoms that are rooted in psychological distress and/or resulting from a lack of resources and adequate social support (American Psychological Association and Presidential Task Force on Integrated Health Care for an Aging Population 2008). For this reason, all members of interprofessional teams must be involved in assessment and ongoing intervention and management.

## Benefits of Integrated Care

So what are the benefits of integrated care, and why has there been such a focus on changing the system? One major benefit of integrated care is the ability to address the fragmented healthcare system (American Psychological Association and Presidential Task Force on Integrated Health Care for an Aging Population 2008). Collaborative care

often eliminates the need for multiple appointments in a variety of locations resulting in increased access and more fluid care. Collaborative care also allows for improved screening and monitoring through information sharing. Assessments are completed in combination, which allows the team to address a range of issues at once. Moreover, integrated care allows the team to simultaneously address mind-body issues and reinforces the importance of mind-body relationships to patients and caregivers (Karel et al. 2012). The care team addresses more comprehensively modifiable risks by implementing services and providing additional support to the patient, caregiver, and families when needed. In addition, when consults are needed, teams are able to more efficiently make use of specialty clinics and other teams as they have a broader picture and can more accurately assess the patient's specific needs. Often interprofessional team management increases communication as well. Due to the numerous benefits, there is increased patient satisfaction as well as provider satisfaction in integrated care settings. The increased satisfaction is not simply perceived by patients and providers, but there is evidence that outcomes for patients are greatly improved (Hirth et al. 2009; Famadas et al. 2008). The resulting improvements in patient outcomes have resulted in numerous national and international organizations with a focus on geriatrics, aging, and complex care management including the Gerontological Society of America (GSA), the American Geriatrics Society, the National Institute for Care of the Elderly (NICE), and the International Federation on Ageing, to name a few, to highly recommend the provision of integrated care (Partnership for Health in Aging 2014).

## How to Begin

Many practitioners are interested in implementing integrated care and forming interdisciplinary teams. Nevertheless, they are faced with questions of how to implement this care within the current structure. Many professionals practice independently or within organizations where disciplines

practice in silos. How does a provider, a unit, and/or an organization come together to form an integrated care team? First, the team must begin where they are. Often organizations need proof or outcomes in order to fund a new initiative. Therefore, many teams must begin with a few providers working together to form a team. The new team likely has members under the direction of numerous departments. The team should come together to meet an identified need within the organization or a specific need for an identified population. The team must be savvy and understand the language and culture of the organization so that they can build within the structure of the organization. Also, the team can work to reach their goals within a specified clinic or group experience from which they can build. Therefore, it may be necessary to start small and then gradually expand. As an example, many times there is a need to address dementia assessment, diagnosis, and treatment in primary care. In a primary care setting, there often is not enough time to comprehensively address patient and family needs in this area. Therefore, providers may decide to offer an interdisciplinary memory clinic that specifically assesses patients referred from primary care for dementia and related disorders. In addition, this clinic could go a step further to provide the patient and caregiver with resources and guidance for future care. All of this information would be integrated into an individual treatment plan made available to the primary care provider addressing the patient's current needs. This memory clinic although very specific and small initially fills a need for the organization, provides comprehensive dementia assessment and care planning that could not be accomplished by one provider, and identifies and meets the needs of those patients and family members assessed. The interdisciplinary memory clinic has therefore met the needs of the organization and the patients. In addition, if the clinic has measurable outcomes, this would allow for improvement in the future and identification of both strengths and weaknesses of the project. If the clinic is successful, the organization and providers are very likely to support continuation and expansion if necessary. Again, the team can start small with a specific goal and expand

accordingly. Teams as with other providers must act as one and provide services as well as feedback in a timely manner. If a provider or another team cannot reach the provider or they are not provided with the resulting assessment and treatment plan, then many others will not want to use the services in the future. This conceptualization and model was used in developing the Memphis Dementia Clinic model (Jacobson et al. 2012).

## Team Models

There are differing team models. The ideal function of a team would be to have fully integrated care in one location. However, due to the structure of most current medical systems and limitations on space, time, and reimbursement, establishing fully integrated care poses a challenge for providers. Therefore there are numerous ways in which teams operate. Here three different team models are described: multidisciplinary, interdisciplinary, and transdisciplinary. The models of care are dependent on the setting, communication style of the team, and the provider roles (Partnership for Health in Aging Workgroup on Multidisciplinary Competencies in Geriatrics 2010). Many collaborative care teams are set up as multidisciplinary teams. In these teams, the care is collaborative; however, the members contributions are additive as they tend to practice independently but in parallel. Oftentimes the teams are colocated, but each individual member performs their own assessment. The disciplines although working together have independent discipline-specific goals. The roles of the providers are often more clearly defined as the providers are focused on their discipline-specific treatment plans. In addition, there tends to be a hierarchy as the team shares information but one discipline takes on primary management, which oftentimes is medicine. Many times this manner of care is confused for interdisciplinary due to the fact that other disciplines are present. However, this is not the case as the care is collaborative but not integrated. For example, in this team type, another provider may consult the psychologist. The psychologist performs their own

discipline-specific intake and develops goals of care and recommendations. The results of this assessment and intervention can be brought to the team in a treatment team meeting or the providers could be notified about the results electronically or through traditional records. The team does not have one integrated treatment plan in this scenario but numerous plans being implemented simultaneously.

The second type of team is the interdisciplinary team. This is the treatment style that is clearly identified as the useful model of care in geriatrics. The care is fully collaborative unlike the multidisciplinary team that is simply colocated and shares information. The highlight of this treatment style is the fully integrated treatment plan. Each discipline is working toward united goals of care and they often have overlapping roles and skills that allow for the team to perform as one. In addition, there is no hierarchy as the team works together to make all care decisions. On interdisciplinary teams psychologists usually receive information about new patients at the time of consultation or initial intake. The members of the team can perform the initial intake in combination or they all provide initial assessment individually and come together in regular treatment team meetings to develop a unified plan of care for the patient. The team usually communicates their findings to address the biopsychosocial issues with each member contributing to the treatment plan and all members being involved with intervention and maintenance as needed. Often the needs of the patient may dictate the continued level of involvement in the intervention, but all team members remain available reviewing the case in treatment team as long as the team is managing the patient's care. In this team structure, psychologists may provide cognitive assessment and initial mood management. Results of assessment would be shared with the team, which could lead to continued psychotherapy for the patient. Psychotherapy could assist the patient in adjusting to and coping with a new chronic medical condition. Psychology could also assist the patient in determining goals of care and continue to assist with communication with the team and other professionals for the duration of their care.

The third type of team is the transdisciplinary team. This type of treatment team is the ultimate in collaboration. The providers on this type of team are able to provide more holistic care for their patients. There is a single treatment plan that has been developed for the patient by all members. The team not only understands the roles of other providers, but this collaboration has allowed for the expansion of their roles. As the members work together, they learn more about their teammates and the other discipline's roles. This allows for more seamless information sharing and integration. The team also trains together to learn skills specific to their care provision, and therefore multiple if not all providers are able to perform certain tasks equally. In this team style, the team members share leadership responsibilities, as again they are working toward the same goals. Palliative care and hospice are modeled after this style of care team. These teams work to provide values based on patient-centered care, so assessment and treatment are focused on the patient's goals of care for all providers. In this treatment team structure, psychologists may work with the other team members to devise a team initial assessment measure, which gathers pertinent information for all members. The psychologist will use this information to determine if further evaluation is necessary and make treatment or other recommendations along with the team members. Also, due to the nature of the team and the overlap in roles, the psychologist and other members of the team may share responsibilities in assessment, in documentation, and on some interventions as the roles can expand to include specialty-specific assessment. As in palliative care, most members of the treatment team are able to assess symptoms and goals of care and are well versed on end-of-life planning. This information is then taken back to the team to develop the integrated treatment plan.

### **Interprofessional Training/ Multidisciplinary Competencies**

As healthcare moves toward more interprofessional team care, healthcare providers must learn to work together across multiple settings.

Therefore, learning to work on a high-functioning interdisciplinary team should be incorporated into the training of all healthcare professionals so that they are able to provide optimal care to older adults (Karel et al. 2012; Fulmer et al. 2005). Although healthcare is moving in the direction of integrated care, most disciplines continue to train students in silos with very limited opportunities for collaboration and even fewer opportunities for integrated practice (Partnership for Health in Aging 2014). Trainees across disciplines are missing opportunities to gain reciprocal knowledge. Due to the highly beneficial nature of integrated care, it is recommended that across the learning spectrum opportunities there would be opportunities to engage in interdisciplinary training (Partnership for Health in Aging 2014). This training should consist of understanding the need for integrated care, learning to work collaboratively, and the unique aspects of collaborative care across numerous settings including acute care, clinical care, long-term care, and care within the home (Leipzig et al. 2002).

Presently, there are several geropsychology training programs that have moved toward incorporating integrated care into the curriculum (Leipzig et al. 2002). Internationally, many geropsychology programs are using the Pikes Peak model as a tool for developing graduate and postdoctoral curriculum and didactics, which is inclusive of interdisciplinary training as a competency (Pachana et al. 2010). The University of Alabama, for instance, has worked extensively to develop a comprehensive graduate geropsychology training program, and they have included interdisciplinary clinical practice as well as classroom experience within the program. Specifically, they have developed an interdisciplinary Health and Aging course, which includes faculty from disciplines outside of psychology (Warton et al. 2013). In addition, there are a growing number of interprofessional training programs, which work to provide shared learning experiences for trainees across disciplines. Within these programs, the didactics, rotations, and many projects involve collaboration; participants are often at similar developmental levels in their professional training so that they are working with

others at similar expected competency levels (Partnership for Health in Aging Workgroup on Multidisciplinary Competencies in Geriatrics 2010).

Interprofessional programs must have primary faculty across disciplines to provide guidance and support to the trainees and appropriately modeled collaborative care and to ensure that discipline-specific competencies are appropriately evaluated in order to be successful. Overall, numerous professional organizations, accrediting bodies, credentialing, and licensing boards are recommending and supporting interprofessional training programs (Partnership for Health in Aging 2014; American Psychological Association and Presidential Task Force on Integrated Health Care for an Aging Population 2008).

### **Barriers and Difficulties Associated with Interprofessional Teams**

The numerous benefits of collaborative interprofessional care have been stated, but as with any manner of care there are a number of barriers to implementation. First, there are institutional difficulties. The structure of the healthcare system is such that many providers are under the management of discipline-specific departments. This often means that providers have variations in professional/department expectations, time and availability to the team, space allocation, different direct supervisors, and various other discipline-specific professional requirements. These differences can pose as challenges for the team. The team may have varying levels of support across departments, which can lead to unequal workload. Documentation and coding of appointments becomes more complex when working in team settings, so teams must ensure that all members are accumulating adequate and accurate workload. Scheduling of team meetings and treatment planning can also be very difficult, especially if providers do not have time fully dedicated to the team or there are differences across disciplines in availability. Therefore, providers must work together to form a team plan. It is helpful for the team to define their purpose and goals for

provision of care. The purpose of the team should be clearly defined and patient centered. In using the Memphis memory clinic example mentioned previously, the purpose of the team would be to provide comprehensive assessment, treatment planning, and resources for patients and their caregivers (Jacobson et al. 2012). Therefore, the team must decide what patients are appropriate and what the shared responsibilities would be for each discipline. In this example, the memory clinic team determined that they will take referrals from primary care of outpatients over 85 years of age and those exhibiting likely cognitive impairment. This specificity allows multiple disciplines to clearly understand the usefulness of the clinic and assists in developing an understanding of roles of the contributing healthcare providers. Psychology will provide the neurocognitive assessment, the geriatrician will provide the physical and neurological evaluation, the geriatric pharmacy will perform medication reconciliation, and social work would provide the family with necessary resource recommendation and advance care planning. With clear goals and discipline-specific tasks, the team comes together to create an integrated treatment plan. Without this prior planning, the goal of the clinic and roles on the team could be interpreted very differently by members of the team resulting in conflict and loss of efficiency and effectiveness, as well as providers feeling as though their skills are being utilized inappropriately. Taken together, this can ultimately lead to conflict. Planning can often decrease the likelihood of role-based conflict.

In addition to systemic issues, the team must also understand and learn to work with one another. Enhanced communication is the ultimate benefit of collaborative care; however, poor communication is often the greatest barrier to implementation of team care (Leipzig et al. 2002). Teams therefore must learn to work together. Of the utmost importance is mutual respect for the role and value of each team member. All disciplines must take the time to learn and understand the competencies and roles of the treatment team members. Often many disciplines have overlapping abilities, which is often expected and appreciated. Nevertheless, many teams have great difficulty when providers

are unclear about their role on the team and feel threatened or defensive about their area of practice (Leipzig et al. 2002). Bearing this in mind, teams must work to better understand one another by developing trust and expressing appreciation. Teams should meet consistently to not only discuss patient care but treatment team management. Team members should work to foster positive relationships with their fellow team members and provide support as appropriate in the professional environment. Providers who are happy and satisfied with their work provide better care overall (Leipzig et al. 2002). Again, members of teams have the benefit of shared experience and can process difficulties together as well as celebrate triumphs.

## Policy Issues

As healthcare adopts interprofessional care as a preferred method of care, policy change must follow to make room for the implementation and maintenance of these teams. This includes improving reimbursement across disciplines for interdisciplinary encounters. For instance, in the USA, there are now Current Procedural Terminology (CPT) codes (medical codes maintained by the American Medical Association (AMA) that describe the medical diagnosis services similar to the ICD-10 coding but speak to the service or procedure and not necessarily the diagnosis) for team conferences as well as health and behavior codes that can be used when providing care to patients whose primary issue is a medical condition and who may not have a psychiatric diagnosis (Karel et al. 2012). These new codes are great improvements that will assist in interdisciplinary care provision. Nevertheless, there is great need for additional support, as these nontraditional roles for healthcare providers will call for changes in workload. Due to the increased need for collaboration across disciplines, many providers spend a great deal of time outside treatment team meetings consulting with team members about patient care. Also, institutional support for interprofessional care is of great importance as it dictates the sustainability of care teams and again can eliminate some of the discussed barriers to implementation.

Supplementary financial support is also of great importance due to the changes in coding; the collaborative care settings are often not as profitable for individual providers as traditional clinics (Partnership for Health in Aging 2014).

### **Psychologists' Unique Contribution**

Psychologists have a great deal to offer interprofessional teams. They have the ability to perform cognitive assessments, mood assessment, and capacity evaluations. Psychologists have the ability to intervene using non-pharmacological behavior management (especially important for those patients with dementia), evidence-based therapies, supportive therapies, relaxation, and enhanced communication. In addition, psychologists are helpful in providing caregiver support and bereavement services for the patient and family. Geropsychologists also have the unique skill set of understanding the geriatric population and how to modify assessment and intervention methods to address the specific needs of the population. Geropsychologists are adept to understanding the impact of sensory loss, functional decline, and debility. Furthermore, conceptualizing patients from the biopsychosocial perspective gives insight into the influence and interactions between physiological change, social change, and psychological change. Geropsychologists should be familiar with delirium, dementias, the neurocognitive effects of certain medications, methods for non-pharmacological symptom management, and the influence of environmental change, family dynamics, and changing social roles. Geropsychology board certification now provides a method to identify as an expert provider with these geriatric-specific competencies (for more information on this, see the entry on Training Psychologists in Aging) (Karel et al. 2012).

### **Advocacy**

Many times psychologists' skills are overlooked, and they are not always included as healthcare

providers on interprofessional teams (American Psychological Association and Presidential Task Force on Integrated Health Care for an Aging Population 2008). Psychologists therefore must advocate for inclusion. Patients, caregivers, families, and other providers can greatly benefit from the skills that psychologists bring to the table. Psychologists also benefit from working within these team structures as they are able to improve communication and often intervene much earlier than if they were consulted separately. Psychologists and other providers who work on interdisciplinary teams learn a great deal more about their patients, which in turn informs future practice. Psychologists must advocate by speaking to the unique contributions that they bring to the interprofessional table. Psychologists, however, must first be seated at the table. Psychologists should therefore become more informed about policy issues and legislation that influence research and practice, with specific attention paid to policies that support psychologists' participation in treatment teams as well as support appropriate reimbursement. As stated previously, more often than not, other disciplines do not understand the education, training, and competencies of psychologists and more specifically geropsychologists. Psychologists need to inform other providers of the services that can be offered, with a focus on how these services and skills when provided in collaboration improve overall patient care. Advocacy on a national level begins with collaboration between professional psychological organizations and other national professional organizations to expand the reach of the message. The Partnership for Health in Aging is a coalition of 35 member professional organizations that has continued to detail the necessity of integrated care as well as training. This work can also take place within interdisciplinary national organizations such as The Gerontological Society of America (GSA), which advocates and promotes improved care for older adults and all professionals with a geriatric focus in the USA, as well as international organizations such as the International Federation on Ageing, NICE, and the International Association of Gerontology and Geriatrics (IAGG) which advocate globally for aging issues in

research, training, and care provision through collaborative intergovernmental and multinational organization collaboration. Individual psychologists can also advocate in their individual workplace by offering to work with providers from multiple disciplines to not only demonstrate the services provided, but to importantly demonstrate an interest in others' work as well and how collaboration is overall beneficial in daily practice.

## Summary

Overall, interprofessional treatment teams are thought to provide the most comprehensive care for the complex care needs of the geriatric population. Integrated care shows numerous benefits for the patients in providing improved access, more holistic care, and more efficacious management. As for providers, interprofessional care allows them to have access to more information and develop a more integrated treatment plan. Providers of integrated care, when performed appropriately, are more satisfied with their jobs and their patients have more positive outcomes. There are three types of interprofessional teams, with interdisciplinary teams being the standard and transdisciplinary team care provision being an ultimate goal. There can be numerous barriers to the provision of team care at the institutional as well as individual provider level. Communication is thought to be one of the most beneficial aspects of collaborative care for providers, but lack of communication can be devastating to the implementation of team processes. Getting a team started requires some initial planning, but once started the outcomes are mostly positive. With the focus on increasing the number of interprofessional teams, it is important to incorporate interprofessional collaboration in training across the training continuum. For psychologists it is very important to understand the role they can serve on the team. All too often psychology is not at the table when it comes to integrated teams. Therefore, psychologists must advocate for team participation as the development of policy that will support the implementation of integrated care teams across settings for sustained comprehensive geriatric care.

## Cross-References

- ▶ [Advocacy with Older Adults](#)
- ▶ [Clinical Issues in Working with Older Adults](#)
- ▶ [Palliative Care](#)
- ▶ [Training Psychologists in Aging](#)

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## Interventions for Late-Life Cognitive Health

Caitlin S. Moore<sup>1</sup> and J. Kaci Fairchild<sup>2</sup>

<sup>1</sup>Ryan Dolby Brain Health Center, California Pacific Medical Center Neurosciences Institute, San Francisco, CA, USA

<sup>2</sup>Sierra Pacific Mental Illness Research Education and Clinical Center, VA Palo Alto Health Care System, Stanford University School of Medicine, Palo Alto, CA, USA

### Synonyms

Brain training; Cognitive stimulation; Non-pharmacological interventions

### Definition

Interventions or techniques designed to prevent cognitive impairment, slow cognitive decline, or enhance cognitive function.

### Introduction

In 2015, the number of people living with dementia worldwide was estimated at 47.47 million, and this number is projected to triple by 2050. The total estimated worldwide costs of dementia were \$604 billion in 2010, which is equivalent to 1% of the world's gross domestic product. Moreover, dementia is a significant contributor to the disability and dependency experienced in late-life. Currently, there are no effective pharmacological interventions that slow or stop this progressive

cognitive decline. In recognition of the global prevalence of dementia and its costly economic impact, the World Health Organization and Alzheimer's Disease International declared dementia an international public health crisis and urged the global community to mobilize their resources for immediate action (World Health Organization 2012). In conjunction with the continual efforts to develop effective pharmacological treatments, efforts to identify modifiable risk factors for dementia and effective nonpharmacological interventions have steadily grown. These promising areas of research may serve as important components in risk-reduction strategies that can minimize the number of affected individuals worldwide.

Dementia is a nonspecific umbrella term that describes the clinical syndrome of cognitive and functional impairment, yet the term "dementia" does not assume a particular etiology. The two most common causes of dementia are Alzheimer's disease (AD) (accounting for 60–80%) and cerebrovascular disease (10–20%), though on autopsy most patients with AD also have concomitant cerebrovascular disease. Given that AD and cerebrovascular disease account for a preponderance of cases of mild cognitive impairment (MCI) and dementia, the bulk of research on nonpharmacological interventions has focused on these etiologies. Thusly, information presented henceforward will focus on MCI and dementia presumed due to AD and/or the cerebrovascular disease.

### Modifiable Risk Factors

In the absence of treatments that cure or slow the progressive decline, the World Dementia Council (WDC) has emphasized prevention as a key element to counteract the international dementia public health crisis (Baumgart et al. 2015). Much of the prevention efforts have focused on the identification of modifiable risk factors as they represent opportunities for intervention to reduce late-life cognitive impairment. It has been suggested that delaying symptom onset by 1 year may lower AD prevalence by more than

nine million cases over the next 40 years (Barnes and Yaffe 2011).

*Hypertension.* The relationship between hypertension and cognitive function appears to change with age. At midlife, but not late-life, hypertension is associated with an increased risk of AD and dementia, with a weighted Odds Ratio (OR) of 1.61 (95% CI: 1.16, 2.24). The authors calculated the population attributable risk (PAR) of hypertension (in addition to other dementia risk factors described below); PAR refers to the proportion of cases of a disease in a population that can be attributed to a given risk factor, assuming that there is a causal relationship. This estimate takes into account the strength of the association between the risk factor and the outcome, in addition to the prevalence of the risk factor. Based on this equation, approximately 5% (1.7 million) of AD cases worldwide are potentially attributable to midlife hypertension. If the prevalence of midlife hypertension was reduced by 10%, there could be more than 160,000 fewer AD cases; a 25% reduction in midlife hypertension would be associated with more than 400,000 fewer AD cases worldwide (Barnes and Yaffe 2011).

*Hyperlipidemia.* The relationship between cholesterol levels and cognition appears to be complex and nonlinear. Cholesterol levels appear to decline before the onset of dementia with a greater decline in cholesterol from mid- to late-life is associated with more severe cognitive impairment in late-life (Rusanen et al. 2011).

*Smoking.* It is well recognized that smoking augments oxidative stress and inflammation, which are believed to be important pathophysiologic mechanisms in AD. Although the conferred risk of smoking has differed in the literature, the most comprehensive meta-analysis reported a relative risk (RR) of 1.59 for AD, or put another way, smoking increased the average risk of developing dementia by around 50% (Barnes and Yaffe 2011). Yet it is not clear if a linear dose-relationship exists between smoking and cognitive impairment. Persons smoking more than two packs per day were almost twice as likely to develop AD (HR, 2.57; 95% CI, 1.63–4.03) yet there was no statistically significant increased risk in those smoking under two packs per day.

When compared to nonsmokers, those smoking more than two packs per day in midlife were almost three times (HR, 2.72; 95% CI, 1.20–6.18) more likely to develop vascular dementia in late-life. It is estimated that nearly 14% (4.7 million) of AD cases worldwide and 11% (575,000) in the USA are attributable to smoking (Hughes and Ganguli 2009). A 10% reduction in smoking prevalence could potentially reduce the number of AD cases by 400,000 cases globally and 50,000 in the USA (Barnes and Yaffe 2011).

*Obesity.* Similar to hypertension, the association between weight and AD appears to change with age. In a 36-year follow-up study of 136 adults aged 40–45 years, compared with normal weight, those who were overweight had a twofold increased risk of AD and vascular dementia, while obesity was associated with three times and five times higher risk of AD and vascular dementia, respectively (Whitmer et al. 2007), yet obesity in late-life has been shown to possibly be protective against dementia (Fitzpatrick et al. 2009). Furthermore, midlife obesity and dementia risk have a RR estimate of 1.60 (95% CI: 1.34, 1.92), or put another way, midlife obesity conferred a 60% excess risk of developing dementia. Approximately 2% of (677,000) AD cases worldwide are potentially attributable to midlife obesity. In the USA, the PAR is higher – 7.3% (386,000 cases) – due to the higher prevalence of midlife obesity. A 10% reduction in midlife obesity prevalence could potentially prevent more than 66,000 AD cases worldwide and 36,000 cases in the USA (Barnes and Yaffe 2011).

*Diabetes Mellitus.* Diabetes mellitus is frequently associated with changes in cognition. A number of studies have implicated a relationship between insulin resistance and the pathogenesis of plaque formation and impaired neuronal signaling in AD. A recent meta-analysis showed that diabetic patients had a 73% increased risk of all type dementia, 56% increase of AD and 127% increase of VaD (Gudala et al. 2013). Approximately 2% (825,000) of AD cases worldwide are currently attributable to diabetes, including 3% (nearly 175,000) in the USA. A 10% reduction in diabetes prevalence could prevent more than 80,000 AD cases worldwide and nearly 17,000

cases in the USA could; a 25% reduction in diabetes prevalence could potentially prevent more than 200,000 cases worldwide and 40,000 cases in the USA (Barnes and Yaffe 2011).

*Alcohol.* Numerous studies have reported the beneficial effect of moderate alcohol consumption on cognitive function. The relationship between alcohol consumption and dementia and MCI risk appears to be U-shaped, with the greatest benefit garnered by those who drink in moderation. Consistent with this, abstainers and heavy drinkers appeared to be at higher risk of dementia, a recent systematic review reported moderate alcohol consumption significantly reduced overall risk of incident dementia by 38% and AD by 32%, but did not find a significant association with vascular dementia (Peters et al. 2008).

*Sedentary Lifestyle.* There is mounting support for the association between physical activity and dementia. In reviewing the extant physical activity literature, a systematic reviewed reported a RR of 1.39 (95% CI: 1.16, 1.67) for all-cause dementia and 1.82 (95% CI: 1.19, 2.78) for AD. Thus physical inactivity is associated with an almost 40% excess risk for all-cause dementia and an 80% excess risk for AD.

It has been estimated that approximately 13% (nearly 4.3 million) of AD cases worldwide may be attributable to physical inactivity, including 21% of the AD cases (>1.1 million) in the USA. A 10% reduction in the prevalence of physical inactivity could potentially prevent more than 380,000 AD cases globally and nearly 90,000 cases in the USA (Barnes and Yaffe 2011).

*Diet.* Observational studies on the relationship between diet and cognition have found that certain dietary practices and nutrient intake are predictive of cognitive decline and dementia. However, essentially all RCTs that have focused on specific nutrient components, including dietary fatty acids, fish oil, vitamins E and C, B6, B12, and folate, have generally produced negative or mixed results (Smith and Blumenthal 2010). Thus recent studies have moved from an individual nutrient approach to a whole diet approach. The Mediterranean diet, which is the most widely researched whole-diet approach, consists of a high consumption of vegetables, moderate consumption of fish

and wine, low consumption of dairy products and meat, and almost exclusive use of olive oil as the primary fat source. A recent review of the existing literature reported growing evidence of the beneficial cognitive effects of the Mediterranean diet (van de Rest et al. 2015).

To date, there has been one clinical trial that had baseline and follow-up neuropsychological testing. This study utilized a subcohort from the Prevencion con Dieta Mediterranea (PREDIMED) trial (Valls-Pedret et al. 2015). In this study, participants were randomized into one of three intervention groups: a Mediterranean diet supplemented with extra virgin olive oil, a Mediterranean diet supplemented with mixed nuts, or a control diet (advised to reduce all dietary fat) with a median follow-up up to 4.1 years. Results revealed that participants allocated to the Mediterranean diet plus nuts had improvement in memory compared to those in the control group. Similarly, participants in the Mediterranean diet plus olive oil had improved executive function and global cognition relative to the control group. However, there were no group differences in incidence of MCI or dementia.

The Dietary Approach to Stop Hypertension (DASH diet) is another diet that has been supported by emerging research in the cardiovascular disease literature. The DASH diet has been shown to protect against hypertension, obesity, cardiovascular disease, and diabetes – all of which are known to impact cognitive function. Like the Mediterranean diet, the DASH diet emphasizes plant-based foods, whole grains, low-fat dairy, and moderate amounts of lean meat and fish. The DASH diet differs from the Mediterranean diet as it includes more lean meat (the Mediterranean diet encourages less meat and more fish intake) and has more variety of fat source (the Mediterranean diet almost exclusively relies on olive oil as the primary fat). The DASH diet also specifies low consumption of saturated fat and sweets and higher consumption of dairy than the Mediterranean diet. The two diets also differ in respect to recommended amounts of alcohol consumption as the DASH diet allows for one to two drinks per day for women and men, respectively, whereas the Mediterranean

diet incorporates moderate consumption of wine. While there is less research on the DASH diet and cognition, observational studies do suggest that adherence to the DASH diet may be associated with slower rates of cognitive decline (Tangney et al. 2014).

**Social Engagement.** A systematic review of 29 longitudinal cohort studies reported that low social participation, less frequent social contact, and more loneliness were significantly associated with incident dementia. Low social participation [RR: 1.41 (95% CI: 1.13–1.75)], less frequent social contact [RR: 1.57 (95% CI: 1.32–1.85)], and more loneliness [RR: 1.58 (95% CI: 1.19–2.09)] were each independently significantly associated with incident dementia (Kuiper et al. 2015).

**Depression.** Late-life depression is associated with poorer general health and, in particular, has a strong association with greater burden of cardiovascular and cerebrovascular disease. Furthermore, depression is consistently an independent risk factor for AD, vascular dementia, and all-cause dementia. There continues to be debate as to whether late-life depression is a risk factor for or prodrome of dementia. The relationships between depressive symptoms and cerebrovascular disease appear to be bidirectional, giving rise to the term “vascular depression” (Butters et al. 2008). It may be that depression and dementia share common etiological factors as inflammation, vascular changes, and vascular risk factors have each been implicated in both disorders. A meta-analysis of 13 studies found that a history of depression was associated with an approximate twofold increase in risk of dementia, with pooled relative risk estimates of 2.01 (95% CI: 1.16, 3.50) for 7 case-control studies and 1.87 (95% CI: 1.09, 3.20) for 6 prospective studies (Barnes and Yaffe 2011). More than 10% (nearly 3.6 million) AD cases worldwide and almost 15% (>780,000) in the USA may be attributable to depression. A 10% reduction in depression prevalence could potentially result in more than 325,000 fewer AD cases worldwide and 67,000 fewer cases in the USA.

**Cognitive Reserve.** “Cognitive reserve” refers generally to the capacity of the brain to recruit

alternative neurological pathways to process tasks in a more efficient manner. As a result, brains with greater cognitive reserve can tolerate more damage or disease than brains with less cognitive reserve. The idea of reserve against brain damage emerged from the observation that there does not appear to be a clear relationship between the degree of brain neuropathology and extent of clinical symptomatology. Furthermore, it has been suggested that education or occupational attainment may protect one against the development of AD. In a meta-analysis that included 21,456 individuals, the risk of dementia was significantly lower for those with higher education (OR, 0.53; 95% CI: 0.45, 0.62), occupational attainment (OR, 0.56; 95% CI: 0.49, 0.65), intelligence/IQ (OR, 0.58; 95% CI: 0.44, 0.77), and mentally stimulating leisure activities (OR, 0.50; 95% CI: 0.42, 0.61) (Valenzuela 2008). When all of these cognitive reserve markers were combined, the pooled OR was 0.54 (95% CI: 0.49, 0.59). This can also be expressed as its inverse: the odds of dementia were significantly increased in those with low cognitive reserve (OR, 1.85; 95% CI: 1.69, 2.04). Worldwide, approximately 19% (6.5 million) of AD cases are potentially attributable to low education, including 7% (>385,000) cases in the USA. A 10% reduction in the prevalence of low educational attainment could potentially lower AD prevalence by more than 500,000 cases globally and 36,000 cases in the USA (Barnes and Yaffe 2011).

## Summation of Risk Factors

While aforementioned risk factors is not exhaustive, it has been suggested that the seven potentially modifiable risk factors addressed in their study (e.g., hypertension, diabetes, smoking, physical inactivity, cognitive reserve, obesity, and depression) contribute to up to half of AD cases globally (17.2 million) and in the USA (2.9 million). If the prevalence of all seven risk factors were reduced by 10%, there would be as many as 1.1 million fewer AD cases globally and 184,000 fewer cases in the USA; if the prevalence of these risk factors were reduced by 25%, AD prevalence

could potentially be reduced by up to 3.0 million cases globally and 492,000 in the USA (Barnes and Yaffe 2011).

## Interventions

Much of the research on nonpharmacological interventions for late-life cognitive impairment addresses, in part, the previously identified risk factors. The remainder of the chapter will now discuss two of the most widely studied nonpharmacological interventions for late-life cognitive impairment: cognitive training and physical exercise.

*Cognitive Training.* Cognitive training interventions can be grossly categorized as either remediation or compensation approaches. *Cognitive remediation interventions* seek to improve cognitive function through focused training and practice, whereas the *compensation interventions* promote independence and support daily functioning through modification of the environment via external aids (Rodakowski et al. 2015). Remediation interventions are more effective at improving selected cognitive abilities than compensation interventions. This is not surprising as the goal of compensation interventions is to teach individuals to adapt to changes in their cognitive function, rather than address specific cognitive abilities.

The Advanced Cognitive Training for Independent and Vital Elderly (ACTIVE) trial is the largest and most widely cited study of cognitive training in older adults. ACTIVE enrolled 2,802 nondemented, community-dwelling adults aged 65 years and older and randomly assigned them to one of four groups: memory training, reasoning training, speed-of-processing training, or no-contact control. Training was conducted in small groups in ten 60- to 75-min sessions over 5–6 weeks. Memory training focused on improving verbal episodic memory through by practicing learned memory strategies. Reasoning training focused on improving ability to solve problems that contain a serial pattern. Speed-of-processing training focused on visual scanning and information processing, where the speed and complexity

of stimuli grew increasingly more difficult. Each training intervention produced large and significant improvements in the trained cognitive ability that appeared to persist to at least 5 years for memory training and to 10 years for reasoning and speed-of-processing training.

Efforts to extend these cognitive benefits to those with mild to moderate cognitive impairment have generally been less successful than the ACTIVE trial or similar interventions with nondemented community-dwelling older adults. In a recent review of the literature of cognitive training interventions in MCI and early dementia, 12 of the 20 studies reported significant differences in cognition posttraining between control and treatment group (favoring the treatment group), but the between-group differences were generally modest (Rodakowski et al. 2015). Cognitive training focusing on memory included the teaching of compensatory and restorative strategies including errorless learning, spaced retrieval, visual imagery, associative learning, cueing, categorization, hierarchical organization, and method of loci. Across the 12 studies, intervention effects on cognitive function were generally detected in indices of working memory and delayed memory. Studies that combined cognitive training with some form of holistic or psychotherapeutic approach (i.e., social engagement, stress management) all demonstrated small improvements in cognitive function (compared to active and nonactive controls), suggesting that multimodal approaches should be further pursued in future research.

In addition to the in-person skills-based cognitive training programs discussed above, computerized cognitive training programs have emerged to combat MCI and dementia – but not without controversy. Computerized training has become a \$2 billion industry, and the concern has emerged that society's desire for an accessible and convenient intervention for dementia may supersede the scientific community's ability to adhere to the rigorous scientific process that clinical trials require. Given this ethical issue, computerized cognitive training has become an ongoing area of controversy, as many have questioned the quality (and often motives) of extant research.

There are numerous issues that face the computerized training field. First, critics have questioned whether computerized training improves cognition in a manner that extends beyond the task being trained. Put another way, critics ask do the training benefits generalize to daily functioning? Second, the utility of possible computerized training transfer effects is often questioned. Critics suggest that the reported benefits represent only statistically significant effects with little to no clinically significant benefits seen in cognitive or daily functioning.

Third, it is not clear from the computerized training literature as to what is considered the proper type of cognitive training, how often one must engage in training, and how long the benefits last (i.e., is this a time-limited intervention or a lifestyle change). Finally, it is not clear that the beneficial effects of computerized training are large enough to warrant engagement in this activity over activities that have more empirical support to improve overall health (e.g., exercise) or life satisfaction (e.g., socializing with friends, playing with grandchildren).

Citing these aforementioned issues, the Stanford Center for Longevity released a consensus paper on computerized cognitive training, stating: “To date, there is little evidence that playing brain games improves underlying broad cognitive abilities, or that it enables one to better navigate a complex realm of everyday life.” The authors do not argue that computerized cognitive training cannot, in theory, improve cognitive function, but rather that the empirical support at this time is inconclusive at best. They did, however, highlight several studies that showed promising results and were deemed to have sufficient scientific integrity. One such study found that older adults (60–85 years old) who engaged in a multitasking training videogame, NeuroRacer, reduced multitasking costs compared to both an active control group and a no-contact control group, and performed better than untrained 20-year-old participants, with gains still evident at a 6 month follow-up (Anguera et al. 2013). Further, these changes were corroborated by electroencephalography, with trained participants evidencing enhanced midline

frontal theta power and frontal–posterior theta coherence.

However, as there are two sides to every story, another group of scientists has released opposing position paper (cognitivetrainingdata.org) that highlights the broad and growing literature that suggests clinically significant beneficial effects can be achieved by computerized cognitive training. A recent meta-analysis of 52 RCTs compared the cognitive effects of computerized cognitive training in 4,850 healthy older adults and found that the effect of computerized intervention on overall cognitive outcome was statistically significant (effect size  $g = 0.22$ ,  $P < 0.01$ ) (Lampit et al. 2014). The beneficial effect of group-based computerized cognitive training was somewhat larger (32 trials, effect size  $g = 0.29$ ,  $P < 0.01$ ), which equated to an average improvement of approximately one point on the Mini-Mental State Examination (MMSE). Small to moderate effect sizes were also found for memory, speed, and visuospatial cognitive domains but not for executive functions. One of the most notable results was that “do-it-yourself” computerized training completed at home did not produce improvements. Rather, the modest improvements seen were in individuals supervised by a trainer in a center and undergoing sessions one to three times a week.

Overall, it appears that cognitive training can improve cognition, but the effect sizes are generally quite modest. With the largest meta-analyses on computerized cognitive training programs reporting an average improvement of only one point on the MMSE after training, the debate on the utility of computerized cognitive training interventions appears to be far from resolved. The literature on cognitive training is heterogeneous which complicates overall interpretations of the literature. Intervention studies differ with regard to modality (individual, group, computerized), goal (compensation versus remediation), population (healthy aging, MCI, dementia), treatment focus (single-domain versus global cognition), and the efficacy of the training program employed. Given this myriad of factors, it is difficult to draw unequivocal conclusions about the field as a whole.

*Exercise.* It is well established that engaging in exercise is associated with general health, including outcomes like improved muscle strength, arterial compliance, cardiovascular fitness, and overall functional capacity. It has also been observed that physically fit individuals have a reduced risk of developing MCI or dementia as compared to their sedentary counterparts in both cross-sectional and longitudinal studies. In longitudinal studies, older adults that participate in physical activity show less cognitive decline over 2- to 10-year follow-up periods (Bherer et al. 2013).

Despite this repeated observation in cross-sectional and longitudinal studies, RCTs on aerobic exercise have produced conflicting results. A recent Cochrane Review that included 12 trials and 754 participants reported that there was inconsistent evidence that aerobic exercise or increased fitness improved cognitive function in cognitively normal older participants (Young et al. 2015). This builds off of a previous review (Smith et al. 2010), which reported a modest effect of physical fitness on cognition, including improvements in attention, processing speed, executive function, and memory, in cognitively normal older adults. These findings were tempered with the concern that there is generally a high degree of variability of treatment effects across studies. The higher quality studies tended to show smaller effects and studies with the highest quality rating tended to show no effect of exercise on cognition at all. Intriguingly, larger gains in aerobic fitness were associated with lesser cognitive improvement. Thus, even in studies in which positive results are found, the relationship between physical fitness and cognitive function appears complex. This variability across studies raises the question of what variables may moderate the beneficial effects of physical exercise. For example, gender, age, APOE status, and baseline level of fitness have all been raised as possible subgroups that need to be considered when analyzing these results.

One possible moderator in the relationship between physical fitness and cognitive function is the degree of cognitive impairment. In a recent review of 22 RCTs examining the efficacy of

physical exercise on cognition in individuals with MCI or dementia, there was generally a positive effect found in participants with MCI. These effects were seen in global cognition, executive function, processing speed, and attention. However, the effect of exercise on cognition was not as clear in subjects with dementia and was confounded by poor quality studies and methodological issues. Thus, it may be that exercise is most beneficial for individuals with MCI (versus cognitively normal or demented).

While most studies have focused on aerobic exercise programs, there is emerging evidence that other types of exercise programs (e.g., resistance training, balance training, Tai-Chi) may also benefit cognition. Tai-Chi is a multimodal mind-body exercise that integrates physical, cognitive, social, and meditative components. A meta-analysis of 20 studies with a total of 2,553 participants on the impact of Tai-Chi on executive function revealed a large effect when Tai-Chi was compared to nonintervention controls and moderate effect when compared to exercise controls (Wayne et al. 2014). Thus, Tai-Chi represents a promising avenue for exercise research that extends beyond aerobic fitness.

The mechanisms through which exercise impacts on cognition and brain health remain elusive. Animal studies have shown that exercise increases cell proliferation and stimulates neurogenesis in the dentate gyrus of the hippocampus, an important brain area for learning and memory. Exercise regulates a number of growth factors, such as brain-derived neurotrophic factor (BDNF), which plays a crucial role in synaptic plasticity; insulin-like growth factor 1 (IGF-1), which promotes neuronal growth; and vascular endothelial growth factor (VEGF), which stimulates angiogenesis and vasculogenesis and promotes brain ischemic tolerance. Lastly, exercise reduces inflammation and oxidative stress, which are known to negatively impact the brain. As many of the proposed mechanisms are based on animal studies, there is a great need for replication in human subjects.

In summary, despite the repeated observations of a relationship between aerobic exercise and cognition in cross-sectional and longitudinal

studies, the empirical evidence of this relationship in intervention trials is inconclusive. Higher quality RCTs tend to show smaller effect sizes than lower quality RCTs. Further research on moderators of this relationship may help to clarify the mixed findings. There is emerging evidence of Tai-Chi as an effective intervention; however, this literature is still in its nascence compared to that of aerobic exercise. Given the benefit of physical exercise on overall health, providing exercise as a recommendation for patients still appears justified, although its impact on cognition is unclear.

### **A Multivariate Approach to Risk Reduction**

As dementia is not caused by a singular pathway or mechanism, it is increasingly plausible that the prevention and treatment of dementia will also not be a simplistic and single-faceted intervention. Dementia risk factors are diverse and additive, thus an intervention that addresses multiple mechanisms may have a greater effect than interventions that only address one mechanism in isolation. Regardless of the type of single-factor interventions studied thus far (e.g., pharmacological vs. exercise vs. cognitive training), the beneficial effects are generally quite modest (if observed at all). It may be that addressing multiple risk factors simultaneously (e.g., exercise plus cognitive training plus pharmacological intervention) will have additive beneficial effects and thus may result in greater cognitive improvement. This multivariate approach is similar to the multifaceted intervention approach observed in numerous diseases (diabetes, cancer, heart disease) in which diet and lifestyle interventions are heavily emphasized in conjunction with medical intervention. A comprehensive approach in neurodegenerative disease is necessary and reflects the myriad of moderators and mediators in the clinical syndrome of dementia. Given that most of the identified modifiable risk factors are inter-related and connected to the general notion of a healthy lifestyle, focusing on one single lifestyle or health factor may be insufficient to reduce an

individual's risk of developing cognitive decline and/or dementia.

The most widely cited multivariate intervention to date is the Finnish Geriatric Intervention Study to Prevent Cognitive Impairment and Disability (FINGER) study (Ngandu et al. 2015). The FINGER study is the first published randomized controlled trial on multivariate risk factors and cognitive decline. The main hypothesis was that simultaneous changes in several risk factors (even of smaller magnitude) would lead to a protective effect on cognition. The authors found significant intervention effects on the primary outcome (overall cognition), main cognitive secondary outcomes (executive functioning and processing speed), and other secondary outcomes (BMI, dietary habits, and physical activity). Improvement in the primary and main secondary cognitive outcomes was 25–150% better in the intervention group than in the control group. However, there was no main effect on memory. The FINGER trial provides a reliable reference frame by including at-risk elderly people from the general population in a large, long-term study (2 years).

Another multi-pronged intervention trial was The Study of Mental and Resistance Training (SMART) (Fiatarone Singh et al. 2014). The SMART study was a randomized, double-blind, double-sham controlled trial of adults with MCI. Participants were randomized to two supervised physical interventions – active or sham physical training – and two cognitive training interventions – active or sham cognitive training. The intervention phase occurred 2–3 days per week for 6 months with an 18-month follow-up. Primary outcomes were global cognitive function (Alzheimer's Disease Assessment Scale-cognitive subscale; ADAS-Cog) and functional independence (Bayer Activities of Daily Living). Secondary outcomes included executive function, memory, and speed/attention tests, and cognitive domain scores. One hundred adults with MCI were enrolled and analyzed. Physical activity (in this case, resistance training) significantly improved global cognition at 6 months and executive function across 18 months. Cognitive training only attenuated decline in the memory

at 6 months. It was concluded that the physical exercise intervention (resistance training) was effective at improving cognition over 18 months and was also more effective than cognitive training alone.

## Future Directions

Thus far we have identified a number of risk factors that increase one's likelihood of developing MCI and dementia. However, there is still significant uncertainty with respect to the relationship between individual risk factors and dementia (for example, what mechanisms explain these relationships, and to what extent does a causal relationship exist). Many of the dementia risk factors discussed are also risk factors for other health outcomes (e.g., cardiovascular disease, cancer, all-cause mortality). There is a clear need for more research on risk reduction and brain health – both more longitudinal, population-based cohort studies and randomized controlled trials on the effectiveness of specific interventions that address modifiable risk factors.

The two primary foci of intervention in MCI and dementia are cognitive training programs and exercise (primarily aerobic) programs. Cognitive training programs have generally shown to be beneficial, though the cognitive improvements are generally quite modest with several moderating factors that impact treatment benefit. Future research needs to clarify what type of cognitive training is most beneficial (computerized versus in-person, domain-specific versus broad, etc.), optimal frequency and duration, what biological mechanisms are implicated, and who benefits most from this type of intervention.

Despite the legion of cross-sectional and observational studies noting a significant relationship between fitness level and risk for MCI and dementia, the intervention literature is mixed at best. The lack of clear causal relationship is somewhat surprising and requires further research. Specifically, future research should outline what types of exercise is most beneficial, in addition to the frequency, intensity, and duration recommended. Further, extant research suggests that certain

modifying variables may exist (e.g., gender, level of cognitive impairment), and other moderators should be identified and characterized. Lastly, the aerobic exercise literature often relies exclusively on peak  $VO_2$  to definite cardiorespiratory fitness. Peak  $VO_2$  has methodological considerations that may be contributing to the mixed literature. Specifically, peak  $VO_2$  is affected by several demographic factors (e.g., age, gender) and physiological variables (e.g., muscle mass, cardiac symptoms). Given these issues, analyses focusing exclusively on peak  $VO_2$  should address these possibly moderating variables. Additionally, studies on cardiorespiratory fitness should broaden their definition of fitness and pursue additional variables that might capture more or different aspects of fitness level.

Some of the most promising lines of research are multimodal in nature. This type of research is important because it addresses the complexity of pathways leading to the clinical syndrome of dementia. It seems plausible that no single pathway to dementia exists, and thus no single method of intervention will be effective in preventing or delaying this syndrome. Research studies that incorporate multiple aspects of lifestyle and health may have a better opportunity to result in clinically significant improvement in symptoms. There is sufficiently burgeoning evidence to conclude that life-long physical activity, maintaining a healthy diet, and prevention and management of cardiovascular risk factors (diabetes, obesity, smoking, and hypertension) is likely to reduce the risk of cognitive decline and dementia. Interestingly, with the exception of depression, many of the risk factors of dementia are more strongly associated when present at midlife rather than late-life (e.g., midlife hypertension is more strongly associated with dementia risk than late-life hypertension). Thus public health studies should focus their intervention on these risk factors in middle age to prevent or delay the development of cognitive impairment later in life.

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## Iowa Centenarian Study

Peter Martin, Jennifer Margrett and  
Peggy Lockhart  
Iowa State University, Ames, IA, USA

### Synonyms

Life span, Centenarians

### Exceptional Longevity: The Iowa Centenarian Study

As life expectancy has increased, so has interest in understanding determinants of longevity and importantly, active life expectancy and maintenance of high quality of life in advanced age. The last census reported more than 53,000 centenarians in the USA, reflecting a 6% increase over the previous 10 years (Meyer 2012). The two largest centenarian studies in the USA have been conducted in the Northeast and the Southeast areas of the country in more densely populated areas (Perls and Terry 2003; Poon et al. 2007). The Iowa Centenarian Study is unique, in that it involves rural Midwestern centenarians. It is unclear to what extent longevity is related to geographic regions, and this study fills the gap of including participants from a generally rural area. Additionally, the Iowa Centenarian Study focuses on understanding the behavioral determinants and resources of exceptional longevity, especially in rural environments. With a focus on behavioral longevity components, the Iowa Centenarian Study addresses important issues in geropsychology, namely aspects of subjective

well-being and maintaining maximum potential in very late life.

A central premise in the Iowa Centenarian Study is the assumption that psychosocial resources in part determine physical and mental health in later life (Martin et al. 1996; Randall et al. 2010). Without adequate individual resources, such as a robust personality and socio-economic resources, it is much less likely for individuals to reach the century mark. Furthermore, psychosocial resources are important for continued well-being in very late life (Martin, 2002).

### Study Design and Measures

The Iowa Centenarian Study emphasizes the importance of optimal functioning and adaptation as defined by three important areas: cognition, mental health, and activity. Less desirable outcomes include dementia, depression, and fatigue (Martin et al. 2000; Martin et al. 2006; Miller et al. 2010). The conceptual framework for the Iowa Centenarian Study centers on the ability of psychosocial resources to predict adaptation across these three essential functional domains (Martin et al. 2012b; Margrett et al. 2010).

The recruitment of 152 centenarians from Iowa established the baseline assessment for this study (Martin et al. 2012b). Participants were chosen from a list of centenarians maintained by the State of Iowa. Participants from care facilities are overrepresented in the study due to the fact that a survey of all care facilities in the state is conducted every year, whereas including residents in the community is dependent on information provided by centenarians themselves, their families, or community organizations. Participants had to be able to verbally answer questions and provide informed consent. No proxy reports were included. As in other centenarian studies, the vast majority of participants in the Iowa Centenarian Study is female (86.3%) and White (99.3%). The average age was 101.6 years (range = 100–112 years). Eighty-two percent of the centenarians lived in long-term care facilities. Twenty-three percent had some high school

education, 28.7% completed high school, and 48% reported educational experience beyond high school.

A smaller group of 28 centenarians participated in the longitudinal follow-up of the Iowa Centenarian Study. The follow-up assessments combined general baseline data with longitudinal data collected four times within a six-month period. There was only one significant difference between the baseline and the follow-up sample: participants who were included in both studies were more likely to live independently.

Baseline measures were selected using domain recommendations made by a National Institute on Aging panel for studies of exceptional survival in humans (National Institute on Aging 2009), including past history, demographic variables, cognitive status evaluation, and life events. Functional capacity was assessed with self-reports of activities of daily living (ADL). Physical health, nutrition, fatigue, personality and coping, social support, psychological well-being, and physical exercise were also part of baseline measures. Mental status, physical activity, fatigue, and subjective well-being were again assessed in the short-term longitudinal study (Margrett et al. 2012). Few other centenarian studies have directly assessed the “cognitive representation” of life at 100 years of age (Lehr et al. 2000). Thus, centenarians were asked to evaluate their situation as a person who has lived 100 years. Sample questions include, “What is it like to be 100 years?” or “Did you ever think you would live to be 100 years?”

## Baseline Findings

Overall, Iowa centenarians had a positive view of themselves and thought it was positive to be a centenarian. In general, centenarians looked at being 100 years of age as meaningful, challenging, and exciting. Over half believed they had no influence on becoming a centenarian and very few thought they would ever reach that goal.

Over 70% of the centenarians in the Iowa study rated their health as excellent or good

with half reporting that they were able to get out and about. Over 80% reported no trouble eating on their own and did not report nutritional problems. Although the self-rated health of centenarians appeared to be quite good, functional capacity was more limited in the areas of mobility, cooking, housework, and managing money. For example, less than 10% of this oldest age group was able to go places independently. The next section highlights some of the findings in the three adaptation areas essential to quality of life in very old age: cognitive functioning, mental health, and activity.

## Cognitive Status and Change Among Iowa Centenarians

Many older adults frequently worry about maintaining cognitive ability as they get older and consider it an important component of successful aging (Rowe and Kahn 1996). The risk of cognitive impairment or impaired mental status increases with age; however, the rate or the inevitability in very late life is still debated (Alzheimer’s Association and 2009; Crum et al. 1993). Relatively little has been determined about the cognitive status of the very old and we lack a clear understanding of the cognitive capabilities of centenarians.

Maintenance of cognitive functioning is important to quality of life, and cognitive deficits significantly impact later life functioning. Not only is the emotional and financial cost of caring for those with cognitive impairment significant, it also increases the probability that an individual will require long-term care in a skilled nursing facility (Gaugler et al. 2007). Short cognitive screening tools are typically used to assess mental and cognitive functioning across a variety of settings. However, studies reporting multiple assessments of mental status or cognitive functioning among centenarians over time are rare. Of the 152 Iowa centenarians assessed at baseline, a subset of 28 participated in four follow-up sessions occurring over a 6-month period. The goal of this aspect of the study was to determine the cognitive status of the centenarians at baseline and

to evaluate the degree of individual change in cognitive status at follow-up intervals.

Using the Short Portable Mental Status Questionnaire (Pfeiffer 1975), the Iowa Centenarian Study assessed mental status at baseline for all participants as well as change across baseline and four follow-up occasions for the longitudinal subsample. For the entire sample at baseline, diversity in mental status performance was observed: about 40% of participants scored in the “normal” range, 20% exhibited a score suggestive of mild cognitive impairment, and 40% evinced scores indicative of moderate to severe impairment. Next, the study investigated the degree of individual change in mental status using multiple approaches (i.e., categorical designation based on score, comparison to individual standard error of measurement). Findings indicated significant diversity in the degree and nature of intra-individual change. Decline was only one of the observed patterns of change; a significant number of centenarians maintained mental status across occasions while others exhibited improvement. Findings from this portion of the Iowa Centenarian Study illustrate the need to consider the range of cognitive functioning among very old individuals as well as the potential for change and the most useful assessments for gauging change. Future work is needed to examine correlates of change (e.g., depressive symptoms, fatigue) across a wider variety of cognitive indicators.

### **Mental Health Among Centenarians**

A more complete understanding of centenarians from the geropsychology perspective requires a focus on mental health issues. Compared to information pertaining to physical and functional health among the very old, very little knowledge exists about the mental health and mental health changes in very late life. Are centenarians content and happy or are they discontented and unhappy as they move into their second century of life? Does subjective well-being in very late life depend on individual and socioeconomic resources? An important goal of the Iowa Centenarian Study was to shed light on the mental

health status of centenarians and to better understand it in order to gain important information about the quality of life for people surviving to one hundred and beyond.

There have been several previous studies demonstrating largely positive mental health among centenarians (Gondo and Hirose 2006). However, centenarians realize they only have a short time to live and although their well-being was relatively stable over their lifetime it may decline rapidly with impending death (Martin et al. 2000). Some may feel currently deprived of positive experiences and report feelings of uselessness and a diminishing sense of positive affect.

The Iowa Centenarian Study also investigated the level and change in mental health as measured by positive and negative affect (Martin et al. 2012a). These dimensions were repeatedly measured among a subset of Iowa centenarians over six months, and results suggested that there was a slight decrease in positive affect scores over time. In addition to assessing levels of positive and negative affect, individual trajectories also play an important role. Mean growth curves confirmed a relative decline in positive affect but no noticeable increase in negative affect. Centenarians who thought of their financial resources as being better when compared to others were able to draw on resources which allowed them to continue with activities that are meaningful and purposeful.

Even though mean levels of negative affect did not appear to change over time, there were individual differences. Relatively good perceived health and higher levels of physical activity were associated with an increase in negative affect over time. This result is somewhat puzzling but may reflect frustration by this group of centenarians. Specifically, centenarians who feel that they are more capable of participating in meaningful and purposeful activities may feel frustration due to limited opportunities to actually engage in such activities.

The findings of the Iowa Centenarian Study suggest that changes in affect levels occur even in very old age. Centenarians do not celebrate their longevity milestone of reaching 100 years of age and then wait for death; they continue to be interested in activities that promote better positive

affect and overall well-being. Therefore, it is important to provide positive experiences for old and very old adults. Those who continue to be relatively active will benefit from additional stimulating experiences. Future research should not only view centenarians with regard to physical health; it is also necessary to consider the important component of their emotional and mental well-being.

### Activities of Daily Living and Physical Strength

Another important aspect of the Iowa Centenarian Study focuses on physical activity and strength. Handgrip strength has been recognized as a predictor of mortality among older adults (Franke et al. 2012; Gale et al. 2007). Hand grip strength and disability are associated with cognitive decline for nonagenarians and centenarians in a cross-sectional study (Jeune et al. 2006).

Of the baseline sample, 11 Iowa centenarians provided complete data for all follow-up assessments. Measures assessed at baseline (i.e., ADLs) and T1 (all other data) were assessed as predictors of functional limitations at T4. Findings indicated an association between ADLs, grip strength, perceived health, and markers of mental health and functional limitations. The results from this study suggested that measures of physical health, mental health, and perceived health were associated with physical functioning in centenarians. Greater levels of handgrip strength, positive affect, and self-rated health were associated with better function.

Objectively measured daily physical activity was assessed by a pattern recognition device (SenseWear Pro 4, BodyMedia, Pittsburgh, PA) that integrates information from two orthogonal accelerometers and thermal sensors assessing heat flux, body temperature, and galvanic skin response. Activity, quantified as average energy expenditure and expressed in metabolic equivalent tasks, was inversely associated with all four measures of physical function (i.e., global function, upper body function, basic lower body function, and advanced lower body function), whereas

handgrip strength was positively associated with all of them. At first sight, these findings are somewhat puzzling but they perhaps suggest that inactive centenarians are not troubled by their limitations; conversely, more active centenarians may be more aware of their limitations. Not surprisingly, better functioning was associated with higher levels of self-rated health. Clearly, more research with larger samples is needed to replicate these findings.

The Iowa Centenarian Study reported strong associations between affect and functional limitations. Centenarians with higher functioning scores demonstrated higher scores in positive affect, whereas those scoring lower in functioning reported greater negative affect. Causal inference is not possible; however, this suggests a positive relationship between affect and activities of daily living. Higher levels of ADL functioning may promote improved affect and vice versa. If exceptionally old people feel useless and weak, this may also contribute to less engagement in functional abilities (Martin et al. 1996).

When assessing functional limitations, the terms ADL and physical functioning are often thought of as being synonymous; however, physical functioning is a much broader term that includes both positive (e.g., physical abilities) and negative (e.g., functional limitations) components of the range of functioning (Cress and Meyer 2006; Selim et al. 2005). Because physical strength and physical activity can *increase* functional performance or “reserve” (Stewart 2003), it is important to include components that specifically measure late-life function and disability. It is noteworthy that handgrip strength was more strongly associated with late-life function and disability (e.g., visiting friends, going out with others) than with traditional ADL measure. The Iowa Centenarian Study also showed that the ADL measure was only weakly associated with the measures of physical activity, compared to the association observed with measures that include late-life function disability. Therefore, more sensitive measures of functioning and functional limitations need to be considered when assessing exceptionally old adults.

## The Importance of Psychosocial Resources

In order to maintain and optimize functioning in activity, cognition, and mental health, centenarians rely on individual and socioeconomic resources (Martin 2002). Based on earlier work in the Georgia Centenarian Study (Martin et al. 1996), the primary resources in the Iowa study included personality as individual resources, social support as an indicator of interpersonal or social resources, and perceived economic status as financial resources.

Prior studies on centenarians have used personality traits in their assessment of individual resources (Martin 2002). In the Iowa Centenarian Study, centenarians had relatively low scores on neuroticism and extraversion, and higher scores on agreeableness with openness and conscientiousness at slightly elevated levels. There are different interpretations for these personality traits. For example, these personality traits could have developed recently as centenarians may find it more important to agree with others, particularly those who live with primary caregivers. Furthermore, centenarians may become more introverted as their contact with others declines and sensory and mobility impairment may make it more difficult to benefit from or engage in contact with others. At the beginning of one's second century there may also be fewer reasons to worry about everyday life. Alternatively, centenarians may have had very stable personality traits over many decades of life, and these "robust" personality traits may have allowed them to survive into very old age.

Another important resource includes social support. Because centenarians need to rely on social support, nearly all of the centenarians reported that they could depend on help when they needed it. Eight out of ten centenarians indicated that they had close relationships with other people and 75% felt a strong emotional bond with at least one other person. As indicated by this sample, perceived social support remains important and was very strong for this age group.

Economic resources are also important for optimal adjustment in very late life. Many

centenarians are concerned with outliving their accumulated resources but still tend to underestimate their financial difficulties (MacDonald et al., 2010). Research findings suggest that older adults with relatively low incomes are typically more satisfied financially when compared to younger adults (Goetting et al. 1996). This is known as the "satisfaction paradox" and is contributed to the psychological accommodation to poor financial circumstances and downward comparisons to younger counterparts (Garasky et al. 2012). The Iowa study examined perceived economic well-being among centenarians by investigating whether that perception is related to the ability to manage activities of daily living, cognitive functioning, and psychological well-being. In addition, the Iowa Centenarian Study addressed the question whether these relationships vary by residential status (i.e., community dwelling compared to long-term care residence).

The focus of the study was on six perceived economic status variables and their relationship to activities of daily living scale, cognitive functioning, and mental health. Most centenarians at baseline (87%) indicated that they had financial resources sufficient for emergencies and reported that paying their expenses was not a problem (82.3%). However, 66% of the participants responded that they were unable to manage their own finances. Of these participants, 81.5% resided in a long-term care facility.

One measure of financial activity includes aspects of bill paying. Of those centenarians who indicated paying their bills was not a problem, cognitive functioning was higher than those reporting that they were barely able to make ends meet. Those reporting they could not meet their expenses had the lowest cognitive functioning scores. Financial security also related to the activities of daily living. Those centenarians who indicated that their money met their needs very well had the lowest mean score on the activities of daily living scale, whereas those reporting their money poorly met their needs had the highest mean in activities of daily living. The results may suggest that economically disadvantaged centenarians simply cannot afford to buy services

that would help with their activities of daily living (cleaning, cooking, money management, etc.).

Having a better perception of their economic circumstances also related to reporting fewer depressive symptoms. Those centenarians indicating that their money barely met their current and future needs reported more depressive symptoms. In addition, those centenarians who indicated they needed assistance with their finances felt they were financially better off than others their own age. Receiving help, therefore, may allow centenarians to view their financial situation as more positive. On the other hand, centenarians who receive assistance may not realize the full extent of their financial difficulties.

Taken together, research on psychosocial resources indicates that very old adults show a robust personality profile (i.e., low in neuroticism, high in agreeableness), and they can rely on social support. The management of financial resources is often difficult for oldest old adults, and when resources are low, depressive symptoms are high. Future research should investigate to what extent increase or at least stability in resources may maintain levels of overall well-being.

## Summary

There are many factors that contribute to longevity and adaptation in very late life. The Iowa Centenarian Study defines late-life adaptation as the maintenance and optimization of cognitive function, relatively high levels of activities of daily living, and robust mental health that are specifically relevant for this very old age group. If cognition, activity, and mental health decline, optimal adaptation is compromised and the benefits of longevity may be put into question. The Iowa Centenarian Study, in concert with other centenarian studies, provides evidence that many centenarians can continue to function cognitively on a very high level and remain autonomous and stay in good mental health. However, there are great individual differences within this group of survivors, and the Iowa study suggests that individual and social resources may distinguish those who do well from those who encounter problems.

It is therefore of paramount importance to strengthen psychosocial resources among the very old and their family members, and service providers need to be aware of the continued need of good cognitive and mental health for those who live a very long life.

## Cross-References

- ▶ [Blue zones](#)
- ▶ [Chinese Longitudinal Healthy Longevity Study](#)
- ▶ [Five-COOP Study](#)
- ▶ [Fordham Centenarian Study](#)
- ▶ [Georgia Centenarian Study](#)
- ▶ [Heidelberg Centenarian Studies](#)
- ▶ [Hong Kong Centenarian Study](#)
- ▶ [Health in Centenarians](#)
- ▶ [Korean Centenarian Study, Comprehensive Approach for Human Longevity](#)
- ▶ [New England Centenarian Study \(NECS\)](#)
- ▶ [Oporto Centenarian Study](#)
- ▶ [Okinawa Centenarian Study, Investigating Healthy Aging among the World's Longest-Lived People](#)
- ▶ [Psychology of Longevity](#)
- ▶ [Sydney Centenarian Study](#)
- ▶ [Well-being in centenarians](#)

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## Irish Longitudinal Study on Ageing (TILDA)

Joanne Feeney<sup>1,2</sup> and Rose Anne Kenny<sup>1,3</sup>

<sup>1</sup>The Irish Longitudinal Study on Ageing, Department of Medical Gerontology, Trinity College Dublin, Dublin, Ireland

<sup>2</sup>Centre for Public Health, Queen's University Belfast, Belfast, Northern Ireland, United Kingdom

<sup>3</sup>Mercer's Institute for Successful Ageing, St. James' Hospital, Dublin, Ireland

### Synonyms

TILDA

### Definition

The Irish Longitudinal Study on Ageing is a nationally representative longitudinal cohort study of people aged 50 and over in Ireland. It is a multidisciplinary study focusing on the health, economic and social circumstances of older adults in order to understand the determinants of ageing, early identifiers of the process, inform policy and track the effectiveness of policy change and interventions. The study has leveraged intelligence from previous technology research in clinical cohorts to create a unique dataset of physiological coupled with neuropsychological measures.

### Description

The Irish Longitudinal Study on Ageing began in 2009 with the aim of increasing the knowledge and understanding of ageing and the needs of older Irish adults. 8,175 people aged 50 and over living in the community participated in the first wave, with follow-up interviews conducted biennially. The second wave was carried out between 2012 and 2013, and the third wave commenced in early 2014. The fourth wave is due to begin in 2016 and further waves are planned.

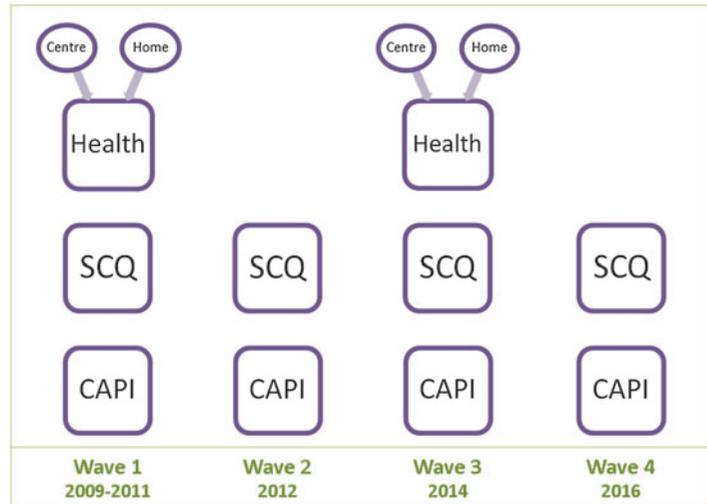
### Design

To generate the TILDA sample, all postal addresses in Ireland were assigned to geographic clusters and a sample of these clusters was selected and stratified by socioeconomic status and location to ensure a nationally representative sample. Almost 30,000 households were screened to recruit participants and any individual aged 50 or over and their partners (irrespective of their age) were invited to participate. The response rate was 62% (Kearney et al. 2011).

At each wave of data collection, all respondents complete a structured computer-assisted personal (CAPI) interview which is carried out in their own home by a trained interviewer. The CAPI contains questions on family, health and wellbeing and financial circumstances. In addition, respondents are asked to fill in a self-completion questionnaire which contains more sensitive questions on mood, lifestyle, relationships and living environment. The CAPI and SCQ data are collected during each wave of TILDA. Every second wave all TILDA participants are also invited to undergo a health assessment, either a full assessment at a dedicated assessment centre or a modified assessment carried out in the participant's own home. The initial health assessment was carried out during wave 1 (2009–2011) with a response rate of 72% and is being repeated with additional measures at wave 3 (2014–2015). An outline of the TILDA data collection model is shown in Fig. 1. The health assessment comprises detailed measurements of health and physical functioning (Cronin et al. 2013). These include assessments of cognition, cardiovascular function, gait and mobility, vision, ocular health, and bone health. TILDA also has a unique focus on neurocardiovascular instability (Kenny et al. 2002). Accordingly, as part of the health assessment, sensitive measures of orthostatic blood pressure, heart rate variability, cerebral perfusion, and pulse wave velocity are carried out. This information will help unravel the complex relationship between vascular health, the autonomic nervous system and brain integrity, with a view to improving dementia and frailty risk detection.

### Irish Longitudinal Study on Ageing (TILDA),

**Fig. 1** A schematic showing the design of successive waves of the Irish Longitudinal Study on Ageing



### Cognitive Function

A large part of the health assessment is devoted to assessing cognitive function using pen-and-paper and computer-based tasks. These tasks probe global cognition, visual and verbal memory, crystallized intelligence, attention, processing speed, multisensory perception and executive function. Several of the measures included are novel in the context of other longitudinal studies of ageing, such as the Sustained Attention to Response Task (SART) (Robertson et al. 1997) and the sound-induced flash illusion (Shams et al. 2000). In addition to the suite of detailed measures, shorter, primarily verbally administered cognitive tests are included in the CAPI interview. This ensures that every TILDA participant is cognitively assessed. The CAPI cognitive measures comprise tests of verbal and prospective memory and verbal fluency. These tasks are common to other population studies on ageing, namely the Health and Retirement Study in the U.S., English Longitudinal Study of Aging and the Northern Ireland Cohort Longitudinal Study of Ageing, thus facilitating international comparisons. TILDA CAPI also includes a common multi-domain measure of cognition (Mini Mental State Exam), which can be used as an indicator of general cognitive function.

Interviewers have the option to administer a quick seven-item cognitive screening test before commencing the interview if another person in the

household expresses concern about the respondent's capacity to proceed with the interview. Where it is established that an individual is mentally or physically incapable of giving the interview themselves a nominated proxy respondent is interviewed on their behalf. This is usually a spouse or close family member, or occasionally a friend or carer. Proxy respondents answer detailed questions about their relative or friend's cognitive status in order to find out whether or not cognitive impairment is an issue and to ascertain the severity of that impairment.

### Mood

The presence of clinically significant anxiety and depression are ascertained during the CAPI interview using the CIDI-SF for anxiety disorders and depressive disorders. These instruments are in use from wave 2 onward. The Center for Epidemiological Studies Depression Scale (CES-D) is included in the CAPI at each wave and also forms part of physical and cognitive health assessment to assess concurrent depressive symptoms. The anxiety subscale of the Hospital Anxiety and Depression Scale (HADS-A) has also been included in all waves of data collection. At wave 3, a measure of state anxiety was added to the health assessment to investigate the impact of situational anxiety on objective measurements of cognitive and cardiovascular function. Other instruments measuring worry

and perceived stress are contained in the self-completion questionnaire.

### Psychosocial Wellbeing

Psychosocial factors may have an important role to play in determining resilience or vulnerability to certain disease states. Fostering or maintaining an active, socially engaged lifestyle in later years is advocated to reduce the risk of physical and mental ill-health (Fratiglioni et al. 2004). There is a large psychosocial component to the TILDA SCQ at every wave. Participants are asked to indicate their frequency of participation in various social activities. Quality of relationships is assessed via questions about emotional closeness to a partner or spouse, other family and friends. Psychometric scales are included which measure loneliness, quality of life and perceptions of ageing. In the second wave of TILDA, a five-factor measure of personality (NEO FFI-3) was added to the SCQ to assess how various traits might be related to health outcomes and financial decision making. At wave 3, an inventory of coping styles and a measure of resilience to stressful events were included to provide further information on individual characteristics which may determine responses to and outcomes following the experience of adversity.

A social connectedness and caring section in the CAPI contains within it questions about the composition of the individual's social network, e.g., number of close children, other relatives and friends, participation in sports and social clubs, religious groups, charitable or community organisations. In addition, TILDA gathers information on care given and received; the type of care needed and the duration of time spent caring. Questions on volunteerism are also included.

### Substudies

A number of substudies are underway using the TILDA cohort. Among these is an investigation of the relationship between hypotension, vascular reactivity and white matter hyperintensities. TILDA data is coupled with neuroimaging to study these phenomena in a subset of

600 TILDA participants over 65 years of age. The study commenced in 2014. Suitable participants are randomly enrolled into the substudy and have magnetic resonance imaging (MRI) scans carried out within 2 months of their TILDA health assessment. Scans include volumetric and functional MRI, diffusion tensor imaging and arterial spin labelling. These brain imaging measures will further be used to predict longitudinal changes in cognitive and daily life function over subsequent TILDA follow-ups. Understanding these relationships will inform future guidelines for blood pressure management in older adults and thus possibly contribute to the prevention of dementia.

TILDA also has a strong programme of biomarker research. Blood samples are taken at every second wave for the measurement of established and putative indicators of disease risk including lipids, vitamins, antioxidants, inflammatory, immune and genetic markers. Various substudies are in progress in this area. One such study of 1000 TILDA participants is investigating the relationship between cytokines, genetic variants of other immune signalling molecules and age-related macular degeneration. Age-related macular degeneration is a common cause of vision loss in older adults, and the ultimate aim of this study is to determine novel targets for intervention to halt the development and progression of this debilitating age-associated disease.

### Findings

TILDA has made a number of significant findings to-date in the area of cognitive function, mental health and psychosocial well-being.

- Orthostatic hypotension (a large drop in blood pressure on standing) is more common in older adults and is associated with an increased risk of falls and faints. TILDA data shows that the prevalence of orthostatic hypotension rises steeply with age in the over 50 population (Finucane et al. 2014), and that these individuals are more likely to be depressed and have lower scores on tasks of global and executive function (Frewen et al. 2014). This research

suggests that this type of blood pressure variability adversely affects healthy brain ageing and may represent a modifiable risk factor for disease.

- Older adults who hold more negative perceptions of the ageing process are more likely to show a subsequent decline in executive function and memory independent of other psychological, health and demographic factors (Robertson et al. 2014). This finding highlights the importance of maintaining a positive attitude towards ageing for health and wellbeing in later years.
- Speed and variability of reaction time performance on the Sustained Attention to Response Task are associated with prevalent and incident frailty after controlling for other cognitive skills and related predictors (O'Halloran et al. 2014). Sustained attention may therefore be a novel marker of frailty.
- Macular pigment is located in the retina and is composed of three dietary nutrients which help to protect the eye. TILDA has found that having more pigment is associated with better cognitive function in older adults, irrespective of education and other socioeconomic factors (Feeney et al. 2013). As these nutrients are also present in the brain, this finding suggests that they may fulfil a neuroprotective role there also.
- TILDA research has shown that cognitive skills, particularly executive function, have a major role to play in the functional mobility of older adults and should be considered when assessing mobility difficulties in older individuals (Donoghue et al. 2012).
- There is a curvilinear relationship between age and quality of life in older Irish adults. Quality of life peaks at age 67 and declines thereafter. Mental health and social participation were the most important factors influencing quality of life in this cohort (Layte et al. 2013).
- Ireland has experienced several waves of emigration over the last century; however, a little is known about the psychosocial difficulties faced by return migrants when they come back to live in their country of birth. TILDA research shows that return migrants experience higher social isolation and alcohol problems compared to those who never lived outside their country of birth (Barrett and Mosca 2013). The degree of isolation varies by duration of time migrants spent away and how recently they returned.
- The importance of considering the entire lifecourse when investigating predictors of physical and mental health in late-life has been highlighted by a number of findings from TILDA. Early-life circumstances affect the experience of loneliness in later life. Poor childhood socioeconomic status and experiencing parental substance abuse growing up had independent effects on loneliness at older ages (Kamiya et al. 2014). TILDA data also shows a graded association between the experience of childhood adversity and increased risk of chronic diseases including cardiovascular disease, lung disease and psychiatric disorders (McCorry et al. 2014). Moreover, the experience of adversity was predictive of an earlier age of disease onset. Older adults who reported having experienced a greater number of adverse life events were also more likely to have impaired blood pressure regulation independent of current mood and health behaviours (Feeney et al. 2014). Taken together, these data add support to a growing literature showing that the experience of cumulative adversity can alter regulatory biological pathways resulting in an increased risk of disease in later life.
- Global population ageing has led to an increase in the "sandwich generation" – older adults with both living parents and dependent children who bear the burden of care for both generations. About one-third of women in TILDA aged between 50 and 70 were found to be in the "sandwich generation" (McGarrigle et al. 2014). Provision of non-financial support to children and financial support to parents were both independently associated with case-level depression among these women. However, women who provided financial support to children rated their self-rated health as being better than women who did not provide this support. These findings highlight the significant caring

responsibilities often faced by older adults and the need to try to reduce the psychological burden of care and financial transfers on this group.

## Cross-References

- ▶ [Aging and Psychological Well-Being](#)
- ▶ [Aging and Quality of Life](#)
- ▶ [Attitudes and Self-Perceptions of Aging](#)
- ▶ [Behavioral and Psychological Symptoms of Dementia](#)
- ▶ [Caregiving and Carer Stress](#)
- ▶ [Cognition](#)
- ▶ [Health and Retirement Study, A Longitudinal Data Resource for Psychologists](#)
- ▶ [Intergenerational Relationships](#)
- ▶ [Loneliness and Social Embeddedness in Old Age](#)
- ▶ [Mental Health and Aging](#)
- ▶ [New England Centenarian Study \(NECS\)](#)
- ▶ [Resilience and Aging](#)
- ▶ [Social Support and Aging, Theories of](#)
- ▶ [Stress and Coping Theory in Geropsychology](#)

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## Job Attitudes and Age

Lale M. Yaldiz<sup>1</sup> and Donald M. Truxillo<sup>2</sup>

<sup>1</sup>Department of Psychology, Portland State University, Portland, OR, USA

<sup>2</sup>Department of Psychology, Portland State College of Liberal Arts and Sciences, Portland State University, Portland, OR, USA

### Synonyms

Attitudes towards work; employee attitudes; job attitudes; work attitudes

### Definition

An attitude is defined as “a psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor” (Eagly and Chaiken 1993). Attitudes include an evaluation of any entity such as people, objects, events, or organizations, and this evaluation may have affective, cognitive, and behavioral components. While affective components deal with the emotional side of individuals’ evaluations (i.e., how they feel towards an object, whether they like it or dislike it, or found it pleasant or unpleasant), cognitive components deal mostly with individuals’ beliefs and thoughts about those objects (i.e., what they think about an object or their judgments about a certain event). As a result of

these affective and cognitive evaluations, the behavioral component of attitudes refers to actual actions, namely, behaviors, guided by how individuals feel or think about specific objects.

Based on this general definition, attitudes towards a person’s job, namely, job attitudes, can be defined as “evaluations of one’s job that express one’s feelings toward, beliefs about, and attachment to one’s job” (Judge and Kammeyer-Mueller 2012). Moreover, as attitudes towards jobs are work specific, they contain evaluations not only of the tasks associated with the job but also of other job-related aspects such as coworkers, supervisors, and the organization itself (Ng and Feldman 2010).

The two most studied job attitudes are job satisfaction and organizational commitment. Job satisfaction refers to employees’ general positive feelings and beliefs about their jobs, assessing either an overall reaction or specific dimensions of the job including how satisfied they are with their pay, coworkers, supervisors, clients, as well as development and promotion opportunities (Judge and Kammeyer-Mueller 2012). Organizational commitment refers to an overall psychological bond between the employee and the organization either due to an emotional attachment or identification with the organization (i.e., affective commitment), perceived costs associated with leaving the organization (i.e., continuance commitment), or a perceived obligation to remain in the organization (i.e., normative commitment) (Allen and Meyer 1990).

## Description

As individuals continuously make evaluations about their jobs, it is important to understand how they feel or what they think about their jobs in order to predict their job-related behaviors such as task performance, extra-role behaviors, counterproductive work behaviors, turnover, OCBs, and health and well-being.

An important implication of considering the intersection of job attitudes and age is that what individuals like about their jobs when they are younger may not seem appealing to them any longer as they grow older, or vice versa. Thus, while individuals' attitudes towards their job may change over time (within-person change), job attitudes may also show differences between younger and older worker groups (between-group differences). For example, one conclusion from a recent meta-analysis is that job attitudes generally improve with age (Ng and Feldman 2010).

These age-related differences on job attitudes have begun to receive more attention from scholars, especially due to the global trend of an increasing proportion of older workers in the workforce. According to the US labor force projections (Toossi 2012), the percentage of older workers (55 years and above) will climb up to nearly a quarter of the total workforce by 2020. Moreover, the decline in the percentage of the young (ages 16–24) and young and middle-aged workers (ages 25–54) is expected to continue in the coming years. The increase in the older worker population in the workforce also shows similar and often more pronounced trends in European countries: According to the most recent employment statistics, the employment rate of older workers aged between 55 and 64 increased to 50.1% in 2013 among EU member states, and it is projected that this increase will continue in the coming decades (European Commission 2014).

In short, considering the aging of the baby-boom generation (European Commission 2014; Toossi 2012), improved health in industrialized countries, changing retirement laws, and older workers' need for additional income, it is expected that older people will stay active in the workforce longer. As a result of this "graying"

trend, researchers have become interested in understanding the dynamics of aging in the employment context and its implications for human resource management. One line of research involves the exploration of the relationship between age and job attitudes and its impacts on job behaviors. These have included both cross-sectional and longitudinal studies (e.g., Ng and Feldman 2010; Wille et al. 2013).

## Theories Behind the Age-Job Attitude Relationship

The following theories have received the most attention in explaining the relationship between age and job attitudes.

### Socioemotional Selectivity Theory

Taking a lifespan development perspective, Socioemotional Selectivity Theory (SST; Carstensen 1995) suggests that individuals' resources, motivations, and goals change across the lifespan. SST posits that as we age, building and maintaining meaningful social interactions and goals becomes more important as a compensatory reaction against physical and cognitive losses (Kooij et al. 2011). When people are younger, they are more focused on attaining growth, which in the workplace may translate into building job knowledge and seeking career advancement. As people age, however, they tend to spend their energy more on strengthening social relationships at work since they have already accumulated work-related knowledge (e.g., Kanfer and Ackerman 2004; Truxillo et al. 2012). Moreover, as SST proposes, different perceptions of time in older and younger people affect their selection and pursuit of social goals. Because older people perceive their remaining time in life as shorter, they focus on meaningful emotional goals such as maintaining social relationships with colleagues. In contrast, younger people perceive their time as more open-ended; thus, they focus on gaining job knowledge and advancing their careers. Another proposition that SST adds to the age-job attitude research is that due to the perceptions of limited time remaining ahead of their life, older people

tend to maximize positive emotional experiences more than younger people. Older individuals tend to search for positive cues in their social relationships rather than focusing on negative events or outcomes.

Consequently, in explaining the age-job attitude relationship, SST suggests that individuals will develop more positive attitudes towards their jobs as they become older (i.e., higher satisfaction with the job, stronger commitment to organization) and have more positive attitudes than their younger counterparts. Ng and Feldman (2010) used SST to explain the findings of their comprehensive meta-analysis where there was a generally positive relationship between age and 35 job-related attitudes.

### **Selection-Optimization-Compensation Theory**

Another lifespan developmental theory utilized in investigating the relationship between age and job attitudes is the SOC model (Baltes and Baltes 1990). According to this theory, individuals employ three basic strategies in the face of losses of their biological, mental, and social resources throughout their life. First, as people get older, they become more selective in investigating their limited energy and time while setting goals. Second, once people narrow down their goals and prioritize them, they try to match their resources with the goals they selected. In other words, they work to achieve an optimum level of performance with available resources. Last, they perform these strategies continuously to compensate any weaknesses related to the age-based losses.

Similar to SST, the SOC model suggests that older workers will have positive attitudes towards their jobs as they actively engage in the selection-optimization-compensation process. For example, an older employee may want to select a single task at a time rather than selecting multiple tasks to complete, taking advantage of his or her accumulated experience. As a result of actively engaging in these processes at work, a recent study also supported that older workers who used SOC-based strategies reported higher job satisfaction than their younger counterparts (Schmitt et al. 2012).

### **Personality Theories: Big Five Personality Traits**

Recent studies on age and personality have begun to provide support for mean-level changes in some personality traits as people become older. The findings are consistent for some factors of the Big Five personality traits (aka five-factor model of personality; FFM; e.g., John and Srivastava 1999), the most widely used framework to assess personality traits in the work context. This personality framework consists of five broad dimensions of personality: extraversion, neuroticism, agreeableness, conscientiousness, and openness to experience.

The results of a comprehensive meta-analysis investigating 92 longitudinal studies on personality traits (Roberts et al. 2006) found that some of the Big Five personality traits showed a consistent change in middle and old age. For example, there was a significant increase in agreeableness in old age (ages from 50 to 60). In addition, the results yielded a significant increase in the mean levels of conscientiousness from ages 20 to 30, 30 to 40, 40 to 50, and 60 to 70. The authors reported a significant decrease in the mean levels of neuroticism in people's 20s and 30s and again from ages 50 to 60. In addition, the mean-level changes in social dominance, one of the facets of extraversion, showed consistent increase with age, from adolescence through age 40. Finally, there was a consistent decrease in social vitality, another facet of extraversion, between the ages of 22 and 30 and then 60 and 70. In sum, the authors concluded that while people become more socially dominant, conscientious, agreeable, and emotionally stable in middle and old age, they also experience decreases in social vitality and openness to experience in old age.

Similarly, the empirical cross-sectional studies yielded support for higher mean levels in overall agreeableness and conscientiousness (Soto and John 2012; Specht et al. 2011) and lower mean levels in neuroticism for older people when compared to their younger counterparts (Soto et al. 2011). These consistent findings about the changes in some personality traits over time are believed to be helpful to explain the age-job attitude relationship and provide additional

insight to the lifespan developmental approaches discussed above. However, despite these evidence in changes in some personality traits over time, the possible mediating role of personality between age and job attitudes is received little empirical study.

### **Additional Mechanisms Relevant to Age and Job Attitudes**

In addition to the lifespan developmental and personality theories discussed above, other broader assumptions that may explain why job attitudes change with age include the increased accumulation of financial resources, higher pay, working in a higher status jobs, or the ability to craft one's job to fit into one's skills and needs.

### **Age and Changes in Specific Job Attitudes**

As the research on age and job attitudes is still in its development stage, there are relatively few publications that shed light on our understanding in this area, particularly the mediating and explanatory mechanisms involved.

In their meta-analysis, Ng and Feldman (2010) compiled 35 job attitudes under three distinct categories and analyzed how each attitude was related to age. The categories included task-based (e.g., overall job satisfaction, satisfaction with pay, satisfaction with promotions), people-based (e.g., coworker and supervisor support), and organization-based attitudes (e.g., organizational commitment, fairness perceptions, and organizational identification). Based on SST, the main study hypothesis was that older workers would have more positive attitudes towards work than younger workers would. The overall conclusion of the study supported that age and job attitudes were associated significantly and that the strengths of the relationships were reported as weak to moderate after controlling job tenure. Most importantly, the findings revealed that age was related to more favorable job attitudes, supporting that older workers generally had more positive attitudes than younger workers. The authors concluded that the overall study

findings were in line with the expectations based on SST. Namely, perceiving the time left ahead of their lives limited as opposed to open ended, older individuals are more likely to focus on positive and emotionally meaningful experiences rather than negative ones. It is worthwhile to note that only one job attitude, satisfaction with promotions, was found to have a negative relationship with age. One possible explanation aligned with SST would be that older employees may perceive available promotion opportunities in their remaining careers as very limited.

A longitudinal empirical study on age and job attitudes by Wille and colleagues (2013) focused on whether employees' attitudes regarding work will change over time as they grow older. Based on personality theories (i.e., Big Five personality model), the changes in the five personality factors and their influences on job satisfaction and work involvement were investigated over the first 15 years of workers' professional careers. The results supported that there were significant mean-level changes in personality factors between the two assessments conducted over 15 years. Specifically, workers' mean levels of agreeableness and conscientiousness increased, while neuroticism decreased over time. Although no significant mean-level changes were found in attitudes over time, the authors were able to show that the variability in attitude changes was related to the variability in the personality changes over 15 years, signaling the possibility that job attitudes mature over time along with personality.

### **Research Methodology**

(a) *Linear versus curvilinear relationships*: In addition to the linear relationships, the studies on age and job attitudes have also examined curvilinear relationships to see whether the effects of age on job attitudes are uniform across various ages. In their meta-analysis, Ng and Feldman (2010) detected curvilinear relationships for only 2 out of 35 job attitudes, concluding that the job attitudes were fairly uniform across ages. Specifically, the only curvilinear relationships were found for

age-normative commitment and age-emotional exhaustion links where the strength of the relationships increased as individuals become older.

- (b) *Cross-sectional versus longitudinal study designs*: Although the field is still developing and there are only a few published studies, there are examples for both cross-sectional and longitudinal designs (see Van Der Velde et al. 1998; Wille et al. 2013). While cross-sectional studies help capture the individual differences in the relationship between age and job attitudes (i.e., between-level variations), longitudinal studies provide a more complete picture about how this relationship changes over time by investigating the fluctuations in the job attitudes in years (i.e., within-person variations).
- (c) *Moderators*: Ng and Feldman (2010) reported a significant moderating effect of organizational tenure for the link between age and satisfaction with work. Specifically, the relationship was stronger (0.24 vs. 0.16) when organizational tenure was higher. In addition, educational level moderated the links between age and job autonomy and affective commitment such that older workers without a college education reported stronger job autonomy (0.19 vs. 0.09) and affective commitment (0.27 vs. 0.16) compared to workers with college education. Finally, the publication year of the study moderated the relationships between age and some job attitudes (i.e., age-job involvement, age-normative commitment, age-distributive fairness). Overall, the results suggested a weaker relationship for studies that were published more recently, supporting the existence of possible age cohort differences in some job attitudes.

## Implications for Practice

The understanding of how age relates to certain job attitudes has important implications for older workers in organizations. First, based on the preliminary findings, older workers are likely to have more favorable evaluations towards their jobs and

work-related aspects than their younger counterparts are. As attitudes are defined as influential components of actual behaviors, having positive attitudes towards one's jobs (i.e., higher satisfaction with work and colleagues, higher commitment to organization) may translate into increased job performance in work contexts. Thus, as stated by theory (i.e., SST, SOC) although older workers may experience physical or cognitive-related losses over time, they also accumulate valuable experiences and job-related knowledge. Also, older workers tend to actively develop strategies to use their resources more effectively to offset age-related losses. Thus, the field presents promising findings to help reduce the negative stereotypes against older workers in various organizational stages such as recruitment and selection, promotion, training, and work groups (Truxillo et al. 2014). For example, through a better understanding of motivations of older workers, organizations can assign emotionally meaningful roles to them, such as mentors. This strategy not only will foster social identities of older workers but also may help influencing the attitudes of younger workers positively.

In addition to helping in eliminating negative stereotypes towards older employees, organizations can develop strategies to motivate employees of different ages once the link between age and job attitudes is uncovered (Kanfer and Ackerman 2004). For example, while organizations may rely on extrinsic rewards such as performance-based pays or bonuses, older workers may need more intrinsic rewards such as praise and recognitions by colleagues or superiors.

## Future Directions

Given that there are only a handful studies published on age-job attitudes, there is still little understanding of the mechanism by which age is related to certain job attitudes. Thus, more research investigating the effect of age on various types of work-related attitudes is needed. Although cross-sectional data may still provide

insights, longitudinal studies are needed to examine the types of within-individual changes that take place over time and explain age differences in attitudes.

Second, to test the possibility of whether job attitudes change uniformly across different ages, future research should analyze the curvilinear relationships between age and job attitudes rather than using strictly linear examinations. Finding curvilinear relationships would produce more research questions such as why and how job satisfaction or affective commitment start changing after a certain age.

Another suggestion for scholars is to conduct cross-cultural studies to see whether how individuals' job attitudes change over time is uniform across diverse cultures. For example, in cultures where individuals gain their self-esteem based on their group memberships and where cooperation is highly valued (i.e., collectivistic cultures), age may be more strongly related to favorable job attitudes compared to that in more individualistic cultures.

Finally, future research should investigate some additional moderators and mediators of the age-job attitude relationship. For example, researchers can examine whether organizational climates supporting diverse age workforce play a moderating role in strengthening the relationship between age and favorable job attitudes of older workers.

## Conclusion

The relationship between age and job attitudes has started to receive more attention from researchers due to the increasing proportion of older workers in the global workforce. This "graying" shift in the workforce necessitates a better understanding of how age is related to individuals' evaluations of various aspects of their work. Taking lifespan developmental approaches into account, utilizing personality theories, conducting more longitudinal studies to track within-person changes, and searching for moderators and mediational mechanisms to explain how and why age is related to certain job-related attitudes are some ways to advance this newly emerging field further.

## Cross-References

- ▶ [Age-Related Changes in Abilities](#)
- ▶ [Attitudes and Self-Perceptions of Aging](#)
- ▶ [Emotional Development in Old Age](#)
- ▶ [Life Span Developmental Psychology](#)
- ▶ [Personality and Aging, A Historical Review of the Research](#)
- ▶ [Selection, Optimization, and Compensation at Work in Relation to Age](#)
- ▶ [Socioemotional Selectivity Theory](#)
- ▶ [Work Motivation and Aging](#)

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## Job Crafting in Aging Employees

Darya Moghimi, Susanne Scheibe and  
Nico W. Van Yperen  
Department of Psychology, University of  
Groningen, Groningen, The Netherlands

### Definition

Job crafting is defined as self-initiated behaviors displayed by employees with the goal to increase

the fit between the individual and the job. Fit can be achieved by matching personal needs and abilities to work supplies and demands.

## Definition and Predictors of Job Crafting

### Person-Job Fit and Job Crafting

Job crafting is founded in the concept of person-environment fit (P-E fit; Lauver and Kristof-Brown 2001), and more specifically, in the concept of person-job fit (P-J fit). This concept describes the fit or match between the needs and abilities of the person on the one hand and the supplies and demands of the job, respectively, on the other hand. Employees' *needs* reflect indispensable requirements, such as a sense of autonomy and competence, that are necessary in order to function and thrive. *Abilities* reflect personal resources, such as knowledge about a certain topic, that help individuals to effectively perform their work tasks and to cope with stressful work demands. *Supplies* refer to external resources that individuals receive from their job and working environment, for instance, support from colleagues. *Job demands* relate to occupational expectations and obligations that employees are confronted with, for example, time pressure. When these four factors are in balance, employees are likely to feel a good P-J fit between themselves and what their job offers and requires from them. P-J fit, in turn, is positively associated with job satisfaction and performance (Lauver and Kristof-Brown 2001). However, employees do not always experience a good P-J fit between needs and supplies, or between abilities and demands. Job crafting is one type of proactive behavior that employees can engage in to modulate their job's supplies or demands (i.e., the J-side of P-J fit) in order to increase P-J fit (Tims and Bakker 2010).

The term job crafting was first introduced by Wrzesniewski and Dutton (2001). They defined job crafting as self-initiated behaviors displayed by employees with the goal to increase the meaningfulness of their jobs. Although these authors did not explicitly position the concept in the P-J fit framework, their definition fits well with the idea that job crafting is enacted to achieve a better fit

between the need for a meaningful job and the job's supply of meaning. An important notion of the concept of job crafting is that individuals actively change the job (i.e., the environment) rather than themselves. By actively crafting their job characteristics and changing physical, relational, and cognitive boundaries of their work tasks, employees can fit environmental supplies and demands to their individual needs and abilities and achieve a better P-J fit.

Based on qualitative data gathered through personal interviews, Wrzesniewski and Dutton (2001) concluded that job crafting can be observed in three different forms. From the *physical* perspective, job crafting involves changing the amount, scope, and type of the tasks the employee has to accomplish. The *relational* form of job crafting includes changing interactions with supervisors, colleagues, or clients by increasing or decreasing contact with certain people. Finally, employees can also make *cognitive* changes by, for instance, focusing attention on the positive outcomes of the job or reframing the job as more meaningful.

Grounded in the definition provided by Wrzesniewski and Dutton (2001), Tims and Bakker (2010) enriched the theoretical background by framing job crafting in terms of the Job Demands-Resources (JD-R) model (Bakker and Demerouti 2007) and P-J fit. Specifically, they defined job crafting as proactive behavior aimed at achieving a greater fit between employees and their work environment by increasing supplies (i.e., increasing structural and social job resources), decreasing hindering job demands, and increasing challenging job demands. This definition overlaps with the physical and relational forms of job crafting identified by Wrzesniewski and Dutton (2001). However, in contrast to Wrzesniewski and Dutton (2001), Tims and Bakker (2010) do not consider the cognitive changes in the perception of a job as a form of job crafting, given that job characteristics are not actually changed.

### **Motivation and Opportunities for Job Crafting**

Job crafting behavior is initiated by the cognitive evaluation of a P-J misfit and the conclusion that

job crafting would be possible and beneficial in reducing the misfit (Tims and Bakker 2010). According to Wrzesniewski and Dutton (2001), employees evaluate whether their job satisfies three basic human needs, the need for job control, the need for a positive self-image, and the need for affiliation. If these needs are not sufficiently met, the *motivation to job craft* arises. From the P-J fit perspective, the motivation to job craft can not only arise from a misfit in needs and supplies, but also from a misfit in abilities and demands. If the demands do not match the abilities, and supplies do not fulfill needs, the motivation to job craft grows, and employees are motivated to change physical and/or relational boundaries of their work environment (Wrzesniewski and Dutton 2001), or adjust structural and social job resources, decrease hindering job demands, and/or increase challenging job demands (Tims and Bakker 2010).

Whether or not the motivation to job craft is translated into actual job crafting behavior depends on *perceived opportunities for crafting*. Perceived opportunities are presumed to moderate the relationship between the motivation to job craft and job crafting behaviors, such that with increasing opportunities employees engage more in job crafting (Wrzesniewski and Dutton 2001). Several job characteristics have been identified that promote or hinder opportunities for job crafting. One job characteristic that determines whether or not employees perceive job crafting opportunities is task interdependence, or the degree to which one employee's work task achievement depends on and feeds into other employees' work task achievement. Jobs with high task interdependence are considered as relatively less amenable to job crafting compared to jobs with low interdependence. Closely (and negatively) related to task interdependence is job autonomy, denoting the degree to which employees have discretion over the timing, location, and/or process to achieve their work tasks. When employees have low job autonomy, such that managers control time and location of work and strictly define tasks and responsibilities, job holders are less flexible in crafting their jobs to fit their

personal needs and abilities than when employees have high job autonomy.

## Job Crafting and the Aging Employee

### Age-Related Differences Impacting the Motivation for Job Crafting

Job crafting may be particularly relevant and beneficial as employees get older. With increasing age, certain within-person changes take place that result in changing needs and abilities (the P-side), which – if not accompanied by changes in the job (the J-side) – can result in greater P-J misfit. Therefore, it is assumed that there is a higher necessity for older employees to engage in job crafting behavior than is the case for young employees. However, not all age-related changes are negative, and some may even enhance P-J fit. An overview of age-related changes in different domains of functioning relevant to work functioning was provided by Kanfer and Ackerman (2004) and, more recently, by Ng and Feldman (2013) and (Truxillo et al. 2014). In the following, age-related changes that may enhance the motivation to job craft are categorized according to whether they primarily address changing needs or abilities.

Age-related changes in needs can be inferred from life-span variations in personality. *Personality changes* in relation to the Big Five traits include age-related increases in conscientiousness and agreeableness, coupled with age-related reductions in openness to experience, some facets of extraversion, and neuroticism (Roberts et al. 2006). These changes suggest that older employees may be less interested than young employees in learning new tasks in unfamiliar domains but more interested in executing familiar tasks and in having positive relations with coworkers. Age-related changes in needs can further be inferred from *changing goal orientations*, which are thought to emerge from the shifting balance of gains and losses as well as reductions in future time perspective across adulthood (Carstensen 2006). Typically, early adulthood provides abundant resources and opportunities to acquire skills and an extended

future time perspective. With advancing age, however, resource limitations become increasingly salient and future time perspective more limited. Accordingly, goal orientation tends to shift with age from growth and development to maintenance and loss prevention. Additionally, a positivity maintenance orientation emerges such that aging people tend to strive for positive and meaningful experiences and to avoid negative experiences.

Age-related changes in abilities comprise physical, cognitive, and emotional domains. *Physical changes* that are typically observed with increasing age include losses in vision and hearing, muscle flexibility and strength, aerobic capacity and immune response. These changes suggest that older employees are less capable of executing physically demanding tasks compared to their younger colleagues. Consequently, aging employees might be more urged to adjust office equipment, such as screens or chairs, to their changing physical health. Age-related changes in *cognitive capacity* include declines in information processing speed or fluid intelligence. These cognitive changes may make it more difficult for older workers to retrieve information, acquire new job-related knowledge, and work under time pressure. It should be noted that not all aspects of cognitive capacity normatively decline with age. Crystallized intelligence or experience-based judgment are stable or even improve with age, often allowing older employees to maintain their level of work functioning (Salthouse 2012). Age-related changes in *emotional ability* include improvements in emotional understanding and regulation and decline in emotional perception and resilience in face of chronic stress (Walter and Scheibe 2013). These changes help older adults to circumvent many negative situations, neutralize interpersonal conflicts, or defuse negative emotions quickly (Scheibe and Zacher 2013). At the same time, age-related vulnerabilities emerge in face of intense and sustained stressors, due to difficulties regulating physiological arousal, as well as in the accurate perception of others' emotions. These changes suggest, for instance, that aging employees might be more suited for jobs that require positive customer

interactions, but less suited for jobs that involve negative customer interactions on an ongoing basis.

### Age-Related Differences Impacting the Opportunities for Job Crafting

In face of these within-person changes in needs and abilities, aging employees can use job crafting as a strategy to fit supplies (i.e., resources) and demands to needs and abilities and turn their work setting into a resourceful environment. However, aging may not only be accompanied by within-person changes that can affect the motivation to job craft, but also by environmental changes that affect the opportunities to job craft. In general, life course variations in opportunities interact with the motivation to job craft and determine whether an employee actually engages in job crafting behaviors or not. As stated above, within-person changes affect personal needs and abilities. In contrast, environmental changes in crafting opportunities refer to changes in supplies and demands. Within person changes in crafting motivation are rather generalizable to the aging workforce because they are highly related to physical aging processes in the human body. In contrast, environmental changes in crafting opportunities are predominantly dependent on the employee's specific work environment and can strongly vary between individuals, such that the same factors, for instance having more responsibilities at work, are perceived as supplies for one employee and as demands for another. In the following, the most prevalent environmental changes in crafting opportunities will be discussed in terms of supplies and demands.

Supplies are intrinsic or extrinsic vocational resources provided by the organization, the job, or the work group. Changes in supplies can comprise autonomy at work due to seniority, recognition due to higher organizational position, or increases in pay (Zacher et al. 2014). Older employees are often occupied in higher organizational positions which are usually also associated with greater *autonomy*. This enables the employees to act more freely and adjust their work conditions to their changing personal needs and abilities, for instance, in terms of working hours or location.

A higher organizational position can further be associated with greater *recognition* from colleagues and supervisors. As mentioned above, learning new processes and engaging in highly cognitively demanding tasks can become more effortful with increasing age (Salthouse 2012). Knowing that these efforts are recognized by supervisors and peers can serve as a buffering supply in highly cognitively demanding situations. Organizational recognition can be expressed verbally and through personal interactions or it can be expressed officially through increased *pay*. Higher pay does not exclusively refer to higher monthly salary but also to increased organizational benefits, such as more vacation days or higher pension that can help the employee to match his private needs to the organizational supplies.

The benefits of aging notwithstanding, many employees are also confronted with higher demands as they achieve a certain age and get closer to retirement. Work demands are extrinsic work factors that can be a threat to occupational well-being if not matched by personal abilities. The main changing work demands associated with aging can be categorized in changing responsibilities and age stereotyping (Truxillo et al. 2014). On the one hand *changing responsibilities* can be associated with the aforementioned higher organizational position that often comes with increasing age. On the other hand, many aging employees are confronted with a decrease in responsibilities either because they are assigned less demanding tasks or because they deliberately withdraw from work responsibilities as a preparation for retirement (Salthouse 2012). Dependent on whether these changes in responsibilities are voluntary and in line with the employee's needs and abilities, they can either be perceived as a supply or a demand. Yet another demand that can decrease the opportunity for job crafting in aging employees is *age stereotyping* (Truxillo et al. 2014). Older employees are often believed to be slow learners, low performers, and resistant to change. In the face of these beliefs, the work environment of aging employees might provide them with less opportunities for job crafting and indirectly coerce them to stay within their environmental boundaries.

## Consequences of Job Crafting

Recent research has shown that job crafting leads to a number of benefits for employees and organizations. For instance, job crafting has been associated with greater supply availability in the sense that people who actively engage in initiatives to increase social job supplies, such as feedback, or structural job supplies, such as autonomy, also report higher availability of these supplies after several months (Tims et al. 2013). Furthermore, crafting challenging demands has been shown to increase work engagement (Bakker et al. 2012), which in turn contributes to organizational goals. This is due to the fact that engaged employees are more likely to focus on their in-role tasks and also show more organizational citizenship behaviors (Tims et al. 2013). Other studies suggest that work engagement is an antecedent of job crafting rather than an outcome. From this perspective, work engagement promotes physical and relational job crafting, and accordingly, increases the fit between the person and the job (Chen et al. 2014). Other aspects of occupational well-being have also been associated with job crafting in the past. More specifically, crafting more challenging demands has been shown to have negative effects on levels of burnout and therefore increasing effects on occupational well-being and health (Tims et al. 2013).

Job crafting has further been associated with greater job enjoyment at a day-to-day level. Job enjoyment, in turn, has been associated with better job performance. Hence, through job enjoyment, job crafting also promotes better occupational performance and is therefore also interesting from an organizational perspective (Tims et al. 2014).

A question that still needs to be addressed in the field of job crafting research is whether benefits of job crafting can be achieved through different job crafting behaviors at different ages. Based on the theoretical background discussed above, it can be assumed that there are indeed differences in the types of job crafting behaviors, and in their outcomes, between older and younger employees. Kooij et al. (2015) recently suggested that future research should take into account employee age,

focusing on age-specific job crafting activities and their effects on successful aging in the work context. Additionally, future research should focus on a broader set of job crafting outcomes such as job stress, work-life balance, and retirement intentions. Until today the main focus has been on employee attitude and affect which might not reveal the whole scope of the job crafting framework. These issues in the rather young field of job crafting also apply to job crafting measurement instruments which will be discussed in the following section.

## Measurement of Job Crafting

The bulk of the existing research has defined job crafting as a rather static, trait-like concept, and the existing measurement approaches reflect this view. More recently, it has been suggested that job crafting also has more dynamic, state-like components and as such, is subject to daily fluctuations. Accordingly, new state-level measures of job crafting are beginning to emerge.

The basic assumption underlying early measurement approaches is that job crafting is a trait that some employees generally engage in more than others. When Wrzesniewski and Dutton (2001) first introduced the concept of job crafting, they exclusively founded their model on qualitative research conducted through behavioral observations and personal interviews with job holders in different sectors. As described above, these methods resulted in a taxonomy of three forms of job crafting behaviors namely, changing task boundaries, changing relational boundaries, and changing cognitive boundaries. In an attempt to expand the possibility for research on job crafting and supplementing the qualitative data, Tims et al. (2012) developed and validated a 21-item Job Crafting Scale (JCS), which operationalizes the four dimensions of job crafting emerging from the JD-R framework. The JCS comprises four subscales: increasing social job resources, increasing structural job resources, increasing challenging demands, and decreasing hindering demands. As part of the validation process the authors also compared self-rated job crafting

behavior with peer-rated job crafting, showing that there is indeed a positive correlation between self-rated and peer-rated job crafting activities. The finding that job crafting can reliably be observed by others supports the validity and relevance of the observational studies conducted by Wrzesniewski and Dutton (2001). The JCS is especially useful for researchers who are interested in individual differences in job crafting behaviors based on the most common supplies and demands mentioned in recent literature (feedback, social support, autonomy, etc.).

There are two alternative measures to assess job crafting, both grounded in the JCS and the definition of job crafting provided by Tims and Bakker (2010). The first one, developed by Nielsen and Abildgaard (2012), also considers job crafting as static and trait-like but not universal across different professions. Emphasizing that blue-collar jobs are characterized by a special constellation of high demands and low supplies, these authors developed and validated a five-dimensional job crafting questionnaire representing more dimensions of demands and less resources relative to the JCS (Tims and Bakker 2010). These five dimensions, each measured with two to four items, are: increasing challenging demands, decreasing social demands, increasing social job resources, increasing quantitative demands, and decreasing hindering demands.

The second alternative measure of job crafting grounded in the JCS is developed by Petrou and colleagues (2012) and reflects the dynamic character of job crafting. Rather than looking at individual differences in the tendency to use certain job crafting behaviors, this measure rests on the assumption that job crafting behaviors are dynamic and that their expression varies on a daily basis and therefore cannot be measured at only one point in time. This state-level job crafting scale, which was validated in a 5-day diary study, contains three subscales: seeking resources, seeking challenges, and reducing demands. It should be noted that although Petrou and colleagues (2012) based their questionnaire on the JCS, their conceptual definition of job crafting is slightly different. That is, Tims and colleagues

(2012) categorize supplies (i.e., resources) as social and structural, and demands as either being challenging or hindering. Fit can therefore also be achieved through challenging demands because they satisfy certain needs but do not exceed the employees' abilities. In contrast, Petrou and colleagues (2012) define demands as generally negative environmental characteristics that should be reduced in order to achieve greater P-J fit.

While there have been some first attempts to create a job crafting instrument that consider different work groups and different definitions of job crafting, age group differentiations are still missing. Future research should aim at adjusting the current measure to aging employees and further specifying whether job crafting should best be measured as a trait, a state, or both.

## Future Directions

### Developing Age-Differentiated Taxonomies of Job Crafting

In the previous sections, job crafting has been defined as proactive employee behavior that is aimed at increasing the meaningfulness and the feasibility of the jobs through a greater fit between the employees' needs and abilities and the job supplies and demands, respectively. This definition is rather general and applicable to different age groups and different jobs. However, Kooij et al. (2015) suggest that job crafting behaviors may differ between young and older workers. They introduce three major forms of job crafting which slightly differ from the definitions given above. The authors base their assumptions on the life-span model of selection, optimization, compensation (SOC; Freund and Baltes 2002) and on age-related intra-individual changes in needs and abilities as reviewed above. *Accommodative crafting* refers to crafting activities that are targeted at regulating age-related demands and changing supplies. This includes the delegation of responsibilities or looking for alternative ways to achieve goals and satisfy needs. *Developmental crafting* is targeted at increasing activities that promote personal growth and the acquisition of

new abilities. *Utilization crafting* comprises the application of existing abilities and knowledge. This can be achieved by seeking tasks that require unused supplies and are attainable with current personal resources (Kooij et al. 2015).

In further developing age-differentiated job crafting taxonomies based on the SOC model and other lifespan theories, it will be important to ensure that identified behaviors aim indeed at changing the job – and not the individual – in order to increase P-J fit. Developmental crafting, for instance, only fits the definition of job crafting to the extent that the focus is on work tasks and characteristics, such as asking for challenging work assignments, rather than personal resources, such as enhancing personal skills and knowledge. In the latter case, employees would craft themselves rather than their jobs. Future research may pay closer attention to job crafting in aging employees and specify whether crafting among older workers entails the same dimensions, motivations, and opportunities as crafting among younger workers.

### Distinguishing Job Crafting from Related Concepts

Tims and Bakker (2010) suggest that there are several concepts similar but not identical to job crafting. Job crafting entails unsupervised, spontaneous, self-initiated, voluntary, and sometimes short-term changes in the work environment (Tims and Bakker 2010), whereas related concepts typically depend on employer approval, are supervised, and result in objective, long-term changes which are in line with the organizational mission (Demerouti 2014). For example, *idiosyncratic deals* (i-deals) are defined as agreements negotiated between the job holder and the employer in order to improve work and/or payment conditions (Demerouti 2014). *Role innovation* denotes actions where employees proactively and in discussion with the supervisor redefine their role in order to reduce a mismatch between the role definition and the actual working situations. *Personal initiative* is associated with occupational behavior through which an employee aligns goals and actions with long-term organizational goals. Initiatives that are rather directed at

organizational goals might not satisfy individual needs as much as job crafting because job crafting is exclusively focused on the individual. Additionally, supervised adjustments to the job might decrease the sense of autonomy that especially aging employees require to increase their P-J fit and experience greater occupational well-being. Future research should investigate whether job crafting does indeed differ from related concepts such as I-deal, role innovation, and personal initiative in terms of antecedents and job related outcomes.

In conclusion, job crafting appears to be a fruitful strategy for aging workers to actively change their job when experiencing age-related changes in needs and abilities, in order to maintain P-J fit at later stages of their career. At the same time, more research is needed to define whether job crafting behaviors differ between different age groups, and whether job crafting behaviors lead to different work outcomes for different age groups. At this point, there are specific definitions and validated measures of job crafting available which allow extended research on job crafting in aging employees.

### Cross-References

- ▶ [Age and Blended Working](#)
- ▶ [Age-Related Changes in Abilities](#)
- ▶ [Aging and Strategy Use](#)
- ▶ [Crystallized Intelligence](#)
- ▶ [Life Span Developmental Psychology](#)
- ▶ [Selection, Optimization, and Compensation at Work in Relation to Age](#)
- ▶ [Work Design and Aging](#)
- ▶ [Work Motivation and Aging](#)

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## Job Loss, Job Search, and Reemployment in Later Adulthood

Ruth Kanfer and Gina Bufton  
School of Psychology, Georgia Institute of  
Technology, Atlanta, GA, USA

### Synonyms

(Mass) layoff; Displacement; Job loss; Job search; Reemployment; Self-regulation; Unemployment

### Definition

This entry focuses on job search and reemployment among older adults (individuals aged 55 or older) who have experienced involuntary job loss due to economic conditions or organizational change.

Job loss refers to an adverse life event in which an employee has been involuntarily terminated from his/her job through no fault of his/her own (Gowan 2014). Following job displacement, many individuals seek new employment. Although the term “unemployment” generally refers to the state of being without work, the US Department of Labor (USDOL) defines adults as unemployed only when they (a) have had no

employment during the reference week, (b) are available to work except for temporary illness, and (c) have made specific efforts to find employment at some point during the last 4-week period ending with the reference week (USDOL 2014). For these individuals, reemployment speed is synonymous with the length of the unemployment spell.

During unemployment, job seekers typically engage in a variety of job search cognitions and behaviors, including developing a job search strategy, preparing resumes, conducting online job searches, and interviewing. A variety of methods have been used to measure job search activities. The most commonly used measure is job search intensity, designed to assess the frequency and time an individual spends on job search activities over a specific period of time (e.g., past week). Because job loss and job search often entail strong affect, many studies also assess the frequency of emotion-focused coping activities (Kinicki and Latack 1990).

Kanfer et al. (2001) describe job search as a motivated, self-regulatory process by which individuals manage cognitions, behavior, and affect for the purpose of obtaining new employment. In this and related models (Liu et al. 2014b; Wanberg et al. 2010; Lopez-Kidwell et al. 2013), self-efficacy is defined in terms of the referent. Self-efficacy for reemployment refers to confidence in one's ability to sufficiently mobilize personal resources to obtain reemployment. Self-efficacy for job search refers to the individual's judgment about his/her ability to successfully perform job search activities.

A central problem in the study of job search and reemployment among older adults pertains to defining reemployment. Wanberg et al. (2015) propose a four-factor criterion matrix by which to evaluate reemployment outcomes: (1) reemployment status and speed (i.e., whether or not a job is found, how quickly the job is obtained); (2) reemployment basis (i.e., whether employment is temporary, contract, or part-, or full-time work); (3) job rewards, including both extrinsic (i.e., wages, noncash benefits) and intrinsic (i.e., psychological need fulfillment, such as

need for competence) rewards; and (4) the perceived person-job demand fit (i.e., the perceived degree of match between a person's knowledge, skills, and abilities and the new job's requirements). To date, however, most research investigating the relationship between job search variables and reemployment has focused on reemployment status and speed.

## Introduction

Over the past two decades, scientific and public interest in older adult job loss, job search, and reemployment has burgeoned. At least three reasons for this growing interest may be identified. First, unprecedented population aging in developed countries around the world has highlighted the high demands that older, nonworking populations may place on societal resources. Second, financial insecurity, healthier aging, positive attitudes toward work, and relaxed retirement policies in many countries have led many older individuals to work longer in life. In the USA, for example, workers aged 55 and older represent the largest growing segment of the national labor force (Bureau of Labor Statistics et al. 2015). Third, and perhaps most importantly, poor economic conditions in the USA and other developed countries at the turn of the twenty-first century resulted in millions of involuntary layoffs of late-career workers, many of whom have experienced difficulty in finding new employment (Johnson and Mommaerts 2011).

The purpose of this entry is to review and integrate theory and empirical advances related to job loss, job search, and employment outcomes in later adulthood. The entry is broadly organized into three sections. The first section reviews foundational concepts, such as older worker, job loss, self-regulated job search, and evidence on age and job search – reemployment relationships. The second section integrates findings on adult development with evidence on job search and reemployment to describe the unique challenges that older workers face in establishing reemployment goals, engaging in job search, and obtaining reemployment.

The third and final section provides a summary list of promising areas for future research.

## Foundational Concepts and Issues

*Defining Later Adulthood and the Older Worker.* There is no universal definition and indeed considerable controversy about what defines an older worker (Schwall 2012). Some researchers have found important differences in work-related behaviors as a function of the individual's subjective age identity (Huang et al. 2015; Kunze et al. 2015) or the individual's future time perspective (Zacher and Frese 2009). To date, however, most researchers employ a definition based on chronological age. In the USA, employment statistics often organize individuals into three age-based categories: young (16–24 years of age), midlife (24–54 years of age), and older (aged 55 and older). In the organizational psychology research literature, the age range that distinguishes midlife and older individuals often varies between 45 and 60, depending on the research question and sample. In the cognitive aging and lifespan research literatures, studies often include individuals in their 80s and 90s, so that the category of older individual may even be further subdivided into young-old and old-old. The precise chronological age at which an individual is considered older also varies as a function of legal, political, and sociocultural norms across countries. In the USA, an individual 40 years or older is defined as an older worker for purposes of age discrimination litigation.

The value of chronological age in defining an older worker stems largely from advances in adult development that focus on the normative, intraindividual changes in abilities and nonability traits that occur across the lifespan (see Kanfer and Ackerman 2004). Studies in cognitive aging and lifespan psychology document a variety of normative, age-related changes in cognitive, physical, and psychological attributes that occur gradually across adulthood and have important implications for job search and reemployment outcomes. Although meta-analytic reviews of the relationship between chronological age and job

performance consistently show negligible relations (see Ng and Feldman 2008; McEvoy and Cascio 1989), older workers in jobs that make particularly strong demands on age-sensitive abilities (e.g., air traffic controller, firefighter) may develop new career goals following job loss. Research in the area of cognitive aging also shows normative, age-related decline in learning abilities that demand fluid intellectual abilities (Salthouse 1996). These findings are consistent with studies of job skill training that show that older individuals are more likely to experience greater difficulty compared to younger adults (Beier et al. 2012). Psychological and economic research that focuses specifically on job loss and reemployment typically uses between- rather than within-subject research designs that compare the employment experiences and outcomes among individuals organized into three chronological age groups: young adults (e.g., ages 16–24), midlife adults (e.g., ages 25–54), and older adults (e.g., ages 55+). Based on theorizing and research in developmental and lifespan psychology, current age-graded retirement age norms, and workforce participation trends, older workers in this entry are defined as those aged 55–75.

*Job Loss.* Job loss is an adverse life event that has long been associated with a host of negative economic, psychological, and physiological outcomes (McKee-Ryan et al. 2005). The loss of income following job loss frequently produces financial strain that can serve to motivate the search for reemployment (cf. Kinicki et al. 2000).

Early work on unemployment and well-being assumed a U-shaped effect between age and well-being (Jackson and Warr 1984), such that job loss had its largest negative effect on adults in midlife. However, recent evidence suggests the largest negative impact of job loss may be among older adults. Research by Gallo and his colleagues (Gallo et al. 2000; Gallo et al. 2006) used data from the US Health and Retirement Survey and found relationships between late-life involuntary job loss and reduced mental and physical health. Job loss among older workers is also associated with increased rates of depressive symptomology (Riumallo-Herl et al. 2014) that can diminish search motivation and job search intensity.

Gallo et al. (2006) found that the depressive effects of job loss were limited to older adults with fewer financial resources. Taken together, these studies suggest that job loss among less wealthy older adults creates a more negative environment for job search and a more pressing need for reemployment than job loss among more financially secure older adults.

How individuals appraise their job loss affects the ways in which they cope with unemployment, which in turn also contributes to the context in which reemployment goal setting and self-regulated job search take place. Most studies of reactions to job loss assess appraisals of unemployment rather than the event itself, although Leana and Feldman (1992) found that individuals with less negative reactions to their job loss engaged in more problem-focused coping activities. Several studies also suggest that job loss and unemployment appraisals vary as a function of sociodemographic and contextual factors (Gowan et al. 1999). Among 45–61-year-olds, Ludāne and Bite (2013) found that sense of loss was greater among lower-wage earners. However, beliefs about the reversibility of the loss (i.e., reemployment) and the view of job loss as a challenge were not determined by wage level but by the individual's beliefs about a just world and age (with age negatively related to beliefs about reversibility).

*Self-Regulated Job Search.* For most individuals who experience involuntary job loss, job search begins with the commitment to pursue a reemployment goal. Consistent with goal theories of motivation and action (see Kanfer 2012), features of the reemployment goal can be expected to shape the individual's job search strategies for goal attainment. Reemployment goals can vary in terms of clarity and other goal attributes. Studies of job search clarity (Wanberg et al. 2002; Bao and Luo 2015) show that individuals who have a clear idea of their job objectives engage in more job search activity than individuals who have not formed a clear idea of the type of job they want to attain. Other attributes of the reemployment goal have received less attention, but may also be important for facilitating job search and reemployment, particularly among older workers.

For example, reemployment goals may differ in the priority placed on pay (e.g., obtaining a job with a wage similar to the previous job wage), work conditions (e.g., finding a job with a flexible work schedule), basis (e.g., full time vs. part time), or the nature of the work (e.g., finding a job similar to the previous job).

In the self-regulation model of job search, the individual's reemployment goal activates the development of search strategies and self-managed activities designed to bring about the goal. Older workers with high level of financial need may, for example, limit job search activities to obtaining full-time work that pays as well as the previous job. During job search, individuals engage in a variety of activities, such as talking to others about job possibilities, conducting online job searches, making job applications, and interviewing. Because job search occurs over time, individuals must also engage in activities that sustain search motivation over time and adjust search activities based on new information. For many individuals, sustaining search motivation requires the activation of emotion regulation strategies to prevent the individual from becoming discouraged or becoming distracted from the search task (Wanberg et al. 2012).

The self-regulatory model emphasizes the self-organizing and self-managed nature of job search. Job assistance programs provide help (most often in the form of social support, skill building, and providing search strategy advice). But individuals must sustain search motivation over weeks and often months in the face of setbacks (e.g., poor interviews, rejection letters, increasing financial strain), distractions, and discouragement. During job search, individuals must also monitor their goal progress and adjust employment goals and/or adjust search strategies. The self-regulatory search process is terminated when individuals either accomplish or abandon their goal.

Self-efficacy is a key motivational variable in self-regulated job search and may be distinguished in terms of self-efficacy for job search (process goal) and self-efficacy for reemployment success (outcome goal). Both forms of self-efficacy appear important for effective self-regulated job search but may work to affect search

motivation in different ways (Liu et al. 2014b). High levels of search self-efficacy or confidence in accomplishing the activity motivate the initiation of job search activities. Older workers who have not been in the job market for years may have low self-efficacy for effectively using online search resources and so avoid use of this search method. Results of a recent meta-analysis on the impact of job search intervention programs by Liu et al. (2014a) found that reemployment success was significantly higher for job seekers who participated in programs that developed job search skills and enhanced search motivation using techniques such as setting of goal, boosting self-efficacy, and enlisting social support. Liu et al. (2014b) also found a significant moderating effect of age, with younger and older job seekers benefiting more from participating in a job search program, compared to middle-aged (mean age 35–50 years of age) individuals.

High levels of reemployment self-efficacy refer to expectations about the likelihood of reemployment success (Liu et al. 2014b; Westaby and Braithwaite 2013). Westaby and Braithwaite (2013) found five variables that significantly contributed to reemployment self-efficacy: having potential jobs lined up, job availability, low perceived discrimination, possessing necessary work skills, and knowledge of job listings. However, high reemployment expectations may reduce sustained job search effort, even if the individual has high search self-efficacy. For example, Liu et al. (2014b) found that high reemployment self-efficacy was negatively related to job search intensity.

*Age and the Job Search – Reemployment Relationship.* Results of a meta-analytic review on the relationship between job search and reemployment by Kanfer et al. (2001) showed a significant positive relationship between job search intensity and reemployment success and number of job offers and a significant negative relationship between job search intensity and duration of unemployment. However, moderator analysis by sample type showed a weaker positive relationship between job search intensity and reemployment success among older job losers compared to younger new job entrants or younger

employed job seekers. They also found that self-esteem and self-efficacy were more strongly related to job search among older job losers than other sample types.

Findings from a recent meta-analytic investigation of the relationships between age, job search, and reemployment outcomes by Wanberg et al. (2015) suggest a more complex picture. In this study, older individuals reported weaker intentions to engage in job search ( $r = -0.06$ ), lower job search self-efficacy ( $r = -0.08$ ), and lower levels of job search intensity ( $r = -0.08$ ) than younger individuals. Although the effects of age on reemployment success and reemployment speed were partially mediated by job search intensity and job search self-efficacy, age also had a direct impact on reemployment outcomes. These findings are consistent with findings by Liu et al. (2014b) suggesting age-related deficits in self-regulated job search, but they also suggest that other external factors contribute to the finding that older workers take longer and are less likely to obtain reemployment.

### **Adult Development and Older Worker Challenges in Job Search and Reemployment**

Older workers typically have longer job tenures compared to younger workers. As a consequence, they have historically been less affected by economic downturns and less subject to involuntary job loss compared to younger workers. However, when older adults do lose their jobs, they typically experience more difficulty obtaining reemployment. As a consequence, the likelihood of long-term unemployment and exit from the search process increases with age (Klehe et al. 2012; Wanberg et al. 2015).

This section addresses how changes in person attributes, such as abilities, skills, and social relationships, may affect self-regulated job search and employment outcomes.

*Adult Development and Reemployment Goals.* Some lifespan theories of human development (e.g., Heckhausen and Schulz 1995) suggest that as individuals enter later adulthood, employment

becomes less important for providing attainment of important financial, psychological, and social life goals. By age 55, many adults have already spent two to three decades in a career or work role, during which time they have likely satisfied many of the life tasks that characterize early adulthood and midlife, including a sense of mastery over their work role, job promotions, pay raises, and financial resources to support exit from the workforce.

During later adulthood new challenges arise related to maintaining good health, developing avocational skills, and satisfying family-based generativity motives. For example, as individuals age there is normative, gradual decline in nearly all physical abilities. Physically, older adults exhibit declines in strength (Warr 1994), psychomotor abilities, visual acuity, and hearing abilities (Fortexa and Prieto 1994). Given that approximately 45% of workers over age 45 perform work roles that require repetitive physical tasks or work in uncomfortable conditions (Johnson et al. 2011), health decline is a salient issue for many older individuals. These age-related shifts also often lead to a corresponding decline in the perceived value of continued career employment for accomplishing important new life goals and tasks. As a consequence, commitment to obtaining reemployment and job search intentions following job loss may be lower for older adults nearing retirement age than for younger adults more interested in maximizing achievement opportunities (Kanfer et al. 2013; Wang and Shultz 2010).

At present, relatively little is known about the determinants of reemployment goals among older workers following job loss or the factors that may affect goal revision during job search. As noted previously, older individuals may differ in the clarity of their reemployment goal or the features of a new job that are most important. Low-wage earners and older adults with little financial wealth are likely to generate reemployment goals that emphasize income replacement, but such goals may be ill formed with respect to generating helpful job search strategies. Studies that have focused on aging and reemployment are consistent with these notions and indicate that factors such as

financial security, poor health, and attitudes toward retirement play a significant role in older adult reemployment outcomes (Lotters et al. 2013; Patrickson and Ranzijn 2003). Further, older adults who are less committed to reemployment goals are more likely to terminate job search following early search failure.

*Adult Development and Job Search.* Gradual age-related declines in fluid intellectual abilities that contribute to decline in short-term memory and reasoning are well documented (Salthouse 1996). In contrast, crystallized intellectual abilities and occupational knowledge tend to increase through late adulthood (Ackerman 2008). According to the theory of selection, optimization, and compensation (SOC; Baltes and Baltes 1990), older workers adapt to these changes by selecting environments and tasks that capitalize on existing knowledge and skills and by using social and technological supports to complete tasks.

Although older workers may successfully compensate for age-related declines in cognitive abilities on the job (Ng and Feldman 2008; Yeung and Fung 2009), different adaptive strategies may be required in the employment marketplace. Older adults are more likely to use outdated search methods than younger adults, such as job listings in newspapers, even though most job listings and applications today are exclusively online (Gibson et al. 1993; Government Accountability Office 2012; Heidkamp et al. 2010), and older workers who have not been on the job market recently are less likely to have updated basic job search skills, such as preparing an effective resume (Patrickson and Ranzijn 2003) or practicing for an interview (Gibson et al. 1993). Age-related changes in cognitive abilities place a greater burden on the older individual during new skill learning, but older job seekers must often learn new job search skills, such as using online job listing sites. Low self-efficacy for learning new search methods may reduce the use of these methods and ultimately weaken job search intensity. Although SOC theory has yet to be applied directly to job search and reemployment, the theory suggests that job search skill learning and motivation may be enhanced by developing skill training programs that provide

the older adult with access to technological and social support aids when learning new job search methods.

Another area in which age-related changes may affect job search pertains to social relations. Although networking has become an increasingly important tool in modern job search, age-related declines in social network size (Wzrus et al. 2013) may reduce the effectiveness of this search method for older adults. For example, Van Hove et al. (2009) found that older job seekers' social connections were smaller and consisted more of weaker ties to lower-status individuals than did the social networks of younger job seekers. Older job seekers are also less likely to use networking as much as younger job seekers (Zikic and Klehe 2006). These findings suggest that older adults' networking abilities during job search are limited in both quality and scope compared to younger adults. Additional research is needed to evaluate the effectiveness of interventions that help the older worker develop more effective social networks for job search.

### **Environmental Challenges to Older Adult Job Search and Reemployment**

Changes in the nature of job skills most desired by employers and employer negative age stereotypes represent two formidable barriers to older adult reemployment.

*Skill Obsolescence.* Compared to younger employees, older employees (with longer job tenures) are at higher risk for having outdated skills. Following job loss, older job seekers with obsolete skills are less likely to obtain reemployment. Skill obsolescence may occur when employees fail to update skills needed to accomplish new job tasks or when employment declines in an industry or occupational sector reduce the market value of an employee's skills (van Loo et al. 2015). Findings from several research streams suggest that the origins of job-specific skill obsolescence among older job seekers compared to younger employees lie in two areas: (1) the lower rate at which older employees participate (prior to job loss) in employee

development activities that afford opportunity for skill updating (Warr and Birdi 1998) and (2) organizational unwillingness to invest in older employee development (Hamil-Luker and Uhlenberg 2002). Other factors contribute to marketplace skill obsolescence. For example, because declining industries, such as textile manufacturing, are more likely to conduct mass employee layoffs that include older workers, the demand for job skills in those industries is lower (Hirsch et al. 2000), further reducing the number of potential jobs that call for the older worker's skills. Maestas and Li (2006) also suggest that older workers with longer job tenures tend to accrue "firm-specific" skills that may be valued by the organization, but not the larger external job market of that organization (Maestas and Li 2006). Finally, Hamil-Luker and Uhlenberg (2002) suggest that because older individuals tend to have lower levels of education and less job skills training than younger individuals, prospective employers often perceive older workers as less employable.

Following job loss, there is often little an individual can do other than to participate in skill updating or new skill training in order to reduce the negative effects of skill obsolescence on reemployment outcomes. However, for some older job seekers, the immediate financial, social, and psychological costs of training may well surpass the long-term benefits of training to improve the likelihood of reemployment for what may be perceived to be a relatively short period of time (until retirement).

*Negative Age Stereotypes and Age Discrimination.* Age stereotypes are beliefs and expectations about individuals based on their age (cf. Posthuma and Campion 2009). Employer age biases, developed from age-based stereotypic beliefs, operate as subtle and pervasive impediments to older worker reemployment success (Bal et al. 2011; Roscigno et al. 2007). Although the 1967 Age Discrimination in Employment Act makes employer decision-making based on age illegal, the legislation does not preclude attitudinal or affective biases that employers may hold about older individuals or their unintentional effects on hiring decisions.

There is extensive research on the prevalence of negative, age-based stereotypes, but less direct evidence on the impact that such negative stereotypes exert in real-world hiring decisions (Hedge et al. 2006). Ahmed et al. (2012) provide evidence for negative age stereotype bias in their study of hiring decisions across a range of restaurant and sales jobs. They found that younger applicants who submitted resumes for restaurant and sales jobs received significantly more responses from employers than older applicants (who submitted the same résumés).

Qualitative and meta-analytic reviews on the validity of negative age stereotypes by Posthuma and Campion (2009) and Ng and Feldman (2012) indicate that common negative stereotypes about older workers are not valid. For example, results of a recent meta-analytic review by Ng and Feldman (2012) on six negative age stereotypes (e.g., that older workers are less motivated or less healthy) found support for only one stereotype, namely, that older workers are less willing to participate in training and career development activities.

During job search, older adults often attempt to overcome negative age stereotypes by concealing their age on résumés, making changes to physical appearance, and using updated language in interviews (Berger 2009; Lyons et al. 2014). The use of negative aging stereotypes by employers during the hiring process can also be discouraging to older job seekers and may spur these individuals to exit the labor force after several unsuccessful reemployment attempts (Maestas and Li 2006). Although little support exists for most negative age stereotypes, their influence on employer decisions can reduce job search motivation as well as the likelihood of reemployment.

## Summary and Future Research Agenda

Job loss and job search during later adulthood is becoming increasingly common as older individuals seek to remain in the workforce longer, whether by choice or financial necessity. Research findings support the use of a self-regulation model of the job search process as a viable framework for

understanding the job search process and how it relates to reemployment outcomes. Evidence to date suggests that following job loss, older job seekers, particularly those over age 50 (Wanberg et al. 2015), experience greater difficulties in job search, longer job search, and lower likelihood of obtaining reemployment than younger job seekers. Theories of adult development have proved fruitful for identifying some of the unique challenges that older job seekers confront during the search process, but do not fully account for age-related differences in reemployment outcomes. Findings from research focused on environmental determinants suggest that skill obsolescence and negative age bias in employer hiring decisions also play a significant role in older job seeker reemployment. Although certainly not an exhaustive list, three broad and promising avenues for future research on job loss, job search, and reemployment in later adulthood may be identified:

### 1. *The development and dynamics of re-employment goals*

Findings to date suggest that job search clarity plays a positive role in self-regulated job search and reemployment outcomes (Zikic and Klehe 2006). Additional foundational research is needed to understand the latent structure of reemployment goals for older adults nearing normative retirement age and to provide for valid assessment of these goals. Advances in these areas can be expected to aid in the development of at least three promising research streams: (1) research aimed at identifying key patterns of reemployment goal revision among older adults across the job search process, (2) studies that examine the relationship between reemployment goals, employability, and well-being, and (3) studies to examine the prevalence of “job choosiness” among older job seekers and its impacts on job search and reemployment outcomes (Trivellato and Giraldo 2006).

### 2. *Job search and reemployment outcomes*

Most studies of job search and reemployment following job loss employ relatively high-level measures of reemployment

outcomes, such as whether the individual obtained reemployment and the duration of unemployed job seeking before employment was secured. Over the past 15 years, organizational researchers have repeatedly called for more research attention to reemployment quality (Saks 2006; Koen et al. 2010; Wanberg et al. 2015). This issue is particularly important for older adults, for whom poor-quality reemployment may hasten exit from the workforce.

### 3. Adult learning, job loss, and employability

Although macro-level economic conditions and organizational restructuring may account for a substantial portion of older adult job loss, a few recent findings suggest that older adults who continue to develop work skills of value to the organization are less likely to lose their jobs than individuals who do not participate in development opportunities (Allen and de Grip 2012; de Grip and van Loo 2002). Similarly, individuals who engage in continuous learning may be more desirable in the employment marketplace. Although many studies have focused on the impact of age-related declines in cognitive function in traditional training settings, less attention has been given to the participation and learning outcomes of older adults in alternative training methods, such as on-the-job training and informal training (Van der Klink et al. 2014). Future research into the determinants and patterns of later adulthood learning (Beier and Ackerman 2005) and its relationship to employability and reemployment outcomes holds strong theoretical and practical promise.

## Cross-References

- ▶ [Age-related Changes in Abilities](#)
- ▶ [Work Motivation and Aging](#)

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## Knowledge Retention at Work and Aging

Anne Burmeister<sup>1</sup> and David Rooney<sup>2</sup>

<sup>1</sup>Leuphana University of Lüneburg, Lüneburg, Germany

<sup>2</sup>Macquarie University, Sydney, NSW, Australia

### Synonyms

Continuity management; Intergenerational knowledge transfer; Intergenerational learning; Knowledge management; Reverse knowledge transfer

### Definition

In the context of aging workforces, knowledge retention refers to management practices and processes designed to preserve older workers' valuable organizational knowledge before they enter retirement.

### Introduction

Workforces in most developed countries are aging because of the simultaneously operating trends of increased life expectancies and decreased birth rates (United Nations 2013). Due to the large numbers of very experienced older and retiring

workers from the so-called baby boomer generation, organizations are facing an unprecedented and unintentional loss of valuable organizational knowledge (Beazley et al. 2002; Daghfous et al. 2013). When valuable employees retire, valuable knowledge retires with them if there are no effective knowledge management or human resource (HR) management processes in place to prevent it. Calo (2008, p. 404) argued that this combination of interrelated and undesirable demographic conditions creates a “perfect demographic storm.” Several researchers have focused attention on the risks associated with losing older and retiring workers' knowledge. These risks range from reduced quality, efficiency, and performance (Ashworth 2006; Beazley et al. 2002; Strack et al. 2008) to diminished creativity (Calo 2008) and limited capacity of organizations to learn from past experience (Dunham and Burt 2011). To prevent *corporate amnesia* (Harvey 2012), organizations need to develop knowledge retention strategies to safeguard valuable organizational knowledge of older and retiring workers.

The objective of this entry is threefold. First, the main terms related to knowledge retention are clarified, the nature of the knowledge retention process is discussed, and its antecedents are identified. Second, knowledge retention is related to life span development theories, such as socioemotional selectivity theory (SST; e.g., Carstensen 2006), and motivations of workers to engage in knowledge retention, and these theories

are reviewed. Third, implications for practitioners and directions for future research are discussed.

## Knowledge Retention Through Knowledge Transfer

In the context of aging workforces, knowledge retention refers to practices and processes that preserve valuable organizational knowledge of older workers before they enter retirement. For this entry, we take older workers to be employees who are older than 50 years and due for retirement within the next 15 years (Joe et al. 2013). Currently, these workers are members of the so-called baby boomer generation, which is large in numbers and consists of workers born between 1946 and 1964 (Kuyken 2012). This kind of generational concept has been challenged because of its lack of theoretical and empirical foundation (Costanza et al. 2012; Costanza and Finkelstein 2015) and will only be used descriptively in this entry to distinguish between the different actors involved in the knowledge retention process.

### Knowledge of Older Workers

Older workers' knowledge has been defined as the sum of their explicit and tacit knowledge (Lahaie 2005). Knowledge can be defined as "information [interpretation of data (i.e., facts)] interpreted by an individual and applied to a purpose for which it is needed" (Bender and Fish 2000, p. 126). Tacit knowledge is different to explicit knowledge and describes knowledge that is complex, difficult to codify, and difficult to teach (Zander and Kogut 1995). Researchers have argued that the knowledge of older workers is mainly tacit (Beazley et al. 2002; Kuyken 2012; Martins and Meyer 2012). For example, older workers possess knowledge about the functioning of their organization with regard to its norms, politics, and culture, and they have extended intra- and interorganizational networks (Ebrahimi et al. 2008; Joe et al. 2013; Kuyken 2012). In addition, the knowledge of older workers has been related to the concept of *organizational memory* (Dunham and Burt 2011; Lahaie 2005), which is defined as "stored information from an

organization's history that can be brought to bear on present decisions" (Walsh and Ungson 1991, p. 610). Importantly, this knowledge held by older workers is useful for learning from past experiences (Dunham and Burt 2011). In addition, older workers' knowledge about who knows what, and their potential ability to connect different knowledge sources, has been explained using *transactive memory* theory (Ashworth 2006; Ebrahimi et al. 2008). Transactive memory theory (Wegner 1987) explains how group members tend to rely on each others' expertise to perform demanding tasks, such that each member specializes in specific areas, thus ensuring that all relevant information is available through combining all their specialized knowledge.

Resulting from the diverse attributes that have been associated with the knowledge of older workers, they have been described as *deep smarts* (Kuyken et al. 2009). The use of this term highlights that older workers' knowledge goes beyond traditional definitions of knowledge that focus on asocial, objective, rational truths (e.g., Bender and Fish 2000). Researchers have used the terms *expertise* (Ebrahimi et al. 2008; Joe et al. 2013) and *wisdom* (Beazley et al. 2002) to more accurately depict the depth of the knowledge and capabilities of older workers. Expertise is acquired over longer periods of time and refers to "specialised, deep knowledge and understanding in a certain field, which is far above average" (Bender and Fish 2000, p. 126). Wisdom is based on reason while explicitly allowing for the nonrational (McKenna et al. 2006, 2007; Rooney et al. 2010a). However, one should be careful not to assume that wisdom necessarily comes with age, experience, and expertise. Many older people, experienced people, and experts are not wise. Wisdom is linked to how one learns, deeply, from experience, regardless of age, and how one transcends technical expertise with insight, imagination, values, and empathy.

### Knowledge Transfer

Knowledge is profoundly social and works within communities of practice (Nonaka and Takeuchi 1995; Rooney 2005; Tsoukas 2005). Knowledge exists in the relationship between people as much

as it does within individual minds. More particularly, the value of knowledge is created as it passes or transfers or is communicated between people in social exchanges (Owen-Smith and Powell 2004).

Researchers argue that older and retiring workers who possess valuable organizational knowledge need to be involved in knowledge transfer initiatives to prevent knowledge loss (Beazley et al. 2002; DeLong 2004). Knowledge transfer involves sharing or communicating knowledge (Szulanski 1996; Wang and Noe 2010). For knowledge retention to occur, older and retiring workers and those workers that are potential knowledge recipients need to interact and communicate in knowledge transfer processes, that is, social interaction and communication. Importantly, these interactions require some level of intimacy for tacit knowledge to be transferred (Rooney et al. 2013). In the context of this entry, these potential knowledge recipients will be younger than the retiring workers, and they often belong to different generations (e.g., generation X, generation Y; Baily 2009). Therefore, researchers refer to knowledge retention through knowledge transfer as *cross-generational knowledge flows* (Liebowitz et al. 2007), *intergenerational learning* (Baily 2009), and *intergenerational knowledge transfer* (Burmeister and Deller low risk R&R; Harvey 2012).

### Competing Models: Source-Recipient Model and Mutual Exchange Model

Extant research discusses whether knowledge retention through knowledge transfer is more accurately represented by one-directional or bidirectional exchange processes. Drawing on the source-recipient model, older workers are depicted as knowledge sources, and younger workers as knowledge recipients. Transfer occurs through the one-directional transmission, older workers' knowledge to younger workers. In contrast, the mutual exchange model proposes that knowledge is codeveloped by older and younger workers and that both groups of actors engage in sharing and reception of knowledge (Harvey 2012). For example, younger workers can contribute current scientific and technical knowledge and function as catalysts that unlock the knowledge

base of older workers (Ebrahimi et al. 2008; Tempest 2003). As a result, knowledge retention through knowledge transfer is understood as a bidirectional, dynamic, and interactive process. We argue that both models can be accurate representations, depending on situational characteristics and the type of knowledge to be transferred. For example, if highly tacit knowledge must be transferred, older and younger workers need to engage in more intense or intimate interactions to make sense of the knowledge. The mutual exchange model more accurately depicts this type of transfer. Conversely, the retention of explicit knowledge that can be documented in written form is more easily transferred without meaningful social interactions. This type of transfer describes the source-recipient model. It is important to understand that most knowledge, and high-value knowledge in particular, is rarely in the form of purely explicit knowledge (Rooney et al. 2003). There is usually a high degree of tacitness in knowledge, and so the mutual exchange model is usually the most relevant model.

### Antecedents of Knowledge Transfer Success

Knowledge transfer research argues that four groups of antecedents influence knowledge transfer success: (1) knowledge characteristics (e.g., Zander and Kogut 1995), (2) individual characteristics (e.g., Argote et al. 2003), (3) relationship characteristics (e.g., Hansen 1999), and (4) contextual characteristics (e.g., Kostova 1999). Researchers have started to examine the applicability of these antecedents to knowledge retention processes. First, knowledge characteristics and particularly knowledge tacitness are argued to influence the degree of social interaction between senders and recipients that is necessary to facilitate knowledge transfer (McNichols 2010). In addition, knowledge characteristics are considered in terms of the relevance and importance to an organization of older workers' knowledge because not all knowledge is relevant to organizational performance. Therefore, organizations need to assess the relevance of the knowledge from older workers before they invest in knowledge retention (Beazley et al. 2002).

Second, the discussion about individual characteristics revolves around the ability and motivation of older and younger workers to interact and share knowledge (Dunham and Burt 2011; Kuhn and Hetze 2007). Thus, the more able and motivated individuals are to engage in knowledge transfer behavior, the higher the probability of successful knowledge retention. Third, relationship characteristics refer to variables that affect the quality of the relationship between knowledge senders and recipients. In the context of intergenerational knowledge transfer (IGKT), the age differences between older and younger workers have been discussed as barriers to transfer success because dissimilarities might result from a lack of shared cognitive frames of reference and mental models (Harvey 2012; McNichols 2010). In addition, lack of mutual trust and respect are emphasized as other barriers to IGKT (Harvey 2012; McNichols 2010). Mutual trust reduces the risk involved in engaging in knowledge transfer behavior. Fourth, contextual characteristics are highlighted as an important factor for IGKT. Accordingly, HR managers can support IGKT processes by creating opportunities for exchange, enabling and motivating workers to engage in IGKT through, for example, training and reward programs, and aligning HR practices and processes to facilitate knowledge retention (Beazley et al. 2002). Furthermore, organizational cultures need to support a learning environment and encourage openness, teamwork, and knowledge sharing, to facilitate IGKT (Beazley et al. 2002; McNichols 2010). IGKT should, therefore, be seen as part of the work of managing organizational diversity and creating organizational cultures that are open and inclusive (Pauleen et al. 2010).

### **Knowledge Retention and Life Span Development Theories**

Theories of psychological aging focus on how individuals experience their own aging and how they anticipate time-induced changes (Hertel and Zacher *in press*). Life span development theories propose that behavioral development should be seen as a lifelong process in which growth and

decline occur jointly (Baltes 1987). To understand IGKT behavior of older and younger workers, life span development theories that focus on age-induced changes in goal orientations are particularly useful. For example, socioemotional selectivity theory (SST) introduced by Carstensen (2006) claims that individuals select and pursue goals as a function of subjective perceptions of remaining time. As a result, if time is perceived as unlimited, individuals prioritize knowledge-related goals, whereas individuals who perceive time as limited tend to focus on emotional goals and social values (Carstensen et al. 1999). This prediction is in line with Erikson's (1963) theory of psychosocial development that introduced generativity as a fundamental motive in the seventh of eight stages of human development and as gaining in importance through adulthood (Hertel et al. 2013). Generativity can be defined as "the concern in establishing and guiding the next generation" (Erikson 1963, p. 267). In accordance with these theoretical assumptions, empirical research has indeed shown that age is positively related to generativity values (e.g., helping, legacy) and negatively related to extrinsic growth values (e.g., gaining influence, advancing one's career; Hertel et al. 2013).

Using SST and psychosocial development theory, IGKT can be seen as a mechanism that addresses the different needs and motivations of older and younger workers. On the one hand, the growth values of younger employees are addressed by providing them with access to important and useful organizational knowledge of older workers. Younger workers can use this organizational knowledge to increase their performance and advance their careers. On the other hand, older workers receive the satisfying opportunity to share their knowledge with others and give something back. As a result, IGKT can ensure that the knowledge of older workers is safeguarded and will continue to be used in the future, even if they leave the organization.

### **Future Directions**

The theoretical foundation of knowledge retention research needs to be strengthened. Studies

either lack theoretical foundation or provide limited reasoning for how and why older and younger workers engage in knowledge retention and IGKT. One exception is provided by Ropes (2013), who used Erikson's (1963) generativity concept to argue that IGKT contributes to the self-fulfillment of older workers. Future studies can draw on life span development theories to explain age-related differences with regard to knowledge transfer behavior. In addition, other theories that are relevant to knowledge transfer behavior, such as social exchange theory (Blau 1964), social identity theory (Tajfel 1974), place identity theory (Rooney et al. 2010b), organizational learning theory (March 1991), social learning theory (Wenger 2000), communities of practice theory (Wenger 1998), intergenerational communication theory (Williams and Nussbaum 2013), and wisdom theory (Oktaviani et al. online first), should be considered.

An important concept in education research is authentic learning (Lombardi 2007). Authentic learning is primarily about giving students the opportunity to encounter complex questions, problems, or situations that they are likely to face in the future and to develop mastery through that engagement (Cronin 1993). Rule (2006) says the core dynamics of authentic learning are (1) encountering (close approximations of) real-world problems, (2) using higher order thinking skills, (3) communicating between members of a community of learners, and (4) empowering students to choose their own learning pathways. Based on the discussion set out above, and particularly our discussion following the mutual exchange model, there is clearly much scope for applying an authentic learning approach in IGKT. To date, there appears to be no empirical research on authentic learning in IGKT situations, and there is much to be gained in the future from such research. Of course, in the IGKT context, we are talking about adult learning in the workplace, rather than school students in the classroom, but Rules' four core dynamics are readily transferable to the workplace and organizational learning.

Future research should also aim to overcome the methodological shortcomings of research on

knowledge transfer in general and with respect to IGKT in particular. Wang and Noe (2010) showed that current studies on knowledge transfer have the following limitations: overreliance on self-reports, single-source and cross-sectional data, and unclear definitions of outcome variables (e.g., frequency/quality/extent of knowledge transfer). In addition, studies on IGKT are often based on qualitative analyses or case studies (e.g., Harvey 2012), and samples are often small or not designed for generalizability. Having said this, qualitative research using discourse analysis and sociolinguistics, phenomenological, and grounded theory approaches will add significant new findings in relation to complex and hard to quantify aspect of the intersection of knowledge, values, and organizational culture with IGKT. In sum, future studies should aim to provide stronger theoretical contributions and use more advanced research epistemologies, designs, data collection approaches, and measurement instruments.

## Practical Implications

To address the risk of losing valuable older and retiring workers' organizational knowledge, HR practitioners and knowledge managers need to develop an integrated knowledge retention strategy that includes the following three elements. First, key knowledge holders need to be identified, and the valuable knowledge that they possess needs to be documented. Second, mechanisms need to be set up that enable the transfer of this critical knowledge to other organizational members, in particular younger workers. Third, HR policies and practices and the organizational culture need to be aligned with the objective of knowledge retention.

## Cross-References

- ▶ [Age Diversity at Work](#)
- ▶ [Expertise and Ageing](#)
- ▶ [Life Span Developmental Psychology](#)
- ▶ [Organizational Wisdom and Aging](#)
- ▶ [Socioemotional Selectivity Theory](#)

- ▶ [Work Motivation and Aging](#)
- ▶ [Workplace Creativity, Innovation, and Age](#)

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## Knowledge, Acquisition and Retention

Phillip L. Ackerman  
School of Psychology, Georgia Institute of  
Technology, Atlanta, GA, USA

### Synonyms

Facts; Information; Skills

### Definition

Knowledge represents a body of factual information, skills, and tools for understanding the world.

## Types of Knowledge

Over the course of the last several decades, psychologists have settled on parsing knowledge into three different types. Ryle (1949/2000) first suggested two different types of knowledge, namely, knowing *that* (which has been termed “declarative knowledge”) and knowing *how* (termed “procedural knowledge”). Declarative knowledge is essentially factual knowledge, such as knowledge of geography (capitols of the world), history (names and events), humanities (artists, composers, and their works), and so on. Generally speaking, the common encyclopedia contains a comprehensive compendium of the declarative knowledge of a culture. Procedural knowledge mainly concerns skills that allow an individual to accomplish a task, whether it be driving a car or riding a bicycle, calculating a tip at a restaurant, or tasks such as diagnosing a car engine malfunction or a radiologist making a diagnosis from a chest X-ray. In the normal course of events, the acquisition of procedural skills typically involves declarative knowledge at the early stages of skill acquisition. For example, in learning to drive a car, a novice driver might attempt to memorize a set of condition-action pairings. For example, the driver might say to him/herself: “If I want to turn left, I need to turn on my signal, slow down, check for oncoming traffic, and then turn the wheel to the left.” With extensive practice, these condition-action pairings become automatized, such that the skilled individual “knows” how to accomplish the task without the explicit engagement of considering the sequence of condition-action pairings. At this point, psychologists consider the knowledge “proceduralized.” However, although it is common for skilled individuals to accomplish tasks without much explicit cognitive mediation (e.g., thinking about which keyboard keys to select to type an e-mail or which piano keys correspond to particular notes on the music score), proceduralized knowledge need not entirely be automatic. When an individual is performing a procedural knowledge skill, he or she may choose to explicitly consciously monitor his/her performance, especially when attempting to improve on

past performance, such as when attempting to improve one’s tennis or golf game.

The third type of knowledge, identified by Polanyi (1966/1983), called “tacit knowledge” represents a domain that is less well defined, when compared to declarative and procedural types of knowledge. Tacit knowledge represents the kinds of knowledge that people rely on to solve novel problems or to conduct means-ends analyses when confronted with tasks that cannot be solved directly by drawing on declarative knowledge or previously learned procedural knowledge/skills alone. Broudy (1977), for example, suggested that tacit knowledge is not easily accessible, so that it is often difficult or impossible for the individual to articulate the knowledge used for such problem solving. Nonetheless, Broudy suggested that tacit knowledge represents the foundation for what an individual “thinks, perceives, and judges with everything he has studied in school, even though he cannot recall these learnings on demand” (Broudy 1977, p. 12).

## Knowledge Acquisition

Over the last century, psychologists and others have explored numerous ways in which acquisition of knowledge can be effective and efficient. Novel attempts at making procedures such as implicit learning or sleep learning effective have been tried and generally found largely useless. Variants of more traditional approaches that typically involve direct memorization or associative learning (e.g., when learning a new language, pairing known words in the home language with words having the same or similar meaning in the new language) represent the most effective means of acquiring new declarative knowledge. Periodically, researchers rediscover that drill and practice, and periodic tests for knowledge learned, may increase the overall effectiveness of declarative knowledge acquisition over learning without frequent testing (see Bransford et al. 2000).

Acquisition of procedural knowledge is somewhat more complex, and as a result, the most effective methods for acquiring procedural knowledge are less well understood, in

comparison to the acquisition of declarative knowledge. Because, as discussed earlier, acquisition of procedural knowledge often starts with an individual acquiring a declarative knowledge representation of the material (such as learning to pilot an airplane or become a radiologist), it is necessary for the learner to spend a considerable amount of time and effort acquiring a declarative representation of the task requirements before even starting to practice the procedural task. Individuals seeking to become a pilot or a medical doctor may spend hundreds of hours in classroom instruction to learn basic principles or system functions, before a novice pilot climbs into the pilot's seat or a novice medical student attempts a diagnosis of a human patient. Because acquisition of such procedural skills involves a combination of declarative knowledge learning and hands-on task practice, researchers have investigated various combinations of such skills, mixing different amounts and sequences of rote and associative learning and task practice, in order to find an optimal process for building new procedural skills. Some attempts have been aimed at breaking the tasks into components and providing part-task training prior to complete task practice or "scaffolding" learning in a sequence that allows the learner to build up procedural knowledge in phases (for a review, see Druckman and Bjork 1991).

With respect to tacit knowledge, there is virtually no direct research on how to build new tacit knowledge, mainly because it is not currently possible to determine exactly how individuals develop tacit knowledge. Even attempts at determining the nature and scope of tacit knowledge have been largely very narrow (restricted to particular tasks or occupations) and not entirely successful in eliciting such knowledge in a reliable fashion.

### **Aging and Knowledge Acquisition**

Laboratory research comparing younger and older adults in the acquisition of knowledge started in the early part of the twentieth century. The findings from this older literature indicated that children and young adults acquire new knowledge faster than middle-aged or older adults and have

higher degree of knowledge at asymptotic levels of practice (e.g., see Hollingworth 1927; Ruch 1934; Thorndike et al. 1928; for a review, see Ruch 1933). More recent research efforts have typically compared the knowledge acquisition performance of college students and adults over the age of 60. These comparisons yield largely similar results to those found in the 1920s and 1930s. That is, young adults learn faster and retain knowledge after explicit learning exposure at a higher level than older adults (see, e.g., reviews by Light 1991; Johnson 2003; and by Verhaeghen et al. 1993).

### **Transfer and Knowledge Acquisition**

The one area where middle-aged and older adults can be expected to perform as well as young adults in the acquisition of new knowledge, or at least show less of a deficit, in comparison to young adults, is when new knowledge is built on a foundation of old knowledge. That is, middle-aged and older adults are found to be at a disadvantage in acquiring "novel" declarative knowledge (i.e., knowledge where there is no external context – such as the task of memorizing random words or numbers), compared to young adults. However, most real-world declarative knowledge is highly contextualized, that is, the knowledge to be acquired is part of a larger network of interconnected foundational knowledge. Those individuals who have higher levels of relevant domain knowledge will be faster in learning new factual information than those from whom the new knowledge is novel. For example, when reading a newspaper (or online news item), the typical adult scans the article for information that is "new" and can either refresh old knowledge or give it only a cursory examination. For an adult, information about politics, entertainment, current events, and even science and technology is acquired incrementally, so that the load on the individual's memory capabilities is much lower than for someone who is not familiar with the general foundational content of the new information. Middle-aged adults who have higher levels of what is called "crystallized intelligence" (basically, their depth and breadth of domain knowledge) are much more effective in acquiring

new declarative knowledge, compared to either younger adults or other middle-aged adults who have lower levels of crystallized intelligence (e.g., see Beier and Ackerman 2005).

## Knowledge Retention

Clearly, older adults are at a general disadvantage, compared to young adults, in acquiring new declarative and procedural knowledge. Studies of short-term knowledge retention, both in and outside of the laboratory, consistently show that middle-aged and older adults are at such a disadvantage compared to young adults (e.g., see Light 1991; Kubeck et al. 1996). Nonetheless, once knowledge is acquired, whether by younger or older adults, there are critical and open questions about the effects of aging and long-term knowledge retention. The problem is difficult, given numerous methodological obstacles in studying long-term knowledge retention, mainly because time delays between assessments involve aging effects, but also often intervening opportunities for use of the knowledge, new learning, and reminiscence effects. Thus, the studies described below provide somewhat indirect evidence on the resilience of knowledge over long periods, but together they present an optimistic view about aging and knowledge retention.

### Declarative Knowledge

The first long-term study of knowledge retention was performed by Owens (1953). He examined a group of men who had completed the Army Alpha test battery (an early adult test of intellectual abilities) in 1919, when they were about 19 years of age. He readministered the test to the same men 31 years after the original test and found significant gains in performance on two subtests, a test of information (general knowledge) and a verbal ability test (synonym/antonym). It is impossible to determine how much exposure to these materials or use of the knowledge was experienced during the intervening years, but these results indirectly suggested that declarative knowledge retention can be very good over a long period of time. In a more precisely controlled study of individuals

over several decades, starting in 1956, Schaie (1996, 2005), in the context of the Seattle Longitudinal Study, found similarly impressive performance of individuals on tests of verbal knowledge (e.g., vocabulary).

In a different line of inquiry, Bahrck and his colleagues (e.g., Bahrck et al. 1974) examined adults, 35 years after graduating from high school. They found that these individuals correctly recognized 90% of their classmates, based on photographs. In another study, Bahrck (1984) examined Spanish language retention, over various time periods, up to 50 years after initial instruction. What he found was that although much of the acquired knowledge was lost in the 6 years following instruction, substantial knowledge was retained up to about 25 years after instruction. Most importantly, Bahrck determined that individuals retained more knowledge when it was originally acquired over a long period of initial instruction and that individuals with superior performance at initial knowledge acquisition (e.g., students who had received higher grades) retained substantially more knowledge than those who did not have such high level of initial performance.

From a different perspective, Beier and Ackerman (2001) examined “current-event” declarative knowledge in a sample of individuals from age 20 to 69, where the events had occurred during the decades from the 1930s to 1990s. They found that adults tended to have the highest levels of current-events knowledge from the respective periods of late adolescence or early adulthood. Although this was a cross-sectional study (i.e., individuals were not followed over time, but rather separate age groups were examined at a single time), these results are consistent with the notion that there may be critical periods for acquisition of declarative knowledge around late adolescence – an idea that is also supported in studies of autobiographical memory (e.g., Rubin 1995).

### Procedural Knowledge

Measurement of procedural knowledge retention can be performed with two related methods. The first method is relatively straightforward – individuals are confronted with a task previously

learned and asked to reproduce the performance. However, this is a one-shot examination. That is, if the individual is given an opportunity to try the task more than once, or even if the task is extensive in time, the problem then becomes one of an unknown amalgamation of assessing retention and assessing relearning of the procedural skill.

Consider the task of riding a bicycle. One could conceivably train a group of young adults or even children on how to ride a bicycle. At some later point, these individuals return to the lab and are asked to ride the bicycle again (presumably excluding those who had intervening experience with bike riding). In the first minute or so of performance, those individuals are both attempting to show their retained knowledge and also increasingly are becoming re-familiarized with the skill (one frequently hears such individuals say something on the order of: “it is all coming back to me now”). From this perspective, the typical method for assessing retained procedural knowledge is to examine a relearning curve. That is, one compares how much time (or how many discrete task trials) is required for the individual to again reach a criterion level of task performance, against the original learning curve for those individuals and/or initial learning curves for a separate group of individuals of the same age, who had no prior experience with the task.

The most interesting investigation of this type was reported by Hill (Hill et al. 1913; Hill 1934, 1957). In the original investigation, Hill learned how to touch-type on a typewriter in daily practice sessions over a 5-month period. Hill returned to the typewriter only twice – once 25 years after the initial procedural knowledge acquisition and then 50 years after the initial practice (when he was 80 years old). At 25 years without practice, Hill performed at the same level of performance that had been achieved after 27 days of initial practice. At the 50-year retention evaluation, it only took Hill 8 days of relearning to reach the level of performance that he had achieved 25 years earlier!

Because study of long-term retention of procedural knowledge requires that individuals, like Hill, do not practice the task over long periods of time, there are no other similarly designed

investigations in the literature. However, the evidence from relatively short-term studies (on the order of weeks or months, rather than years) is that “forgetting increases as a positive function of the retention interval, overlearning is beneficial for retention, relearning after a retention interval is more rapid than the original learning, [and] discrete procedural responses are forgotten more readily than continuous motor skills” (Adams 1987, p. 65; see also Farr 1987).

When it comes to generalizing these findings to the area of adult aging, one important caveat is needed. That is, procedural knowledge skills almost always involve a major component of physical operations, whether they be gross motor movements (as in riding a bicycle) or fine motor coordination (such as in performing cardiac surgery). Thus, the effects of aging on the expression of procedural knowledge may be adversely affected by normal effects associated with the reduction of motor capabilities with advancing age (not to mention additional issues associated with visual and auditory sensory changes also associated with aging). With that caveat in mind, the existing research suggests two important things about the retention of procedural knowledge: (1) High levels of retention are substantially associated with periodic exposure and practice with the skill; and (2) Once learned to a high degree of competence, many procedural skills may be very much like the old adage about riding a bicycle (i.e., once learned, never [entirely] forgotten).

**Knowing With.** As discussed earlier, the nature of tacit knowledge makes direct study of retention exceptionally challenging. Thus, there are really no studies that establish the retention of tacit knowledge in the course of adult aging. Several investigators have attempted to reframe aspects of tacit knowledge, for example, in the study of “wisdom” and aging (e.g., see Baltes and Staudinger 2000). However, such studies fall short of the goal of examining tacit knowledge, as they depend on performing novel tasks, rather than explicitly calling on an individual’s repertoire of previously acquired strategies for problem solving. Currently, it is not clear what the pattern of retention and forgetting is for this type of knowledge.

## Summary and Conclusions

Psychologists have categorized knowledge into three types: knowing that (declarative knowledge), knowing how (procedural knowledge), and knowing with (tacit knowledge). After nearly 100 years of investigations into the relationships between aging and knowledge, researchers have come to a general consensus on at least some of the critical issues. First, acquisition of new knowledge is faster and more effective for adolescents and young adults, compared to middle-aged and older adults. In laboratory studies of novel fact learning or acquisition of novel procedural skills, older adults tend to perform less well initially and typically do not reach the asymptotic levels of performance obtained by young adults. However, it is important to keep in mind that these are average differences – there is substantial overlap in the distributions of learning rates and overall performance between younger and older individuals. Second, because real-world knowledge acquisition is influenced by an individual's domain knowledge, differences between young and old adults in acquiring contextually dependent knowledge in many domains are smaller than those found for acquiring context-free or novel knowledge.

Studies of knowledge retention suggest that both young and older adults benefit greatly from continued access and use of domain knowledge. When declarative knowledge is not accessed over long periods of time (such as when learning a foreign language in school, but not using or practicing again for many years), the degree of retention is dependent on how well the knowledge was acquired to begin with. But in general, lack of use leads to substantial losses in declarative knowledge. For many types of procedural knowledge and skills, the extant research suggests that after long periods of time without practice or use of such skills, performance is reduced, yet is much more quickly reacquired with new practice than the rate the material was acquired during initial learning and skill acquisition.

Aging effects on the acquisition and retention of tacit knowledge remains much less well understood, compared to declarative and procedural

forms of knowledge. Related investigations suggest that when this type of knowledge is well integrated into an individual's day-to-day activities (such as having a job that makes substantial cognitive demands (see Schooler et al. 1999), such knowledge might be retained well into older adult years.

In the final analysis, acquiring new knowledge and skills is easiest for adolescents and young adults. But, knowledge acquired during this period can be well maintained in middle age and beyond, when the knowledge is accessed and used and when the procedural skills are practiced. An individual's knowledge in adulthood is the result of early investments and continued efforts toward maintenance. There may ultimately be a good scientific basis for the common belief of the benefits of efforts with tasks such as doing crossword puzzles and similar activities.

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## Korean Centenarian Study, Comprehensive Approach for Human Longevity

Sang Chul Park  
Department of New Biology, DGIST, Daegu,  
South Korea

### Definition

The nationwide Korean Centenarian Study is special in that a multidisciplinary team approach has been successfully applied through the collaboration of medical, genetic, psychological, nutritional, ecological, economic, family, social, and anthropologic experts. Thereby, it could be possible to explain the features of the centenarians through a holistic approach for the differential and interactive influences of genes, gender, eco-habitats, diets, and socio-cultural variables on longevity. Genetic traits of the Korean centenarians are unique, illustrating the gene and environmental interactions. Gender ratio of centenarians is rather biased to female, and not uniformly but regionally localized. Male centenarians, though fewer in number, are better off functionally and need less medical care than female centenarians. Centenarians living in the mountainous regions are better off than those living near the seashore. Centenarians with outdoor activities showed the significantly higher levels of serum albumin, but a lower serum triglyceride level as compared to the sedentary centenarians. The proportion of centenarians who scored high in dietary diversity was significantly higher in mountainous areas than in the coastal areas. These data implicate the heavy interactions among many variables for longevity. Based on the integration of these variables, a new model for human longevity is proposed, “Park’s Temple Model for Human Longevity.” In this model, the longevity-associated variables are classified into layers of bottom, pillars, and rooftop. The bottom component of the temple consists of the variables, such as genes, genders, personality, ecology, and social cultures, which are basically

not readily changeable. The pillar components are related with personal life styles, such as exercise, nutrition, relationship, and participation, which are more or less readily modifiable. The rooftop components are rather socially or politically determining variables, such as social care, safety, and medical support system. Therefore, this compensating, balancing, and comprehensive model for human longevity, based on the Korean Centenarian Study's multidisciplinary and integrative team approach, may provide a new tool to explain the mechanism of human longevity and also may contribute to analyze the dynamic changes of population longevity.

### Genetic Variables for Longevity

Multiple candidate genes for longevity have been reported in previous centenarian studies. Genes, involved in inflammation and the immune responses (e.g., *IL6*; *LMP2*; *TNFA*; *TGFBI*; and *PPARγ*), genome maintenance and repair (e.g., *P53*), lipid metabolism (e.g., *APOE*; *CETP*; *MTTP* and *PONI*), glucose metabolism (e.g., *IGF1* and *HFE*), oxidative stress (e.g., *SOD1*; *PARP*; and *GSTT1*), mitochondrial mutation, premature aging syndromes such as Werner syndrome (i.e., *WRN*), and telomere length, have been suggested with respect to both age-related diseases and longevity (Murabito et al. 2012). However, genetic variation exists across ethnic groups. Significant association of genes for human leukocyte antigen (*HLA*), *ACE*, *APOE*, *MTTP*, and *CETP* with human longevity in Caucasian populations has not been replicated in studies using Korean centenarians (Choi et al. 2003; Park et al. 2009). Rather, a reverse relationship between the incidence of cancer and degree of longevity has been observed, indicating that prevention of cancers may be an important strategy to enhance lifespan in Korea (Kwon and Park 2005). This notion could be applied to other age-related illnesses such as diabetes mellitus and cardiovascular diseases as well (Park et al. 2009). Individual survival differences may reflect the effect of deleterious genotypes of age-related diseases. Some longevity genes (e.g., *klotho*) buffer the

deleterious effect of age-related disease genes (e.g., lipoprotein, Lp(a)), which may explain an observed paradoxical increase of deleterious genotypes in centenarians. Among many of the genes, the Korean centenarian Study revealed two interesting features of longevity-associated genes. First, a relationship between apoE4 and longevity, well proven in Western countries for its linkage with longevity, could not be reproduced, though its association with dementia status could be confirmed (Choi et al. 2003). Second, an association of MLH1, a feature of the DNA repair system, with longevity was observed in the Korean centenarian Study (Kim et al. 2006). Also, V-yes-1 Yamaguchi sarcoma viral-related oncogene homolog (*LYN*) was found to be associated with longevity (Kwon and Park 2005). These data reflect the unique feature of Korean longevity distinct from those of Western countries. Mortality in Western countries is mainly related to cardiovascular diseases, while mortality in oriental countries such as Korea and Japan is linked to cancer. The major differences in mortality factors could be traced to regional traditional dietary patterns. The dietary habits of Western countries are dominated by animal products, while those of Asian countries are mainly vegetable oriented, leading to morbidity and mortality differences. These data would be good examples for gene and environmental interactions for longevity, implying that the evolutionary genetic selection for the fittest in the respective regions has been operated towards longevity in a tradition-dependent life style course.

### Gender and Ecological Variables for Longevity

The distribution of centenarians in Korea is not random but relatively localized, and those areas with high density of centenarians could be defined as the long live zones. For designation of long live zones, both of the centenarian index (number of centenarians/1,00,000 population) and longevity index (number of oldest old people over 85 years of age/number of old people over 65 years of age) were used for comparison. The southwestern area

of Korean peninsula, specifically localized with four counties (Gurye gun, Goksong gun, Sunchang gun, and Damyang gun, in short named GuGokSunDam area), was designated as the representative long live zone in Korea (Park 2002). But when regional longevity was compared by gender difference, male longevity was highest in cold mountainous northeastern areas, whereas the highest female longevity stemmed from southwestern hilly and warm areas. The regional gender-specific differences of longevity might be affected by the area-dependent environmental factors such as ecological habitats, and social and cultural traditions in addition to habitat-dependent lifestyles. In terms of habitat, the climate would be an important factor in the observed regional differences in longevity in addition to the amount of physical activity and medical service. Warm climate is assumed to be beneficial for longevity because of its protective effect against many respiratory diseases. However, in Korea, mountain centenarians living in cold areas showed a tendency to perform more outdoor activities as compared to seaside centenarians living in warm areas, suggesting that the climate effect on longevity can be overcome by increased physical activity, though limited to male centenarians (Park 2002). Self-rated health status is much better in mountain-living and male gender centenarians, implicating the importance of taking part in active regular exercise and outdoor activities in their daily lives. Some notable differences in health statuses were observed according to region and gender. Only 4% of mountain centenarians had serum albumin levels lower than 3.3 g/dl, while 26% of seaside centenarians had such levels with a higher anemic index, suggesting that the mountain centenarians are in better health as compared to the seaside centenarians (Park 2008).

### Life Style Variables for Longevity

The Korean Centenarian Study reported significant differences in the occurrence of centenarians by gender, location, lifestyle, and diet (Lee et al. 2005). Korean centenarians on average

had normal levels of total cholesterol, LDL-cholesterol, and triglycerides, though these levels were a little bit lower than those of the oldest old people (Korean Nutrition Society 2000). However, an abnormally low serum HDL-cholesterol was observed in four-fifths of seaside centenarians, and this level was lower than that of the octogenarians (Korean Nutrition Society 2000). The cholesterol intake in their diets was lower in female centenarians than in males (Park 2008). Reduced exercise and low protein consumption may have resulted in reduced HDL-cholesterol levels in female centenarians, while greater exercise and high protein consumption may have caused the observed high HDL-cholesterol in male centenarians. Antioxidant nutrients such as  $\beta$ -carotene, vitamin C, and vitamin E and minerals such as calcium and selenium might be potent protectors against age-associated diseases such as cancer and heart disease. The centenarians living in mountainous areas consumed adequate amount of vitamin A, vitamin C, vitamin B<sub>6</sub>, and phosphorus (more than 90% of RDA), while the seaside centenarians showed a tendency of lower intake of antioxidant vitamins, such as carotene, vitamin C, and vitamin E (Park 2008). The high intake of antioxidant nutrients by mountainside centenarians may come as a result of their high consumption of the blanched vegetable food, "Na-Mool." Na-Mool is a traditional Korean recipe for cooking vegetables containing leaves and shoots from a variety of vegetables by mild blanching. The high average INQ (Index of Nutrient Quality) of male centenarians suggests that their diet supply provides very good amounts of nutrients for energy, though some nutrients including Ca, Zn, and vitamin B<sub>2</sub> require supplementation. Korean male centenarians demonstrated better nutritional and health statuses than females. This can be explained by socio-cultural factors and the unique traditional male-priority culture of life. Male centenarians, who represent only a small surviving fraction of the male population, benefit more from socio-ecological factors than females. Korean males receive generally higher education and better care from their families than their female counterparts. Compared to female centenarians, male centenarians had

probably worked harder and had engaged in a variety of physical activity, resulting in better bone functions (Park 2008; Jang et al. 2008). In sum, the Korean Centenarian Study suggests that geographic differences may influence the health and nutritional status of centenarians perhaps through area-dependent differences in physical activity and nutritional intake in daily life as well as cultural tradition. The data thus far indicate that habitat exerts differential influences upon gender differences in longevity perhaps through a modulation of nutritional intake, physical activity, and a socio-cultural pattern of life style.

### **Discovery of Nutritional Complementation by Traditional Food: Vitamin B<sub>12</sub>**

The physiological role of vitamin B<sub>12</sub> was well reported not only for hematopoietic function but also for a broad spectrum of neurological functions. Therefore, maintenance of the normal blood level of vitamin B<sub>12</sub> was emphasized in the aged people (Hausman et al. 2011). It is well established that the major source of vitamin B<sub>12</sub> is of animal origin, while vegetable foods do not contain the vitamin. However, despite a traditional preference to vegetable food, the Korean Centenarian Study revealed that 95.8% of mountain centenarians and 73.7% of the seaside centenarians demonstrated normal levels of serum vitamin B<sub>12</sub> and folate. Previous reports also suggested the relative high level of vitamin B<sub>12</sub> status in older Korean people (Park 2002). Therefore, it has been presumed that traditional Korean cuisine might contain a certain source of vitamin B<sub>12</sub>, which led to discover that Korean traditional fermented products, such as *DoenJang* (Japanese *Miso equivalent*), *Cheonggukjang* (Japanese *Natto equivalent*), *Gochujang* (hot pepper paste), contain considerable amounts of vitamin B<sub>12</sub> (Park 2002). Moreover, it has been observed that Korean *Kimchi* (mixed vegetable fermented products) and seaweeds such as *Gim* (laver) and *Parae* (sea lettuce) are enriched with vitamin B<sub>12</sub> (Kwak et al. 2010). These dietary sources of vitamin B<sub>12</sub> might have contributed considerably for the

relative lack of B-12-deficient subjects in Korean population. Therefore, these traditional fermented foods might have played a role in complementation of nutritional balance for the vegetable-oriented dietary pattern, which thus may have contributed to a considerable degree for enhancing longevity in Korea.

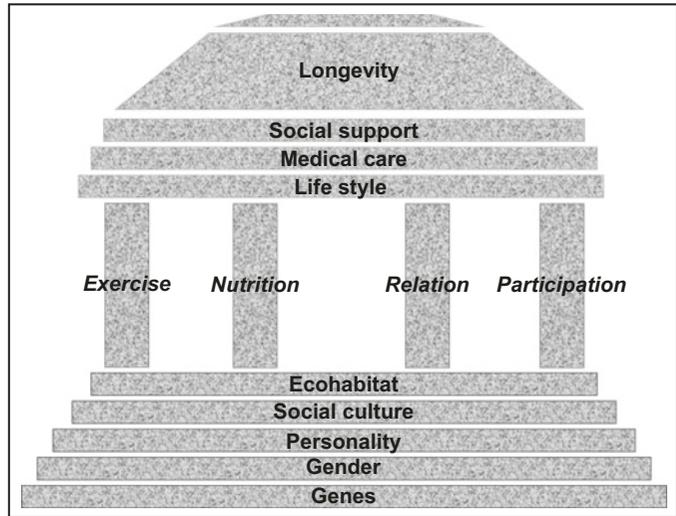
### **Social Care and Medical Support Variables for Longevity**

The average life span of Koreans increased almost 30 years within the last 50 years of period (Korea National Statistical Office 2005). The number of centenarians in Korea also grew rapidly in the last single decade, suggesting a rapid increase in longevity. These demographic changes in average life span and longevity of Korean individuals are directly paralleled with the development in economy and the medical insurance system. The medical insurance system in Korea has been expanded to the national level since 1990. The effects of this expansion could be readily recognized by the rapid parallel increase of the population longevity in Korea. These data implicate the significant role of socio-political variables in the extension of human longevity, suggesting the requirement of comprehensive integration of these factors with biological variables for the longevity phenomenon.

### **Integrative and Comprehensive Approach for Human Longevity**

Korean Centenarian Study data implicate the tight interactions among many variables for longevity. The variables for longevity are as follows: genes, gender, habitat, nutrition, physical activity, social care, and life style, etc. For the integration of these variables, a new model for human longevity is proposed, which might be named, "Park's Temple Model for Human Longevity" (Fig. 1) (Park 2012). In this model, human longevity can be explained in terms of different levels through a comprehensive approach. The longevity-associated variables are classified into three

**Korean Centenarian Study, Comprehensive Approach for Human Longevity, Fig. 1** Park's Temple Model of Longevity (Park 2012)



different layers, each layer containing several variables. The premise of this model is based upon the concept that longevity could be compared to the building of a temple, which consists of three essential components: the bottom, pillars, and rooftop. In building a temple, each component should be strengthened and balanced for safety and stability. The bottom components of the temple are basically fixative or not readily changeable. Variables such as genes, genders, personality, ecology, and social cultures fit into this category. The pillar components of the temple are related to personal lifestyles, which are changeable or readily modifiable variables, such as exercise, nutrition, relationship, and participation. The rooftop components of the temple are socially or politically determined variables, such as social care, social safety, and a medical support system. These different layers of the components are interacting with and compensating for one another in order to accomplish building up the temple of longevity (Park 2012). Since compensation mechanisms among the longevity components could be operating, the balancing mechanism among the variables would contribute to overcome some shortages of the specific components. As such, it is suggested that longevity could be achieved by the interaction of many different variables, which are actively interacting and compensating. These compensating and

balancing mechanisms of longevity may be useful to explain the recent dynamic trend in the rocketing increase in population longevity.

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## Korean Longitudinal Study of Ageing (KLoSA): Overview of Research Design and Contents

Soong-Nang Jang  
Red Cross College of Nursing, Chung-Ang  
University, Seoul, South Korea

### Introduction

In order to outline the factors of healthy aging, a longitudinal study contributes explanatory power to separate the usual aging process from causal factors associated with poor health and disability in later life.

The Health and Retirement Survey (HRS) launched in 1992 in the USA was one of the first panel studies for older people. HRS has made longitudinal data available to capture time trends and major factors related to health and functional

status, family relationships, occupational status, income and consumption, life after retirement, and the effects of social policies for the elderly (see the Health and Retirement Study: A Longitudinal Data Resource for Psychologists). HRS has influenced British and European longitudinal studies of aging which benchmark HRS. In Britain, ELSA (English Longitudinal Study of Ageing) was started from 2002; SHARE (Study of Health, Ageing and Retirement in Europe) involving 13 nations was launched in 2004.

While these studies have produced systematic evidence regarding life course pathways, health and developmental pathways, and evidence for policy, the findings do not necessarily apply to those in different social and cultural contexts, particularly older people in Asian countries and developing countries. In the face of these research gaps, it is necessary to draw on evidence from the longitudinal studies of aging in particular countries. The development of national panel data on aging will provide comparative international evidence for gerontology, geriatrics, and policy. Such comparisons will show both common and unique factors related to health and well-being in later life across both developed and developing countries.

In Korea, the proportion of those aged 65 or higher stood at 13.1% as of 2015, still lower than the 16.2% average of OECD nations. But Korean society is very rapidly aging owing to a recent dramatic rise in average life span and sharp drop in birthrate. The time it will take for Korea to go from an aging society to an aged one, then to a super-aged one, is expected to be much shorter than for any other countries. It took France 115 years to move from aging to aged, the USA 71, Great Britain 47, Germany 40, and Japan 24. For Korea, it will be 19 years. Going from an aged society to super-aged (20% of the population aged 65 or older), it took Great Britain 45 years, France 41, Germany 40, the USA 15, and Japan 12. Korea is likely to travel that path in only 7 years (Korean Statistics Office 2012, 2015). The issue of aging is not only about change in the demographic structure – it entails enormous social and economic repercussions. The “compressed” aging

process demands that Korea pay greater attention to designing responses and solutions than other countries that had to deal with the phenomenon in a more gradual fashion (Jang and Kim 2010).

Korea needed to build up a solid set of statistical data that may be tapped for the purposes of policy-making and evaluation. With the funding of the Ministry of Labor, the Korea Labor Institute established the Korean Longitudinal Study of Ageing (KLoSA), launching its baseline survey in 2006. The purpose of this entry is to introduce the KLoSA and to overview its research design and first findings. The purpose of the KLoSA can be described as twofold. First is to compile information on the various aspects of aging to use as basic statistical data for research on aging. Since aging affects all parts of society, the KLoSA project is designed as an interdisciplinary one, in order to reflect on the social, economic, physical, and psychological aspect of aged persons. The second purpose of the KLoSA is to gather data to be used for international comparative researches. Aging is a common phenomenon occurring in developed economies. The USA, the UK, and 11 EU nations have been conducting panel surveys of those aged over 50 since 1992, 2002, and 2004, respectively. KLoSA was initially designed to benchmark HRS, ELSA, and SHARE.

## Methods

### Target Population and the Sampling Procedure

The survey target for KLoSA is Korean people aged 45 or older who live in ordinary households whereas the benchmarking data included those over the age of 50. The reason for the age criteria expanding to 45 years was that following the Asian financial crisis in the late 1990s, the number of people in their mid-40s retiring increased. The drastic change in the working age limit for the middle aged became a huge social issue. KLoSA, by including both the middle-aged and the elderly, will be able to shed light on not only the issue of aging itself but also the retirement

process experienced by the middle-aged and their old-age planning.

### Sample Selection Procedure

The expected effective sample size was 10,000 residents aged 45 or older living in ordinary households; thus, the necessary number of households surveyed was 6000 households. Region was stratified into urban area and rural area according to 15 metropolitan cities and provinces of Korea. The stratified region was then classified into apartment area and ordinary housing area. Common enumerated districts refer to ordinary house, townhouses, and multifamily houses. One thousand sample districts were first allocated into 15 districts by municipal city and province, and the rest were allocated in proportion to the number in the population. The reason for this was to evenly allocate the districts to obtain credible statistics in low-populated areas. A total of 803 districts and 197 districts were each allocated in the urban area and rural area.

### Selection of Households

With the list of households in the main sampling units and relevant tools, interviewers visited the households and identified the compatibility of each. With fixed samples, 15 households and 12 households were selected for each urban and rural district on a random basis, and interviewers were given the list together with the order of visit. Interviewers conduct the interviews if there is at least one eligible family member (aged 45+) in the household (Korean Longitudinal Study of Ageing Website, <http://survey.keis.or.kr>).

### Research Design

Since the baseline survey of the KLoSA was set up in 2006, its follow-up survey will be conducted in every even year. Supplementary surveys may be conducted with special topics in odd years. As a panel survey is conducted on the same topics repeatedly across a long period of time, the data provides the advantage of identifying dynamic social phenomena over time and analyzing the causation. Likewise, it is likely to be more useful than cross-sectional data in observing the social consequences of aging.

**Korean Longitudinal Study of Ageing (KLoSA): Overview of Research Design and Contents, Table 1** Response rate of Korean Longitudinal Study of Ageing and other longitudinal studies of aging

	Household sample	Individual sample
HRS	80.2%	81.6%
ELSA	69.9%	96.5%
SHARE	55.4%	86.3%
KLoSA	70.7%	75.4%

### Questionnaires

The KLoSA instrument comprises the following sections: demographics, families, health, employment, income, asset, and subjective expectations (Table 1). Basic demographic information included is gender, birth date, marital status, academic background, religion, social network, and social activities.

#### Family

The family section aims to examine the senior citizen's familial relationship and asks about the respondent's children, grandchildren, siblings, and parents. The section also includes inquiries on the level of income of each family member and their relationship with the respondent. Questions regarding the respondent's children require basic personal information and proximity of their residence, frequency of contact, and level of financial support and care exchange. As for grandchildren, the respondent is asked to provide the same set of personal information. Additional questions are included to assess the level of exchange of financial support and the time spent on taking care of the grandchildren.

The same set of basic information is requested again for the respondent's siblings. Questions on parents are divided into two scenarios, depending on whether the respondent's parents are still alive. If alive, their age, educational level, employment status, cohabiting family members, proximity of residence, frequency of contact, financial status, housing ownership, level of exchange in financial support, ADLs, and the level of the respondent's caregiving are asked. If not alive, the timing and age of their death are asked.

#### Health Status and Health Behaviors

The health section comprises four subtopics: health status, functional limitations and helpers, health insurances and services, and cognition. Grip strength is directly measured at the end of this section.

In the health status section, the respondent is asked about self-reported health, chronic illnesses, fall, fracture, vision, hearing, pain, urinary incontinence, and depression. To allow international comparison, the health section mostly keeps in line with the HRS structure. The gastrointestinal diseases have been added to eight chronic illnesses included in HRS (hypertension, diabetes, cancer, lung diseases, heart problems, strokes, psychiatric problems, and arthritis). Additional questionnaires included the timing of diagnosis, current status of medication/treatment, and difficulties resulting from the illness. In health behaviors, health screening attendance, exercising, smoking and drinking habits, and body mass (height and weight) are also included.

**Functional Limitations and Helpers** A functional status section begins with the Korean version of ADLs and IADLs: K-ADL (including 7 items) and K-IADL (including 10 items) developed by the Korean Geriatrics Society. The number of helpers, relationship with the respondent, and relevant costs are also asked. The series of questions on the helper are included in each of the K-ADL and K-IADL sections. Cognitive function was measured by the Korean Mini-Mental State Examination (K-MMSE). K-MMSE is a brief screening test that quantitatively assesses the cognitive status of elderly people with 11 items, divided into two sections; the first requires verbal responses to orientation, memory, and attention questions. The second section requires reading and writing and covers ability to name, follow verbal and written commands, write a sentence, and copy a polygon.

**Health Insurances and Services** The health insurance section is divided into three parts: national health insurance (NHI), medical aid program (MAP), and private health insurance. Those receiving NHI benefits are asked about the

amount of monthly insurance payment and missing payments, if any, based on the beneficiary's coverage type (workplace/community). Questions are also included about the level of overall satisfaction in NHI. The MAP part is inquiring about whether the respondent has received or is receiving aid. Questions on private health insurance first attempt to determine whether the respondent has private insurance coverage and then asked about the insured, amount of insurance payment, and types of benefits.

In the medical service utilization section, topics are divided into hospital stay, outpatient surgery, visit to the doctor, dentist clinics or hospitals, oriental clinics or hospitals, health centers, in-home health care, prescription medication, and over-the-counter drugs to understand the usage frequency and period, payment method, and payment responsibility in each category.

### Employment

It is important for KLoSA to measure the degree of senior citizens' labor market participation as one of the most serious consequences expected from population aging is the aging and shortage of workforce. In Korea, inadequate provision of old-age income security (compared to western countries) tends to push the elderly into the labor market to sustain their livelihood. Understanding the process of retirement, therefore, gains greater significance.

The employment section includes topics on employment, unemployment, and retirement. In the employment subsection, overall circumstances of the respondent's employment are assessed, starting from participation in the labor market. The type of employment is identified: wage earner, self-employed, or unpaid family worker. Additional questions follow on the general characteristics of the work the respondent is engaged in: industry and size of the workplace, type of work, position, starting period, working hours, overtime work, level of wage/income, and retirement age. Level of satisfaction and the degree of physical strength required from the current work are also evaluated. The general characteristics of a second job (if any) are also requested.

Unemployed respondents are asked about the reason of their unemployment, job-seeking status, and method and types of desired employment. They are also asked some general questions on their last job, similar to the set of questions on the current job, including the starting and ending period, industry and size of the workplace, type of work and position, working hours, and income. Characteristics of the respondent's primary employment are also explored if the last job was not the main job in his/her lifetime. Questions are mostly similar to the ones for the last job, including ending period, industry and size of the workplace, type of work and position, working hours, and income.

If the respondent is retired, the general circumstances of the retirement are assessed: reason for retirement, the respondent's attitude, and current activities. As for the unemployed, they are asked about their last job as well as their primary job if the last job was not the main employment. The set of questions here are identical to the ones posed to the unemployed.

### Income and Assets

The individual income section is divided into earnings, pension (annuities), social security, cash transfer, and others. The amount of income generated from each category in the last calendar year is investigated. Wage is further broken down into wage and income from assets. Income generated from real estate and financial activities is explored in the asset section. Income-dispensing pension includes public, corporate, and private pensions.

As for the social security subsection, it probes all types of payment provided by social security schemes in Korea except the national pension. They include insurance (employment insurance, workplace, and injury compensation insurance), government assistance (elderly pension is provided only to the 65-or-older population with low income), and national basic livelihood protection program. In addition, transportation cost subsidy to the elderly (covering everyone aged 65 or older) and veteran benefits (Ministry of Patriots and Veterans Affairs' payment to the winner of the medal of honor and their families,

pension to military or police officers injured on duty, nursing fees, etc.).

Financial support provided from family and/or relatives is also measured, but in the family section, not in this income section. As much of welfare-providing responsibility still lies with the family in Korea, income received from private channels such as family takes up a significant proportion of the elderly's overall income. In consideration of the difference, whereas HRS questions are limited to financial support and alimony, KLoSA explores the entirety of financial support from members of the immediate or extended family.

This section deals with assets and debts, namely, real estate, business/farm, financial assets, nonfinancial assets, assets of family members, debts, asset variation, tax return, charity contribution, inheritance, and will.

Under assets, ownership of real estate, or business/farm, the cash value and income generated from real estate (e.g., land revenue, rent) in the past calendar year are investigated. Financial assets include the following: demand deposits such as savings, household checking accounts, CDs, CMA, and MMF; savings deposits with liquidity constraints such as time deposits, installment deposits, and mutual funds; and stocks, bonds, savings-type insurance (including annuities), private loans to others for the purpose of investment (including private money lending), and mutual savings clubs (Gye in Korean). There are also questions on nonfinancial assets such as mode of transportation (e.g., cars) and paintings/antiques/memberships that, together with financial asset questions, are intended to determine the types and amount of all assets held by the respondent.

### Expectations

Expectations of the elderly are measured in areas of both the public and private domains: economic activities of the Korean society at large, the labor market, South–North Korea reunification and social security as well as individual financial support, inheritance, use of nursery facilities, survival rate, and savings plan. This section is designed to collect information on senior citizens' psychology.

### Response Rate

After 5 months of fieldwork, the KLoSA includes 10,254 persons as panel respondents; 999 survey units have at least one respondent. Each survey unit has on average 6.2 households, and a total of 6171 households were surveyed. Household response rate is 70.7% and individual response rate within households is 75.4%.

### Reliability and Validity

The validity and reliability of the KLoSA data were assessed by comparing the prevalence of major chronic diseases to the findings of the Korean National Health and Nutrition and Examination Survey (KNHANES) which contains national health data produced by the Ministry of Health and Welfare. Self-reported physician-diagnosed hypertension, diabetes, stroke and disability, and smoking rates were calculated according to age groups by gender. In addition, we evaluated the reliability of structured questionnaires such as the Mini-Mental Status Examination (K-MMSE), Activities of Daily Living (K-ADL), Instrumental Activities of Daily Living (K-IADL), and Center for Epidemiological Studies of Depression 10 (CES-D 10) by calculating Cronbach's alpha. Self-rated health, one depression questionnaire and indicating any disability, was used as the gold standards for related health outcomes: the CES-D 10 score, total K-ADL, K-IADL deficiency, and total K-MMSE score. A linear regression of grip strength with age was used to calculate a coefficient for evaluating the validity of the measurement of muscle strength.

The prevalence of self-reported hypertension was somewhat lower than that from the KNHANES data.

The difference averaged 2.0 (minimum 1.0, maximum 10.0). In contrast, the prevalence of diabetes, stroke and disability, and smoking were slightly higher than from KNHANES. These differences resulted from the sample size, sampling methods, and survey process used to obtain each data set. Because health behavioral data were extracted from a subsample of the total KNHANES sample, the sample size was too small to obtain health indicators for older adults, especially with respect to the oldest groups.

**Korean Longitudinal Study of Ageing (KLoSA): Overview of Research Design and Contents, Table 2** Contents of Korean Longitudinal Study of Ageing Questionnaires

Section	Description
<b>Cover screen</b>	
Information on household members (gender, age, marital status, relationship [with the respondent, etc.])	
<b>A. Population</b>	
Date of birth, gender, background, religion, marital status	
Not living together/the spouse aged below 45: date of birth. Academic background, employment status	
Religion, social activities, and relationship	
<b>B. Family children and grandchildren</b>	
Children: gender, age, academic background, employment status, house ownership, marital status, number of children	
Not living together with children: access, frequency of contact, financial aid given to/from children	
Number of grandchildren, care of grandchildren, time/period of care	
Parents and sibling	
Sibling: relationship with the respondent, age, marital status	
Parents: age, academic background, presence (if dead, at what age?), employment status, house ownership	
Not living together with parents: access, frequency of contact, financial aid given to/from parents	
Other family members: financial aid given to/from them	
Presence of a family member with difficulty in ADL/IADL, time and period of caregiving	
<b>C. Health</b>	
Health status	
Subjective health judgment, chronic disease, treatment, experience of traffic accident/injury from a fall/fracture of a bone	
Signs of aging (vision, hearing, pain), BMI, health-related habits (smoking, drinking), depression measurement	
ADL/IADL and caregiver	
ADL and IADL	
Caregiver for ADL (first/second/third): relationship with the respondent, day and hours of caregiving, payment	
Health insurance and facility usage	
Health insurance subscription: health insurance, reimbursement, private health-care insurance, payer of premium, premium in arrears, delayed period	
Health-care facility usage: hospitalization, dental clinic, public health center, oriental medical center, outpatient, home call, prescription drugs, purchase and price of health-care equipment	
Recognition capability	
MMSE-K application of a measurement set tailored to Korea	
Physical performance assessment	
Measurement of grasping power	
<b>D. Employment</b>	
Employed	
Details of employment (workplace information, type of employment, position, industry, labor contracts, working hour, days of leave, salary determination, etc.)	
Perception of and satisfaction with work	
Job position desired, side job, part-time job, etc.	
Self-employed	
Reason of running a business, workplace information, working hour, working day, perception of working hour, days of leave, perception of and satisfactions with work, job desired, side job, part-time job, etc.	
Unpaid family business	
Reason of doing the work, workplace information, status of other workers, revenue, working hour, working day, days of leave, perception of and satisfaction with work, job position desired, side job, part-time job, etc.	
Job seeker	
Job-seeking activities in the last one week/month, willingness to find a job, employability, reason of losing a job, reason of seeking a job, job-seeking activities, difficulty in job seeking, retirement plan, work experience, the latest job, etc.	

(continued)



**Korean Longitudinal Study of Ageing (KLoSA): Overview of Research Design and Contents, Table 2**  
(continued)

Section	Description
Retiree	Time and reason of retirement, spouse's economic activity at the time, pastime items, perception of retirement and economic activity, the latest employment, etc.
<b>E. Income</b>	
	Earned income (salary, one's own business, agricultural and fishery, side job)
	Annuity (national/workplace/private)
	Social benefits (status of grants, type)
	Other income, total household income in the last 12 months
<b>F. Asset</b>	
	Residence (type of ownership)
	Real estate assets excluding residence (real estate ownership, lease, factory/farm)
	Financial asset (including money from the mutual financing association)
	Other nonfinancial asset
	Inheritance/donation, debts, household asset
<b>G. Expectations</b>	
	Subjective judgment about future economic conditions (inheritance/donation, estimated working hour, economic activity), life expectancy, living standards, expectations on the government
	Satisfaction with life

The trends in prevalence by age did not differ significantly between KLoSA and KNHANES, indicating that both of the data sets show similar associations between age and chronic conditions.

Our findings suggest that CES-D 10, K-ADL, K-IADL, and K-MMSE are reliable; the overall raw alpha exceeded 0.7 in all cases, which indicates a good cutoff value. The alpha coefficients for the CES-D 10, K-ADL, and K-MMSE were 0.796, 0.949, and 0.880, respectively, compared to respective values of 0.80, 0.937, and around 0.8 from previous reliability studies. The association between self-rated health and one depression questionnaire was significant for the CES-D 10, which means that the criterion validity of the CES-D 10 is acceptable. The K-ADL and K-IADL were also significantly associated with the self-rated health and K-MMSE scores, indicating that the K-ADL and K-IADL are valid for measuring functional status.

The estimated coefficient of grip strength according to age gave results similar to previous studies, demonstrating its reliability as a measure of muscle power. In general, the validity and reliability of the KLoSA measures are reasonable, and the data provide reliable observations of health indicators for representative Korean adults 45 years old and above.

## Conclusion

As population aging is expected to affect changes in different sectors of our society, KLoSA makes it its primary objective to collect information in a wide range of areas. The topics include basic demographics, participation in the labor market, retirement, income and assets, savings, health, cognition, ADLs, activities and costs to maintain health, family structure, and so on.

The KLoSA tries to provide data that is conducive to international comparison in the areas of aging and policy impact. Industrialized nations today already strive to build panel data that allows cross-border comparisons. The European SHARE, which recently finished its first year of survey, is a joint project of 11 nations that is designed to be comparable with the British ELSA and the US HRS, two panel surveys on the issue of aging that have preceded SHARE. Similarly for KLoSA, it aims to generate data that facilitates comparison with the ones produced in the USA and Europe.

Working toward the stated objectives, the KLoSA is expected to obtain microdata on the phenomenon of aging and the accompanying socioeconomic changes by collecting data from different fields and accumulating such data over time. Availability of the panel data will also

**Korean Longitudinal Study of Ageing (KLoSA): Overview of Research Design and Contents, Table 3** General characteristic of men and women in Korean Longitudinal Study of Ageing

	Men N (%)	Women N (%)
<b>Age</b>		
45 ~ 49	779 (17.46)	1016 (17.57)
50 ~ 59	1311 (29.38)	1598 (27.64)
60 ~ 69	1312 (29.40)	1582 (27.36)
70+	1060 (23.76)	1586 (27.43)
<b>Marital status</b>		
Single	55 (1.23)	37 (0.64)
Married	4087 (91.60)	3878 (67.07)
Widowed	202 (4.53)	1703 (29.45)
Divorced	84 (1.88)	112 (1.94)
Separated	34 (0.76)	52 (0.90)
<b>Family composition</b>		
Alone	150 (3.36)	737 (12.75)
With partner only	1777 (39.83)	1729 (29.90)
With partner and children	2028 (45.45)	2004 (34.66)
With children or others	507 (11.36)	1312 (22.69)
<b>Education</b>		
Elementary school or below	1320 (29.58)	3327 (57.54)
Middle school graduated	803 (18.00)	947 (16.38)
High school graduated	1489 (33.37)	1214 (21.00)
College or over	850 (19.50)	294 (5.08)
<b>Employment status</b>		
Employed	2492 (55.85)	1391 (24.06)
Unemployed, housewives	813 (18.22)	3533 (61.10)
Retired	1157 (25.93)	858 (14.84)
<b>Self-rated health</b>		
Good (very good and good)	2466 (55.27)	2349 (40.63)
Not good (fair, poor, and very poor)	1996 (44.73)	3433 (59.37)

help promote policy and academic studies on related topics, and the results produced and accumulated from such studies will make meaningful contribution to understanding the changes brought on by aging as well as designing and implementing effective policies (Tables 2 and 3).

**Cross-References**

- ▶ [China Health and Retirement Longitudinal Study \(CHARLS\)](#)
- ▶ [English Longitudinal Study of Aging \(ELSA\)](#)
- ▶ [Health and Retirement Study, A Longitudinal Data Resource for Psychologists](#)
- ▶ [Health, Work, and Retirement Longitudinal Study](#)
- ▶ [Irish Longitudinal Study on Ageing \(TILDA\)](#)
- ▶ [Longitudinal Aging Study Amsterdam](#)
- ▶ [Survey of Health, Ageing and Retirement in Europe \(SHARE\)](#)

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## Language, Comprehension

Allison A. Steen and Elizabeth A. L. Stine-Morrow  
University of Illinois, Urbana, IL, USA

### Synonyms

Discourse memory; Language understanding;  
Text memory; Text processing

### Definition

The comprehension of language in the domains of both written and spoken communication requires the decoding of print or acoustic features of speech to create mental representations of meaning, events, and situations. In spite of the apparent ease with which it is accomplished, language comprehension is a complex process requiring the synchronization of a variety of cognitive components (e.g., recognizing letters and words, accessing and integrating word meanings to represent ideas, and using existing knowledge to develop a representation of implied situations). As such, language comprehension is interwoven with core cognitive mechanisms, which show multidirectional patterns of change as a function of both primary aging processes and experience.

## Introduction

Successful execution of language processing components depends to some extent on both mental mechanics, which are vulnerable with aging, and knowledge, which has potential for experience-based growth. Given this, it is not surprising that language comprehension can show dynamic change over the life span. On the other hand, there is also growing evidence for the benefits of language proficiency in building cognitive reserve. In this article, this bidirectional relationship between aging and language is reviewed by considering first the way in which age-related changes in cognition can influence language comprehension, and then briefly how literacy practices and engagement with language can influence cognition and health in late life.

## Effects of Aging on Language Comprehension

Age differences in language comprehension are reflected in the multidirectional effects of age on cognition. Declines in mechanics have been conceptualized in terms of working memory, speed, and interference control. Recent work has considered the role of interactions between mechanics and sensory processing. On the other hand, growth in knowledge and literacy skills as a function of engagement with reading can be a

significant strength in adulthood. A foundation of domain knowledge allows depth of comprehension in specialized domains that is almost impossible to achieve in any other way. Importantly, experience-related growth in knowledge and literacy skill opens pathways to compensation in terms of both processing mechanisms and in the way language input is regulated.

### Implications of Age-Related Declines in Mental Mechanics

Many aspects of language comprehension are unaffected by variation in mental mechanics and are well preserved with healthy aging (Thornton and Light 2006; Wingfield and Stine-Morrow 2000). In fact, older adults with developed literacy skills generally are at least as efficient as the young in word recognition and in accessing meanings of individual words. Nor does aging appear to impair the appreciation of basic sentence structure (i.e., using syntactic form to determine how the meanings of individual words are connected to form ideas). For example, older adults are as able as the young to quickly infer the particularized meanings of words in context (e.g., that the “insect” in *The insect stung the professor* is likely to be a bee or wasp and not a termite). Aging also does not impair the ability to distinguish between grammatical and ungrammatical sentences or to use syntactic structure to infer semantic focus. This was demonstrated in a series of studies by Price and Sanford (2012) who manipulated the syntactic form of a sentence with clefting so as to put different elements in the foreground of attention to examine whether there were age differences in using these cues for focus (e.g., The core idea *John lost his daughter* can be expressed with the subject clefted as, *It was John who lost his daughter*, which puts the focus on John, or with the object clefted as, *It was his daughter that John lost*, which puts the focus on the daughter). Reading times were faster for a continuation in which the grammatical subject was matched to the focused element (e.g., *He had wandered off*, in the former case; and *She. . .*, in the latter). Older adults showed strong effects of focus, at least as robust as those of the younger adults, demonstrating that they were able to use linguistic structure to

modulate activation of concepts in language comprehension. Also, in spoken language, older adults make good use of prosodic contour (i.e., the temporal patterning and changes in frequency that are characteristic of natural speech) to recognize syntactic structure, as well as the differential emphasis of concepts.

On the other hand, a hallmark of language is that it is generative, in the sense that we produce sentences that have never been produced before and comprehend sentences that we have never encountered before. Even though aging does not compromise the ability to use the rules that afford generativity, these rules allow the construction of sentences that are very complex so as to tax mental mechanics. Thus, age-related declines in mechanics may result in comprehension deficits as the demands of language processing increase. When older adults meet these demands so as to show good performance, they do so through the allocation of extra effort. This has been demonstrated with a number of methods, including exaggerated neural recruitment in imaging, increases in reading time, and interestingly, with pupillometry.

It is well established that the pupils dilate with increased cognitive demands. This phenomenon has been used to explore age differences in the effort required to understand syntactically complex sentences (Piquado et al. 2010). The contrast between subject-relative (e.g., *The doctor who was advised by the plumber went on vacation*) and the more complex object-relative (e.g., *The doctor who advised the plumber went on vacation*) constructions has been well studied. Object-relative constructions are more difficult to understand for a number of reasons, including the violation of canonical subject-verb-object ordering, and the fact that the agent of the matrix clause (in this example, the doctor went on vacation) is also the object of the embedded clause (i.e., the plumber advised the doctor). Comprehension is typically more error prone for object-relative sentences, especially for older adults. Piquado et al. (2010) presented younger and older adults with spoken sentences of these forms in order to answer comprehension questions afterwards. They found that for both age

groups, pupil size increased as they listened to the sentences, especially so when they were trying to comprehend the object-relative constructions. Consistent with the idea that syntactic complexity is more demanding of attention for older adults, they showed an exaggerated increase in pupil size when listening to object-relative sentences.

Caplan and colleagues (2011) investigated speed and accuracy of sentence comprehension under varying levels of syntactic complexity. Sentences also varied in plausibility (e.g., *It was the movie that terrified the child because it showed a monster* versus *It was the child that nourished the food in the pantry*). Participants self-paced the presentation word by word, and reading times were recorded as an online measure of comprehension as the sentence unfolded. After each sentence, subjects indicated whether the sentence was plausible or implausible as a measure of comprehension accuracy. Both younger and older adults were less able to distinguish plausible and implausible sentences when they were more syntactically complex, with an exaggeration of this effect for older adults. To some extent, older adults also took differentially more time to process the syntactically complex forms.

There are competing theories regarding the nature of declines in mental mechanics and how these mechanisms affect language processing with aging. Working memory is the capacity for mental computation and simultaneous storage of the products of these computations and is particularly important for comprehension and learning. Processing speed, on the other hand, is the efficiency with which these computations are computed. Finally, inhibition is the ability to ignore contextually irrelevant information. Aging has been shown to be associated with decreased working memory capacity, reduced processing speed, and failure to inhibit, all of which have consequences for language processing.

In the Caplan et al. study, reading time measures were negatively correlated with both working memory and processing speed. Borella et al. (2011) examined the differential impact of processing speed, inhibition, and working memory on text comprehension using structural equation modeling. In this study, processing speed was

measured using the letter and pattern comparison tasks. Working memory measures included assessments of simultaneous storage and manipulations of verbal and visuospatial information. Inhibition processes were operationalized using a number of tasks requiring resistance to interference (e.g., intrusions in working memory). Younger and older adults read a series of narratives followed by comprehension questions for each text. These questions were answered under one of two conditions, text-present or text-absent, such that the texts were either available when participants answered the comprehension probes or not. In addition, half of the comprehension questions probed specific details from the text (i.e., facts explicitly stated in the text), and the other half were inferential in nature (i.e., relying on inferences necessary for text coherence). The best-fitting model was one in which the effects of processing speed and inhibition on text comprehension were mediated by working memory, with working memory as the proximal cause of age differences in text comprehension. A further model comparison examining the statistical fit of this model separately for text-present and text-absent conditions suggested that age and mechanics accounted for more variance in the text-absent condition than the text-present condition. Interestingly, age differences in text comprehension were moderated by condition such that older adults performed equally as well as the younger adults when the text was present during the comprehension probe. Together these results suggest, first, that working memory is a core cognitive mechanism responsible for age differences in text comprehension, but that working memory itself has dissociable components that contribute to comprehension. Second, this study suggests that demands on working memory from comprehension are less related to online processing than they are to the maintenance of information in memory. Finally, evidence from this study suggests that age-related differences in text comprehension may be minimal in typical conditions in everyday life, in which text is available as it is used for particular tasks.

There are both negative and potentially positive implications of inhibition failure for text

comprehension. In a study by Thomas and Hasher (2012), older and younger adults read stories containing irrelevant information, cued with a change in font, and were explicitly told to ignore this information. Later, subjects were given a memory task for a short list of words, half of which were the distracting words from the stories. Older adults were more disrupted in reading by the presence of distraction and were also more likely to recall the distracting words than new words in the memory task. When participants were explicitly told that some of the words in the recall task were from the stories they had just read, younger adults then recalled more of the distracting words and even outperformed older adults in this recall task. Thus, these results are consistent with the view that younger adults not only have more efficient inhibition mechanisms but also have more cognitive control over when to engage these mechanisms than older adults and that this plays a role in language comprehension.

Even though older listeners can take good advantage of cues from prosody to distinguish important and unimportant concepts in speech, mechanics can place limits on this ability as well. For instance, pitch accents (i.e., a change in tone to cue the emphasis of a word or phrase relative to other words in the text) have been shown to boost memory in both younger and older adults (Fraundorf et al. 2012); this is known as an *accent boost*. In Fraundorf et al. (2012), older and younger adults listened to brief stories that included the mention of two contrast sets, for example, about some British and French scientists searching for endangered monkeys in Malaysia and Indonesia. In the target sentence that resolved the story, one element of each contrast set (i.e., British vs. French; Malaysia vs. Indonesia) was selected (e.g., *The French spotted a monkey in Indonesia*). Pitch accent was systematically manipulated so as to stress one (e.g., *The FRENCH spotted a monkey in Indonesia, or The French spotted a monkey in INDONESIA*), both (e.g., *The FRENCH spotted a monkey in INDONESIA*), or neither element. Memory was tested with a fill in the blank task (e.g., *The \_\_\_\_\_ spotted a monkey in \_\_\_\_\_*). Both younger and older adults showed an

accent boost. However, when both words were emphasized with a pitch accent, older (but not younger) adults showed a reduction in the accent boost, which Fraundorf et al. called the *other-accent penalty*. They attributed this other-accent penalty to the lower working memory capacity of older adults. The other-accent penalty was also found for younger adults with relatively low working memory scores, supporting the idea that the age differences were due to working memory declines that limit the ability to focus on multiple concepts in discourse.

Collectively, this literature suggests that many aspects of language comprehension are preserved with aging (e.g., word recognition and basic syntactic and semantic operations). However, age-related changes in mental mechanics can impact language comprehension across text type (sentence, discourse) and modality (print, speech) in more difficult conditions.

### Implications of Age-Related Decline in Sensory Processing

Whether it involves listening to speech or reading print, language comprehension depends on the perception of accurate sensory input. While word recognition processes are generally automatic among those with well-developed literacy skills, when the sensory information is unclear, decoding the surface form can require attentional resources to the extent that comprehension may be compromised. In other words, decoding and semantic processing draw on the same pool of attentional resources. When the surface form is clear (e.g., print that is legible and appropriately sized, speech with well-articulated phonology and good prosody), decoding is accomplished easily so that working memory resources can be devoted to constructing a representation of the meaning. Challenges to signal fidelity – because of noise in the environment, deficits in sensory processing, or a combination of both – can compromise language comprehension.

A number of recent studies support these claims in both the auditory and print domains. When individuals read text in visual noise (i.e., text degradation imposed by embedding the text in a visually complex environment), patterning of

reading times can be used to show that relatively more attention is devoted to decoding and relatively less attention is devoted to semantic processing, which results in poorer memory performance (Gao et al. 2012). Older adults are more impaired than younger adults at lower levels of visual noise suggesting that limits on mechanics exacerbate sensory effects on comprehension.

Similar phenomena have been demonstrated with speech comprehension. Van Engen and Peelle (2014) described three sources of acoustic challenge: within the listener (e.g., hearing loss), from the environment (e.g., background noise), or from the speaker (e.g., increase speech rate, prosodic disruptions, unfamiliar dialect). Such acoustic challenge decreases the attentional resources available for higher-level language processes (i.e., comprehension of meaning) because they are allocated to lower-level decoding processes. Additionally, this shift of attentional resources seems to be moderated by age and working memory capacity such that those with lower working memory capacity (e.g., older adults, and younger adults with lower WM) are more likely to show performance deficits when sensory fidelity is compromised than those with higher working memory capacities.

### Implications of Age-Related Knowledge Growth

Age affords time for experience, and among adults with good literacy skills and practices, preservation or growth of crystallized ability and print exposure is the norm. This “expertise” can boost performance in text comprehension through several different pathways. In fact, among older adults who have achieved strong literacy skills, the effects of declines in mental mechanics on comprehension and memory for text can be negligible. For example, Payne et al. (2012) showed the effects of working memory on sentence recall were only found among older adults with relatively low print exposure (an index of reading experience). Based on word-by-word reading times, they also showed that print exposure conferred an advantage in the efficiency of word recognition processes and was also related to greater effort allocated to semantic

integration processes. Older adults with higher verbal abilities also have advantages in more efficient resolution of lexical ambiguities (Stites et al. 2013) and in using statistical properties of language to guide parsing (Payne et al. 2014). Thus, lifelong habits of literacy experience can help to preserve language processing and comprehension so as to trump declines in working memory.

Domain-specific knowledge can also support language comprehension processes. Chin and colleagues (2015) examined the differential effects of health-specific domain knowledge and domain-general verbal ability (measured as vocabulary) on reading comprehension among older adults. Participants read sentences that were either related to health topics or about other topics (but matched in readability), using a self-paced word-by-word reading paradigm. Based on reading time patterns, results showed that verbal ability was related to increased conceptual integration regardless of domain, but that health knowledge (controlling for verbal ability) was specifically related to increased conceptual integration in health-related sentences. Thus, domain-specific knowledge had effects on processing above and beyond that of verbal ability to support comprehension and memory for text.

### Self-Regulation and Attention

One implication of the effects of mechanics and crystallized abilities on comprehension is that there can be wide variation in the way in which the mental representation of meaning is constructed as language unfolds. In the early history of psycholinguistics, the emphasis was on language *competence*, how the rules of language are used in an idealized way to construct the language representation. Questions about variation in comprehension as a function of abilities are ones about *performance*, how language is actually understood and interpreted in situ. It would be a mistake to think about abilities simply as fuel for the operation of language processing machinery that operates in an obligatory and uniform way (e.g., performance does not simply reflect incomplete computations defined by competence). Rather, as we have described

above, the nature of the language representation is that it is multifaceted, and these different facets can be constructed to varying levels of fidelity.

One view of age differences in self-regulation of language is that older adults show more shallow or “good enough” processing in comprehending language. For example, Christianson and colleagues (2006) showed that when encountering sentences with temporary ambiguities, such as *While Anna dressed the baby played in the crib*, both younger and older adults are likely to incorrectly answer “yes” to the question, *Did Anna dress the baby?* with older adults even more vulnerable to this error. According to the “good enough” account, as the sentence unfolds, the initial interpretation that Anna dressed the baby is maintained in memory even after the interpretation that the baby played in the crib is encoded (in fact, participants are also likely to say that the baby played in the crib). Christianson et al. argued that rather deriving meaning strictly based on the rules of language, we use heuristics to create meaning representations that are consistent with world knowledge. Thus, even though the coexistence of these two meanings is not allowed by the sentence structure, we maintain them because it is easy to create a mental model of the situation. Because older adults tend to rely on knowledge-based heuristics, they are more likely to use such “good enough” processing.

In fact, language comprehension is often shallow. As any middle schooler who has snagged someone with the problem of the plane crash on the border between the USA and Canada can tell you, when you pose the question of where one should bury the survivors, most people will puzzle over the border issue without realizing they are being asked about burying living people. Daneman et al. (2006) measured eye movements as younger and older adults read and attempted to solve problems containing such anomalies (embedded among problems that did not). There were no age differences in the probability of noticing the anomalies (i.e., young and old were equally likely to say that the survivors should not be buried). Based on the eye movement record, Daneman et al. concluded that older adults

were actually quicker in detecting the anomalies, but required more effort (as measured by rereading) to resolve them.

Collectively, this literature suggests that it is not that language comprehension is generally more superficial with age. Rather, that there is a shift in how resources are allocated among the different levels of analysis (Stine-Morrow et al. 2008).

Behavioral research tends to show that older adults are differentially facilitated in word recognition processes by context in both the auditory and print modalities. This is particularly interesting in light of findings from electrophysiological studies suggesting that meaning is slower to come online for older adults. Event-related brain potentials (ERPs) are a time-sensitive measure of brain activation in response to a particular stimulus (e.g., word) widely used to examine online comprehension. In particular, the N400 is a negative ERP component occurring about 400 ms after stimulus onset. Because its amplitude is very sensitive to the predictability from context, the N400 is taken as an index of very early effects of context on lexical processing. Younger adults show reduced N400s for words predictable from the prior sentence context as well as words that do not fit the context but are from the same semantic category (e.g., *To make the hotel look more like a tropical resort, they planted rows of palms/pines*). This is taken as evidence that younger adults actively predict in language comprehension so that items related to the target are activated. However, older adults show only an N400 reduction for expected endings (e.g., *palms*). This suggests that older adults are not using predictive processing. A recent study examined age differences in predictive processing by manipulating constraint and expectancy of sentence final words. Wlotko and colleagues (2012) measured the N400 effect for target words preceded by strong (e.g., *At night the old woman locked the door*) and weak (e.g., *Mr. Smith enjoyed showing people his newly installed stereo*) sentence context. Although both younger and older adults showed reduced N400s for expected endings when contextual constraint was strong, only younger adults showed reduced N400s

for weakly constrained endings. These results suggest that although older adults are equally proficient at conceptual integration (as shown by age-equivalent performance in the strongly constraining condition), younger adults are more likely to use contextual information for predictive purposes. Collectively, age-comparative studies using ERPs suggest that older adults (in general) do not engage in predictive processing in the same way as younger adults. However, older adults with high verbal ability show predictive processing comparable to the young.

The nature of comprehension is that the ideas given by the text are integrated and interpreted in light of existing knowledge, but this balance changes with age to give priority to knowledge-based interpretation (over direct computation of meaning). At the same time, the ability to compute the meaning from the text as an integrated set of ideas is preserved with aging, though the way in which effort is regulated to achieve this may change. Older readers have to allocate more effort to integrate ideas and may engage integration processes more frequently as they read in order to offset the demands of integrating larger segments of text (Stine-Morrow and Payne 2015). To some extent, segmentation itself is a procedural skill that is intact into very late life, though integration processes may become less effective with late-life cognitive declines (Payne and Stine-Morrow 2016).

Self-regulation, then, plays a large role in the preservation of language comprehension with aging. This is seen in both greater reliance on knowledge-based processing and in text-based processing that accommodate working memory limits.

### **Effects of Language on Aging**

An emerging body of literature suggests that over time a mentally stimulating lifestyle can create cognitive and neural reserve that may delay age-related cognitive decline, with some evidence supporting the idea that language experience may impact cognitive health.

### **Education, Literacy, and Longevity**

There is increasing interest in educational attainment and literacy as predictors of longevity and cognitive health (Sisco et al. 2015; Spittle et al. 2015). This body of research has grown in recent years and has shown that controlling for demographic factors known to contribute to life expectancy (e.g., sex, ethnic group, income), educational attainment is a reliable predictor of life expectancy, more so than perhaps more obvious predictors of longevity such as cholesterol level or frequency of health checkups. According to Spittle et al., if all Americans attained a high school diploma, annual mortality would be reduced by about 240,000 persons. However, measures of educational attainment (e.g., years of formal education) are of many varieties and do not take into account the quality of educational experience. One hypothesis for why education has such powerful effects on lifelong cognition is that it is a proxy for literacy, with evidence that, in fact, print exposure is a better predictor of cognitive health than education level and can delay the onset of dementia.

Language is, of course, important for many aspects of life in predominantly literate societies such as in the USA. But perhaps surprisingly, studies comparing low-literacy adults to those with well-developed literacy skills have revealed significant behavioral and anatomical consequences of literacy for cognition and neural substrates, which have the potential to impact late-life health. Often, with comparisons of high- and low-literacy samples in the USA, it is difficult to disentangle the effects of literacy from the social and economic factors associated with literacy illiteracy. However, a number of studies in recent years have focused on populations in which illiteracy is not necessarily a consequence of poverty or socioeconomic stressors that have their own significant effects on cognition and health (e.g., children in Columbia who were conscripted into service during civil war at the expense of early schooling and literacy acquisition; older daughters in the Algarve region of Portugal, who by tradition were given childcare responsibilities while younger siblings went to school to receive literacy instruction). Such natural experiments have shown that illiterates have impoverished

phonological processing, visual attention, abstract reasoning, semantic fluency, and memory compared to their literate counterparts. Literacy acquisition also enhances cortical responses to two-dimensional objects and words and supports the development of verbal working memory capacity. Furthermore, results from neuroscience research (e.g., functional and structural imaging) suggest that literacy reorganizes cortical networks to change the brain's response to both spoken and written language, with greater selectivity of activation (Huettig and Mishra 2014). However, as Huettig and Mishra (2014), in most cultures, literacy acquisition is tightly woven with schooling, so that it is a challenge to disentangle effects of literacy from educational experience more broadly.

### Bilingualism

Further evidence for language impacting cognition is a considerable body of work suggesting that bilingualism (or even better, multilingualism) confers advantages for adult cognition. Early bilinguals (i.e., those who learned a second language early in life and continue to use both languages) show reduced declines on measures of executive control as they age and show a delay in the onset of symptoms for dementia (Bialystok et al. 2012). The roots of these effects are still being explored, but likely derive from multiple mechanisms. First, proficiency in a second language is enhanced among those with strong skill in the first language, so it is possible that the bilingual advantage is grounded in part in early literacy acquisition. More importantly, in managing multiple linguistic codes, only one of which is typically appropriate at a given time, bilinguals are routinely engaging suppression mechanisms in ordinary communication. Thus, bilingualism entails routine practice in attentional control that may contribute to cognitive health in late life.

### Conclusions and Future Directions

Language comprehension is a highly active form of mental engagement. Older adults with

well-developed literacy skills have a number of advantages that support comprehension. Word recognition and use of syntactic cues to guide semantic processing are largely intact. On the other hand, there are a number of ways in which language complexity can tax attentional demands so as to compromise comprehension.

With the rise of neuroscience, there are provocative puzzles that arise in reconciling findings between imaging and behavioral data. For example, older adults typically show exaggerated contextual facilitation in behavioral data, suggesting that the build up of message-level semantics can support decoding processing. Electrophysiological data, however, often show the reverse (e.g., Federmeier et al. 2010), in particular less predictive processing from sentence context with age. Thus, it will be important for future work to develop a theoretical account of age differences in how different sorts of processes come on line in language processing, so as to accommodate both behavioral and neuroscience data.

Literacy is a form of expertise that is often taken for granted in cognitive aging research, and adults who have not developed these skills are typically underrepresented in research samples. However, a nontrivial proportion of adults in the USA have literacy skills inadequate to the demands of everyday life, and they are especially vulnerable to declines in cognitive health in later life (National Research Council 2012). More needs to be known both about the effects of literacy skill as a moderator of cognitive aging and as potential pathway to resilience.

### Cross-References

- ▶ [Age-Related Changes in Abilities](#)
- ▶ [Aging and Inhibition](#)
- ▶ [Cognitive Control and Self-Regulation](#)
- ▶ [Crystallized Intelligence](#)
- ▶ [Language, Discourse Production and Communication](#)
- ▶ [Language, Naming](#)
- ▶ [Sensory Effects on Cognition in Later Life](#)
- ▶ [Working Memory in Older Age](#)

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## Language, Discourse Production and Communication

Lori J. P. Altmann

Department of Speech, Language, and Hearing Sciences, University of Florida, Gainesville, FL, USA

### Synonyms

Autobiographical speech; Complex language; Discourse; Language production; Narrative; Off-topic speech

### Definition

Language production is complex task. A person must create an idea or message, activate the meaning elements, called semantic features, for that message, map those semantic features onto words, and then construct a sentence structure that will encode the relationships between those words specified in the initial message. Only then can the phonological encoding of the words for a sentence begin. Moreover, if the goal is to produce a narrative with several interrelated sentences, the person must decide which information will be included in each sentence, and these sentences have to be ordered logically. Considering the complexity of the process, it is, perhaps, not unexpected that language use has been found to activate nearly the entire brain, including regions that are also associated with complex cognitive tasks like working memory and executive function; moreover, these regions and networks remain relatively unchanged in aging (Shafto and Tyler 2014). Considering the intensive use of cortical resources during language production and age-related differences in cognitive performance, it may be somewhat surprising that the impact of age on language production is not more profound.

Despite the complexity of sentence and discourse production processes, older adults are very good story tellers. Several studies have documented that both older and younger adults

rate the autobiographical narratives of older adults as being of higher quality on several dimensions (James and Burke 1998; Kemper et al. 1989; Pratt and Robins 1991). These findings are often interpreted as reflecting older adults' copious experience with language use (Kemper et al. 1989; Trunk and Abrams 2009). Paradoxically, they also have been found to produce more off-topic, less coherent speech than young adults, as well as to be somewhat less fluent and less grammatical in a range of naturalistic discourse tasks, as well as more controlled picture-guided narrative production, and experimental tasks. This article reviews the literature on sentence and discourse level language production in older adults with a focus on identifying both age-related strengths and vulnerabilities. An overarching goal is to try to identify differences in language production between young and older adults that might contribute to the improvements in story quality reported in old age.

### Story Quality and Off-Topic Speech

A good story is easy to follow, dramatic, vivid, humorous, interesting, and makes a point (Pratt and Robins 1991). Increased age correlates with better story quality ratings in several studies. Pratt and Robins (1991) report that both older age and higher vocabulary size correlate with ratings of narrative quality. Moreover, they find that older adults employ the use of classic story structure, consisting of a precipitating event, efforts to address the problem, and the resolution of the problem, much more often than younger people. In this study, young adults produce only 60% of their narratives in this classic style, while middle-aged adults incorporate the classic story structure in 75% of their narratives, and 95% of the narratives of the older adults employ this structure. This suggests that, in contrast to current conceptualizations of language development in which people are experts in all aspects of language by age 21 or so (e.g., Owens 2015), some aspects of language use, like story-telling, continue to develop across the lifespan (Köber et al. 2015; Trunk and Abrams 2009).

However, not all studies have found age differences in story quality. Beaudreau et al. (2005) report little difference in the story quality of young and older adult speakers who describe pictures and tell stories with differing emotional valence (positive, negative, and neutral). Perhaps a contributing factor to the differences in findings between studies is the fact that the language samples in the Beaudreau et al. study are much shorter compared to those in other studies (e.g., James and Burke 1998), despite the fact that participants were told they had up to 10 min to speak. This suggests that extraneous differences in testing methods may have encouraged shorter narratives and differences in story quality in Beaudreau et al.

Reports of high quality narratives produced by older adults are intuitively inconsistent with reports of off-topic speech, also called off-target verbosity (James and Burke 1998; Pushkar et al. 2000). Off-target speech occurs when a speaker apparently changes topic in the middle of an ongoing conversation, thus, disrupting the coherence of the narrative. Off-topic speech also tends to increase the length of narratives. Research suggests that only a small proportion of older adults, about 20%, tend to habitually produce extremely high amounts of off-topic speech (Goldet al. 1988). The work of Gold et al. (1988) has identified several predictors of off-topic speech that include personality factors (extroversion), declining cognitive ability, and declining ability to inhibit cognitive interference. Other studies have shown that, in general, older adults tend to produce more off-topic speech than young adults, even when off-topic speech is relatively rare (e.g., James and Burke 1998; Juncos-Rabadán et al. 2005; Trunk and Abrams 2009). This raises the question of why older adults' narratives are rated more highly than those of young adults, when they contain more off-topic speech. A possible explanation for this is that off-topic speech may enhance the quality of the narratives in some way, perhaps by adding depth and context to the story.

To address this issue, James et al. (1998) investigate whether the increased amounts of off-topic speech produced by older adults relative to young adults might relate to either differences in

communicative intent or to inhibitory deficits. More specifically, James et al. point out that young and older adults may have different goals for the narratives they produce or may feel the need to provide more background information for young adult researchers when producing stories. In addition, James et al. raises the possibility that early studies on off-topic speech (e.g., Gold et al. 1988; Pushkar et al. 2000) typically collect speech samples using autobiographical questions, raising the possibility that differences between older and young adults may be found only in this type of narrative. For example, older adults may realize that young adults are likely unaware of the details of everyday life 50–60 years in the past and so they elaborate on these topics more. To address these possibilities, James et al. ask young and older adults to produce narratives that describe pictures (objective, expository narratives) or answer autobiographical questions. In fact, in this study both young and older adults produce longer stories during autobiographical narratives. Even so, this study reports that older adults talk more and include more off-topic speech than young adults but only for autobiographical topics. Further, they find that older adults' narratives continue to be longer even when instances of off-topic speech are removed. Subsequently, all the stories were rated by groups of young and old raters. Both young and old groups rated the older adults as being more talkative but also rated the stories of the older adults as more interesting, more informative, and of higher quality. These findings strongly suggest that the off-topic speech of older adults is specific to autobiographical speech. Further, the increased length and off-topic speech in the stories of this group of older adult speakers does not interfere with the quality of their stories.

More recently, Trunk and Abrams (2009) have expanded on the study by James et al. (1998) by investigating more explicitly the possibility that young and older adults' goals for narratives differ. They first ask older and young adults to rate how important they consider certain communicative goals are when producing two types of discourse, procedural and autobiographical narratives. The authors present the goals to be rated in pairs – one

implicitly associated with conciseness and one with increased length, so that participants must decide which of two goals is more important for each of the two types of narrative, (e.g., clarity, interesting; fascinating, focused; comprehensible, elaborative; entertaining, simple; logical, stimulating; and educational, objective). Results reveal that young adults have very different goals for the two types of narratives: Young adults prefer procedural narratives to be clear, focused, comprehensible, simple, logical, and objective; whereas, they prefer autobiographical narratives to be interesting, fascinating, elaborative, entertaining, and educational. In contrast, older adults' ratings show no strong preferences between most pairs of goals presented, suggesting older adults apparently value both goals in each pair relatively equally. Further, the older adults seem to have similar expectations for both types of narrative; for example, they seem to equally value both being clear and being interesting for both types of topics. As Trunk and Abrams point out, it may actually be this equal weighting of priorities – both clear and interesting, both focused and fascinating – that makes the narratives more preferred by both young and old raters. Subsequently, a subset of the original participants produces two procedural and two autobiographical narratives, and the narratives are rated on the same dimensions included in the earlier questionnaire. As in James et al. (1998), the narratives of older adults are longer and contain more off-topic speech than those of young adults, and autobiographical narratives are longer than procedural narratives. Ratings of the narratives of young adults correlate with their own previous judgments of the importance of different characteristics of speech, but the ratings of the older adults' narratives do not correlate with their previous judgments of the importance of these goals. As the authors point out, however, the latter finding may be due to insufficient variance in rating ranges, since older adults show no specific preference for goals. Interestingly, Trunk and Abrams also report that, while objective measures of off-topic speech show older adults produce more off-topic speech in both autobiographical and procedural narratives, raters only notice that older

adults are more talkative, less focused, and less clear in the procedural narratives. These findings suggest that listeners may not expect or appreciate the extension of some of these goals to procedural discourse. However, in general, the findings are compatible with a developmental view of narrative expertise (Köber et al. 2015), in which adults learn over the course of their lives that good narratives must embody a number of somewhat competing goals particularly in autobiographical speech, whether they are able to tailor their narratives to fit these expectations or not.

By definition, off-topic speech should be highly related to measures of global coherence. Global coherence refers to the extent to which the sentences in a narrative relate to the overall topic or theme of the narrative. Wright et al. (2014) compare global coherence between young and older adults in five discourse tasks: single and sequential picture descriptions, stories based on a wordless picture book, recounts of autobiographical events, and procedural narratives. The only type of narrative showing age differences in this study is the recount of autobiographical events, which is the most common type of narrative analyzed in the literature. Moreover, they find that better global coherence in the autobiographical recounts is associated with better episodic memory and executive function, in particular inhibitory and switching ability. These findings are consistent with those of James et al. (1998) who only found age differences in off-topic speech in autobiographical narratives but Wright et al. take the additional step of relating coherence/off-topic speech to age-related changes in cognition.

These studies indicate that, although older adults may start to show increasing off-topic speech, the quality of narratives remains high (Beaudreau et al. 2005), indeed usually higher than young adults (James and Burke 1998; Kemper et al. 1989; Pratt and Robins 1991; Trunk and Abrams 2009). The improving quality of narratives may represent a learning process over the lifespan (Kemper et al. 1989; Köber et al. 2015) during which speakers learn to integrate diverse goals, such as the complex balance between elaboration and focus in a narratives

(Trunk and Abrams 2009) to increase the quality of their narratives. These improvements in narrative quality occur in tandem with decrements in other aspects of language production.

### **Lexical Diversity and Information Content**

Two aspects of narrative structure that may contribute to narrative quality are lexical diversity and information content. Lexical diversity refers to the variety of words used relative to the number of words used. Thus, if the words are repeated over and over, the lexical diversity ratio is low; conversely, more unique words in a narrative increase the lexical diversity. Information content refers to just that: how much information is conveyed. In constrained tasks, such as telling particular stories or describing pictures, the amount of information is often measured as the proportion of predetermined main concepts that are included in the narrative. In unconstrained speech, such as conversations or responses to open-ended questions, propositions are counted (e.g., Kemper et al. 2003; Kemper and Sumner 2001). Many studies examine information content not only by analyzing the absolute amount of information conveyed but also by analyzing the density of the information, which is essentially a measure of how many words are needed to produce a proposition or main concept and can be calculated in a number of different ways.

A well-established measure of lexical diversity is type-token ratio (TTR), which is the ratio of the number of different words to the number of total words. Higher TTRs are associated with more diverse word choice, while lower TTRs signal repeated use of the same words. Kemper and Sumner (2001) report older adults actually produce a higher TTR than young adults in autobiographical narratives. More recent findings support and refine this finding across narrative types. Fergadiotis et al. (2011) compare lexical diversity in young and older adults across several types of language samples. They find that older and young adults produce similar levels of lexical diversity when asked to tell a story based on a picture or on

a wordless picture book. In contrast, older adults employ a more varied assortment of words when describing how to do something or recounting autobiographical events. Similarly, in a large-scale corpus-based analysis of telephone conversations, Horton et al. (2010) also report that TTR correlates with age: older speakers use a larger variety of words. Thus, in at least three types of language samples, procedural narratives, autobiographical speech, and conversations, older adults have been shown to use a greater variety of words than young adults.

In general, these findings have been attributed to differences in vocabulary between groups, which is well attested (e.g., Kemper and Sumner 2001). While this is a logical conclusion, in fact, there is little support in the literature for assuming that TTR is related to vocabulary. Kemper and Sumner (2001) report that, in autobiographical narratives, TTR loads on a working memory factor rather than a vocabulary factor in both young and older adults. Considering that, it is somewhat surprising that they also find TTR is significantly higher in the older adults than in the young adults, while working memory scores are lower. This finding likely arises because the models of verbal abilities are calculated separately for young and older adults. Thus, within the young adult group and the older adult group, those with higher working memory also produce a greater assortment of words in their narratives.

In summary, research has found that the narratives of older adults have greater lexical diversity than those of young adults when producing relatively unconstrained speech. However, when narratives are constrained, such as in picture description or telling stories based on a picture book, lexical diversity shows no age-related changes.

Information content is another vulnerable aspect of language production in aging. Several studies examine age-related change in the inclusion of main events in stories, proposition counts in narratives, and proposition density. Further, many of these studies examine the relationship between information content and cognitive abilities, specifically working memory and executive function. Wright et al. (2011) investigate how

young and older adults create stories based on different picture stimuli and the extent to which each group reproduces predetermined main concepts inherent in the stimuli. As predicted, older adults produce fewer main events than young adults. Juncos-Rabadán et al. (2005) report a similar study in native Spanish speaking young and older adults. In the latter study, older adults' narratives contain a lower density of information content (i.e., more words are needed to produce the same amount of information) than the narratives of young adults, although the actual amount of information produced by the two groups is similar. Further, these researchers also determine that density of information content correlates significantly with vocabulary scores of their participants.

Similarly, Kemper and Sumner (2001) report lower proposition density in older adults' narratives compared to those of young adults. Furthermore, they relate low proposition density to poor processing ability, assessed by a number of fluency tasks. Specifically, when processing resources and, in young adults, working memory are limited participants may add additional words, particularly lexical fillers (i.e., words like "you know," and "like" that do not add to the semantic content or syntactic complexity of the sentence) to maintain their fluency while accessing words and formulating sentences. Thus, poorer processing, signaled by poor verbal fluency, is associated with increases in verbosity. These studies are consistent with the findings in Kemper et al. (2001) who report that, in a longitudinal study, propositional density declines with increased age. Moreover, similar to the findings in Juncos-Rabadán et al. (2005), Kemper, Thompson, and Marquis report that participants with higher vocabulary scores at initial testing have higher proposition counts initially; however, the ameliorating effect of vocabulary on proposition density declines with increasing age.

Taking a different approach, Wright and colleagues (2011) elicit stories from young and older adults using wordless picture books. Contrary to their expectations, they find no differences in the number of main concepts produced by the two groups. Extending their analysis, these

researchers find that older adults produce significantly longer stories than young adults for the same picture books. Consequently, older adults produce more words per main concept or lower information density. This is consistent with findings reported above suggesting that older adults are more verbose than young adults. Additionally, using canonical correlations, this study identifies a significant association between the proportion of main concepts produced and cognitive abilities, including working memory, long-term memory, and executive function in the older adults. However, the same analysis was not significant in young adults.

These studies demonstrate that age-related differences in the density of information in narratives exist, even when the absolute amount of information produced does not differ (Juncos-Rabadán et al. 2005; Wright et al. 2011). Interestingly, the density of information seems to rely on both vocabulary size and cognitive abilities. Considering this, older adults with more robust lexical-semantic networks and better cognitive abilities appear to have more linguistic and cognitive resources to support information density in speech, making their narratives more concise and precise. However, the evidence suggests that the initial advantage provided by a robust vocabulary early in the aging process wanes over time (Kemper et al. 2001), perhaps due to declines in other critical cognitive abilities, such as executive function, working memory, and long-term memory.

### **Declining Syntactic Complexity**

One of the undisputed findings in geropsychology is that many cognitive functions decline in aging (Lindenberger and Baltes 1997). Consequently, much of the research examining language production in older adults has focused not only on documenting age differences in different quantifiable features of language but also on whether these effects are related to between age group differences in cognitive function, such as working memory, executive function, and speed of processing. Analyses have addressed language

produced in response to several elicitation techniques, including open-ended questions, stories composed to fit a wordless picture book, and single sentence responses in constrained sentence production tasks. One of the most commonly analyzed features of narratives has been syntactic complexity. Research has documented age-related declines in syntactic complexity and occasionally, in the accuracy of syntactic processing.

Taking a lifespan perspective, Marini et al. (2005) examine the picture descriptions of adults from age 20 to 84. They report a systematic decline in syntactic complexity (i.e., the number of embedded clauses per sentence) starting at age 40. Several studies by Kemper and colleagues also compare syntactic complexity differences in the productions of young and older adults. In an early study, Kemper et al. (1989) examine language production in young and older adults using three elicitation methods, a structured conversation, and two open-ended, autobiographical questions, one answered orally and one in writing. Analyses reveal lower syntactic complexity in the language samples of older adults than in those of young adults. Moreover, this study also finds that adults with better vocabulary and/or better working memory ability produce more complex sentences. Two subsequent studies by Kemper and colleagues further elucidate the effects of aging and cognitive abilities on language complexity and semantic content.

Kemper and Sumner (2001) analyze the structure of verbal abilities in 100 young and 100 older adults in separate structural models. Using language samples elicited by autobiographical questions, these researchers analyze sentence complexity, sentence length, propositional density, and type-token ratio (discussed above) in relation to a range of vocabulary, reading, working memory, and executive function tasks. Importantly, they find that the language samples of older adults are significantly less syntactically complex and shorter than those of young adults. In both groups, the structural model identifies three underlying constructs, referred to as vocabulary, working memory, and processing, although the language measures align slightly differently for

young and older adults. For both young and older adults, sentence complexity is associated with working memory, supporting the hypothesis that working memory capacity limits sentence complexity in both young and older adults. They find that, for older adults, lower processing ability is associated with longer sentences, while for young adults longer sentences are associated with both lower processing ability and lower working memory.

Converging evidence for these findings come from Kemper et al. (2001) who report a longitudinal analysis of autobiographical narratives collected from 30 older adults. Study participants are tested annually over periods of between 7 and 15 years. Strong within-person declines in sentence complexity are evident over time, with a steep drop between age 74 and 78. Further, the growth curve model of change over time indicates significant effects of both initial working memory scores and the interaction between age and working memory. Interestingly, robust differences in sentence complexity at the onset of the study are minimized over time as age increases and working memory declines. This suggests that limitations in cognitive abilities like working memory and executive function may constrain the syntactic complexity of narratives, leading to an overall simpler style of speech.

Evidence that older adults adopt a speech style with significantly limited syntactic complexity and information content in language production to accommodate changes in cognitive abilities can be found in the fact that, except for speech rate, their speech is relatively impervious to dual task effects. In a series of studies examining narrative production while walking (Kemper et al. 2003) or doing a rotary pursuit task (Kemper et al. 2009), Kemper and colleagues have found that only young adults simplify their syntax and reduce their proposition density in dual task conditions. In fact, during a complex dual task the syntactic complexity and sentence length of young adults typically drop to near that of older adults in the single task. Further, the extent of dual task effects on sentence complexity in young adults is related to working memory; young adults with lower working memory, who had limited syntactic

complexity in their narratives with no dual task, experience more limited dual task declines. In contrast, the syntactic complexity and proposition density of older adults remain relatively constant (Kemper et al. 2003, 2009). Similarly, speed of cognitive processing predicts changes in words per minute in both young and older adults; people with faster speed of processing show the greatest slowing under dual task conditions (Kemper et al. 2009). Kemper suggests that the speech of older adults is already optimized for communication under conditions of reduced working memory and processing speed and is, in effect, at a functional floor – their speech cannot get more simple or contain less information without breaking down completely (Kemper et al. 2003).

The juxtaposition of high quality narratives in combination with decreased syntactic complexity in the narratives of older adults suggests the interesting possibility that decreased syntactic complexity may actually play a role in the quality of narratives. Indeed, this particular possibility was explored in an early study by Kemper et al. (1990). Fewer clauses per utterance and fewer embedded clauses modifying the sentence subject significantly predicted both the quality (i.e., “interestingness”) and clarity of language samples from young and older adults. Thus, the simpler syntax used by older adults, while clearly reflecting declines in working memory and other cognitive abilities, may actually reduce the processing burden on listeners, making narratives clearer and the information in it more accessible.

## Conclusion

Throughout this entry, we have compared young and older adults’ language production with the overarching goal of identifying characteristics of older adults’ language production that might account for the rather consistent judgments that older adults’ narratives are of higher quality, more interesting, and clearer than those of young adults (James and Burke 1998; Kemper et al. 1990; Trunk and Abrams 2009). Several themes have emerged. First, most of the differences in young and older adults’ narratives have been found in

autobiographical narratives. Older adults’ autobiographical narratives, produced in response to questions about events or people in their lives, are longer and contain more off-topic speech; however, these do not seem to interfere with narrative quality (Trunk and Abrams 2009). Moreover, older adults’ narratives have greater lexical diversity, and often take more words to convey the same amount of information. But, it is unknown whether these latter characteristics contribute to story quality. Second, older adults may be more expert at producing autobiographical narratives, and this expertise may continue to improve even into their 80s (Kemper et al. 1989), although syntactic complexity and information density may decline concurrently (Kemper et al. 1990; Marini et al. 2005). One piece of evidence for this is that older adults appeared to realize that a good narrative must be both clear and interesting, both comprehensible and elaborative (Trunk and Abrams 2009), and apply these criteria to both autobiographical and procedural narratives. In contrast, young adults seemed to have strict and contrasting schema for procedural versus autobiographical narratives, and actually use these schema for producing these genres of narratives, though they led to poorer story quality ratings. Another piece of evidence for the greater expertise of older adults in producing narratives is that their narratives are typically structured using classic story grammar elements, whereas only about half of the young adults typically include classic story grammar episodes in their narratives (Pratt and Robins 1991). Further evidence for greater age-related expertise in narrative production is the greater lexical diversity in older adults’ narratives, relative to those of young adults (Fergadiotis et al. 2011; Kemper and Sumner 2001). In contrast, several aspects of language production seem to be impaired in older adults relative to young adults. There is robust evidence that the narratives of older adults, compared to those of young adults, are syntactically less complex (Horton et al. 2010; Kemper and Sumner 2001), are not as globally coherent (Wright et al. 2014), and have lower information density (Kemper and Sumner 2001; Wright et al. 2011). Intuitively, these seem to be characteristics that

would detract, or at least distract, from the quality of the narratives. However, Kemper et al. (1990) found negative correlations between sentence complexity and ratings on interestingness and clarity. This suggests that the simplified syntax used by older adults may contribute to story quality, likely by making the story easier to understand. This reasoning, in turn, suggests that lower syntactic complexity need not be considered a deficit in aging, as it may actually benefit the listener. On the other hand, no one has yet directly examined whether age-related differences in global coherence or propositional density detract from or add to story quality, or whether increased lexical diversity and use of classic story grammar structure benefit story quality. Understanding which aspects of narratives contribute to judgments of narrative quality in older and young adults will help us better understand language changes in aging and determine which changes facilitate and which interfere with communication. Understanding these effects may help us determine which changes truly represent age-related deficits and which merely represent differences.

## Cross-References

- ▶ [Cognitive and Brain Plasticity in Old Age](#)
- ▶ [Executive Functioning](#)
- ▶ [Language, Comprehension](#)
- ▶ [Language, Naming](#)
- ▶ [Memory, Autobiographical](#)
- ▶ [Working Memory in Older Age](#)

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## Language, Naming

Lori E. James<sup>1</sup> and Danielle K. Davis<sup>2</sup>

<sup>1</sup>Psychology Department, University of Colorado, Colorado Springs, CO, USA

<sup>2</sup>University of Florida, Gainesville, FL, USA

### Synonyms

Word production; Word retrieval

### Definition

The verbal production of a single, specific word to represent a concept

### Main Text

The cognitive process of producing a known word is called *word retrieval*. Most of the time, speakers engage in word retrieval while producing phrases, sentences, or even larger units of language as part of their verbal communication with others (see Altmann's entry on "[► Language, Discourse Production and Communication](#)"). However, some

word retrieval requires the production of a single, predetermined, specific word to represent a concept, in which case it is called *naming*.

In this review, typical effects of adult aging on naming are presented, along with suggested accounts of the age differences. Early work in the field of cognitive aging suggested that language processes were generally unchanged in healthy adulthood. This conclusion is now known to be inaccurate and probably had at least two causes. First, much of the initial "language" research in aging involved comprehension of vocabulary words, which is at least as good for older as young adults (see entry about "[► Language, Comprehension](#)" and/or Rabbitt's entry about "[► Crystallized Intelligence](#)"). Second, age-related changes in language processes can be easily overlooked because they are much less salient than age-related changes in the ability to form new memories (see entry about "[► Memory, Episodic](#)"). However, older adults are aware of and are often concerned about their word retrieval problems, and research has established some reliable differences between young and older adults' naming abilities.

Many factors about a word itself can make it more difficult to retrieve and produce in a naming task, for speakers of all ages. For example, words that are used infrequently are harder to name than words used on a regular basis, and proper names (e.g., President *George Washington*; celebrity tennis player *Serena Williams*) are harder to name than common words (e.g., the noun *photosynthesis*; the adjective *prosperous*). However, aging is an independent factor that contributes to the difficulty of word retrieval and naming. The cognitive changes that occur with healthy aging do not impact all aspects of naming to the same degree. Developing a comprehensive understanding of these multidimensional changes in naming with age is critical for understanding the normative changes that occur in older adulthood.

Research on naming has adopted a variety of measures to index how readily word retrieval and production occurs. One such measure is accuracy, or how frequently people produce the correct word or name. People are generally accurate when naming objects or concepts, but the types

of errors that speakers make are somewhat predictable and have been influential in understanding the processes underlying successful naming. Because correct production is the most common outcome for each stimulus during a naming study, response times are a second index often used to provide a sensitive measure of subtle changes in the naming process. Response time measures can encompass both the time to initiate articulation (also called *onset times* or *naming latencies*) and the time to complete articulation of the word, with slowed naming taken as an indication of difficulty. Another measure of naming ability is the occurrence of tip-of-the-tongue (TOT) states, in which a word cannot be articulated and feels like it is currently just beyond the speaker's reach. A TOT reflects a partial failure to retrieve a known word or name, and its occurrence thus indicates naming problems.

First, research that uses a variety of these measures to assess age-related changes in producing common (i.e., non-proper name) words is reviewed, and then the effects of various word characteristics on the naming abilities of young and older adults are described. Next, older adults' disproportionate difficulties with retrieval of proper names are summarized. Finally, some of the theoretical mechanisms suggested to cause age-related naming deficits are briefly described.

### Age Differences in the Retrieval of Common Words

Retrieval failures for common words (i.e., words that are not proper names) become more frequent with age and are often cited as a source of frustration for older adults. Decades of research have elucidated the ways that these naming difficulties manifest, and this work has been particularly useful in illustrating the stages at which the process of naming is most affected by aging. For example, older adults are less accurate than young adults when naming a picture or recalling a word from a definition and are more likely than young adults to use circumlocution (i.e., to produce a synonym or description of the desired term) when attempting to produce a specific word (Maylor 1995).

Although this could reflect age-related increases in vocabulary (older adults generally know more names than young adults to describe a pictured object or a definition), this idea is challenged by the fact that older adults are also generally slower to retrieve words. Early research on naming comparing people between their mid-20s and mid-70s showed age-related increases in time to accurately name pictures depicting everyday objects. People named items more quickly as the trials progressed, presumably because the early trials served as "practice" that facilitated naming on later trials. However, while there was a trend toward reducing age differences, notable age-related declines in naming speed still remained across the experimental session, suggesting that practicing the naming task does not eliminate age differences in word retrieval (Thomas et al. 1977). Naming latency and accuracy have been shown to decline with age in both cross-sectional and longitudinal comparisons. For example, when adults between the ages of 30 and 70 named pictures of line drawings depicting actions (e.g., *running*, *diving*) three times over a 7 year period, accuracy decreased and response times increased across the decades (i.e., cross-sectional declines were established), and adults over age 50 experienced decreased accuracy over time (i.e., adults in this age range evidenced longitudinal declines). The diversity of errors also increased with age: The types of errors older participants made were more varied, including more substitutions of nouns for verbs (*surgeon* for *operating*), more incorrect responses that had served as answers on a previous trial (saying *running* for *winning* after producing *running* in response to a prior picture), and more fragments of incorrect words (often resulting in self-correction; e.g., "*swi – diving*") (Ramsay et al. 1999).

In addition to reduced accuracy and longer reaction times, some research has shown that aging leads to more frequent production of other types of errors during naming. Specifically, dysfluencies such as pauses, hesitations, and fillers (e.g., "umm") can increase with age, perhaps as attempts to "buy time" to find the word in the face of retrieval difficulties (Burke and Shafto 2008). For example, when researchers presented

multiple pictures (e.g., pictures of a *snake*, *lamp*, *brush*, and *cart*) for young and older participants to name, onset times for the groups did not differ. However, older adults took significantly longer to fully articulate each word and paused more between picture names, leading to a slower speech rate for older than young adults (Belke and Meyer 2007).

A specific word retrieval problem that can occur during naming is the aforementioned TOT state. Despite being able to retrieve and produce conceptual information about a specific term (e.g., “It’s a reptile that has the ability to change colors to match its environment. People who fit in well in all type of situations can also be called this.”), a speaker may be unable to produce the desired word (*chameleon*) at the moment they need to name it. A speaker experiencing a TOT feels that production of the word could occur at any time. This fleeting and imminent nature of TOTs distinguishes them from cases where a person does not know the word at all or from cases where he or she “feels” like they might or should know the word. At some point, the speaker will remember the word (or will be prompted with the word) and will then be able to retrieve and produce it. This is called *resolution* of the TOT state.

Older adults experience more TOT states than young adults and also differ from young adults on the duration of their TOTs and the type of information they have available during their TOT experiences. For instance, older adults have access to less information about an intended word during a TOT state. Young adults can often retrieve the first letter or number of syllables of the word and sometimes produce other alternate terms (i.e., words that are similar in sound or meaning to the correct word, but the participant knows to be incorrect) instead of the intended word. However, older adults are more likely to experience “drawing a blank” during a TOT, meaning they cannot recall any part of the word. They are also less likely than young adults to have alternate words that are similar in sound or meaning come to mind. Additionally, although older adults are just as likely to resolve their TOTs as young adults, they take longer to do so (Burke et al. 1991).

## Factors that Influence Naming

The claim that naming worsens with age is quite broad. Research has examined specific conditions under which age differences in word retrieval are more or less likely to emerge. Properties of a word itself can influence how easy it is to produce, and the influence of these factors on age-related changes in naming is described below.

**Frequency.** Words with high frequency (e.g., *decide*) are used quite regularly in everyday speech and are more readily retrieved and produced by speakers of all ages than low-frequency words (e.g., *decry*) that are rarely used. Both young adults and older adults have more TOTs for low- than high-frequency words, suggesting that words that are not used often are more difficult to retrieve. Further, one result indicated a trend toward an interaction of age group and word frequency, such that older adults experienced disproportionately more TOTs when naming low- than high-frequency words (Burke et al. 1991).

Research has also examined the influence of word frequency via picture naming. A study of aging and naming in monolingual and bilingual speakers showed that young adults named pictures more quickly and accurately than older adults. Both age groups exhibited longer naming latencies and poorer accuracy for low- than high-frequency words, with a trend toward larger frequency effects in older adults. In other words, older adults had larger differences in accuracy and reaction time between low- and high-frequency words than did young adults. Although bilingual status effects on word retrieval are beyond the scope of this entry, the findings related to age suggest exacerbated naming difficulty for low-frequency words in older adulthood (Gollan et al. 2008), similar to the finding with TOTs (Burke et al. 1991).

*First-syllable frequency* refers to how often a word’s initial syllable is used within a language. The word *decanter* has a high-frequency first syllable because the initial syllable /dɪ/ is found in many words. The word *omnibus* has a low-frequency first syllable because /ɒm/ does not begin many words. A word’s first-syllable

frequency influences young and older adults' TOT incidence, and TOTs increase more with age when the word contains a low-frequency first syllable (Farrell and Abrams 2011).

**Neighborhood Characteristics.** Another factor affecting naming is the word's *neighborhood density*, or whether it shares sounds with many other words. For example, *decanter* has high neighborhood density because it shares sounds with many words (e.g., *decide*, *decry*, *banter*, *otter*) but *omnibus* has low neighborhood density because it shares sounds with relatively few words (e.g., *omnivore*, *rhombus*). People are more likely to have TOTs for words with low than high neighborhood density, and neighborhood density interacts with word frequency. Specifically, low-frequency words that *also* have low neighborhood density are particularly likely to result in TOTs for young and older adults (Vitevitch and Sommers 2003). However, high neighborhood density has also been shown to have a cost for older adults, in that their picture-naming accuracy declines with increased neighborhood density (Gordon and Kurczek 2014). The high-frequency phonological neighbors have been suggested to compete with the target for production.

Like neighborhood density, *neighborhood frequency* describes a feature of the words that are phonologically related to a target word. However, instead of describing how *many* phonological neighbors a target word has, neighborhood frequency is the average word frequency of those neighbors. Thus, words that have low neighborhood frequency have neighbors that are low in word frequency (are used infrequently), whereas words that have high neighborhood frequency have neighbors that are high in word frequency. Young adults' naming is not impacted by neighborhood frequency, but older adults experience more TOTs for words with low than high neighborhood frequency, so long as the words also have low neighborhood density or low word frequency (Vitevitch and Sommers 2003). That is, low neighborhood frequency compounds word retrieval difficulties traditionally associated with low neighborhood density and low word frequency, but only for older adults.

More work is needed to better understand the relationships among word frequency, syllable frequency, neighborhood density, and neighborhood frequency. Specifically, very little is currently known about how the interplay of these factors might change across adulthood, particularly using reaction times or accuracy measures in addition to TOT rates. However, current research indicates that the effects of neighborhood characteristics emerge more prominently and in a more complex fashion as people progress into older adulthood.

### Effects of Alternate Words on Naming

Researchers have relied on typical naming paradigms, such as picture naming or recalling a word from a definition, to isolate the processes involved in retrieving and producing only a single intended word. These procedures typically allow participants to focus on the task of retrieving the desired word. However, everyday naming often does not occur under such controlled conditions, free from distractions or interference. Often, people must retrieve words when other stimuli are competing for attention, as when trying to recall a specific word while on a crowded bus with other people who are talking. Additionally, people sometimes have incorrect alternate words spontaneously come to mind during attempts to produce a word or name (e.g., *thermometer* comes to mind when trying to retrieve the word *barometer*). Research has explored how these alternate terms can affect naming, with the goal of elucidating how they influence young and older adults' word retrieval.

Picture-word interference paradigms and TOT priming studies both measure the success and efficiency of word retrieval, but they do not always produce parallel results, and the precise influence of alternates on word retrieval should be considered in light of the specific procedure used. In the picture-word interference paradigm, a to-be-ignored distractor word (e.g., *cat*) is presented with a to-be-named picture (e.g., *dog*). Distractors can either be shown visually somewhere on or near the target image or can be presented auditorily. Participants are to produce the name of the pictured item and ignore the

distractor word, and slowing of response times to name the picture indicates the degree to which the distractor word influenced target word naming. The TOT priming paradigm involves traditional TOT-eliciting techniques, in which participants must retrieve a word from a definition or a picture. In one version of the priming paradigm, an alternate word (or set of words) is presented *before* the definition or picture is shown, allowing researchers to assess how the word(s) influence the likelihood of experiencing a TOT for the target word. In another version of the priming paradigm, alternate words are presented *after* the participant initially attempts to retrieve the word and experiences a TOT. This method allows researchers to examine the effect of alternates on TOT resolution, or how likely the word will be retrieved once a TOT has occurred.

**Phonologically Related Alternates.** In some cases, alternate words that share phonology (i.e., sounds) with the target word have been shown to facilitate word retrieval. For example, in picture-word interference studies, presenting a distractor word that is phonologically related to the target word (e.g., seeing the word *doll* and a drawing of a *dog*) speeds picture naming when compared to an unrelated word (e.g., *book*), so long as the picture and distractor word are presented simultaneously. This *phonological facilitation effect* occurs in both young and older adults, to a similar degree (Taylor and Burke 2002). The distractor word prepares the target word's phonology to be articulated more quickly, an effect that does not vary across adulthood. Further evidence that phonologically related alternate words facilitate naming comes from studies using the TOT paradigm: Compared to unrelated words, phonologically related words (sharing at least the first syllable) that are presented prior to a TOT-inducing question reduce both young and older participants' TOT rates. Similarly, when phonologically related words are presented while a participant is in a TOT state, both young and older adults are more likely to resolve their TOTs (James and Burke 2000). Providing at least part of the TOT word's phonology is critical for both avoiding TOTs and resolving them when they do occur. However, these facilitative effects are not necessarily

uniform across the lifespan: As individuals progress into advanced adulthood (late 70s/early 80s), phonologically related words may no longer help resolve TOTs compared to unrelated words (White and Abrams 2002).

Additional research using the TOT paradigm illustrates that phonologically related alternates have the potential to interfere with word retrieval, particularly in advanced old age. TOT resolution is only facilitated when phonologically related primes do not share grammatical class with the target (e.g., prime word *robust*, an adjective, for the TOT word *rosary*, a noun). Presenting phonologically related alternate words that share grammatical class with the target (e.g., prime word *robot*, a noun) does not help young or older adults resolve their TOTs compared to unrelated words. In fact, for the oldest adults (aged 75–89), phonological alternates that share grammatical class actually make the resolution of TOT states less likely (Abrams et al. 2007). These alternates seem to compete with the target for retrieval, whereas alternates that do not share grammatical class do not, and older adults might experience more competition than young adults.

**Semantically Related Alternates.** Contrary to phonologically related alternates, picture-word interference studies have shown that it takes longer to name a target picture (e.g., *dog*) when the distractor word shares meaning (e.g., *cat*) compared to an unrelated distractor word, specifically when it is presented shortly before or at the same time as the target picture. This is called the *semantic interference effect*, and although it occurs for young adults, research has shown that older adults experience differentially greater interference than young adults (Taylor and Burke 2002).

Whereas semantically related words can delay word retrieval in picture-word interference studies, they do not increase the likelihood of TOTs for either young or older adults. For example, in one study, young, young-old, and old-old participants read TOT-inducing questions, and if they had a TOT (e.g., for the word *chameleon*), they were either shown the first letter of the target word with dashes representing the rest of the word (*c-----*) or were shown a semantically related alternate word (*salamander*). Participants from all

age groups were still able to resolve their TOTs after semantically related alternates were presented, although less often than when the first letter of the word was presented (Heine et al. 1999). In other words, semantically related alternates were not helpful to TOT resolution in the way phonological cues were, but they did not completely prevent resolution of TOT states (see also proper names section, below).

## Retrieval of Proper Names

As noted before, individuals of all ages have more difficulty retrieving proper names than other types of words, and this difficulty is exacerbated in older adulthood. Older adults experience more TOTs than young adults for all types of words, but they have disproportionately more TOTs for proper names, as demonstrated in picture-naming tasks as well as definition-based tasks (Burke et al. 1991; James 2006). Part of the reason that proper names have become a focus of research relates to the special status proper names have in social settings and conversation; regardless of whether a proper name is used in a confrontational manner (e.g., used as a means to greet or summon someone) or referentially (e.g., used to refer to others not present in the conversation), successful retrieval of a proper name has direct social consequences. For instance, most proper name retrieval failures cannot be compensated with a description or synonym, and are very noticeable when they do occur because they can lead to social embarrassment or misunderstandings.

Most research regarding proper name retrieval has focused on differences in accuracy as opposed to reaction time because response times for proper names are generally much longer and a lot more variable than for common names (e.g., object names). Diary studies were among the earliest techniques used to document older adults' specific deficits for naming people or producing other proper nouns. Questionnaires assessing the frequency and details associated with young, middle-aged, and older adults' naming failures in everyday situations indicate that adults of all ages experience more naming failures for proper

names than object names or abstract words, with a particularly dramatic age-related increase in failures for proper names (Cohen and Faulkner 1986). Results from one diary study in which participants recorded information about TOTs they experienced over a 4-week period indicated that middle-aged and older adults experienced a differentially greater proportion of proper name TOTs than young adults (Burke et al. 1991). These studies also found that the majority of older adults' naming failures occurred for the names of friends or acquaintances. Perhaps this is because these names are retrieved more frequently than other proper names (e.g., place names or celebrity names), thereby offering more opportunities for retrieval failures to occur.

Although there is utility in understanding naming problems that occur in everyday life, there are limits to the conclusions that can be drawn from diary studies. Naturally occurring naming failures may be influenced by a number of factors such as how frequently a name is encountered or recalled and the time and effort an individual expends on retrieving names. To control for such factors, laboratory research has been conducted to more clearly determine whether proper name retrieval is disproportionately impaired in older age. In a laboratory-based, controlled study on aging and word retrieval, young and older adults saw a series of definitions designed to elicit TOTs for either common words (objects, adjectives, and verbs) or proper names (places or people). Older but not young adults experienced more TOTs for person names than any other word type, and older adults experienced more TOTs for person names than young adults (Burke et al. 1991).

Production of proper names in response to celebrity pictures does not appear to be susceptible to interference from alternate names, contrary to the frequently articulated belief that other names produce interference that disrupts or "blocks" name retrieval. For example, when young and older participants answered a question about a famous fictional character (e.g., *Eliza Doolittle*) and then immediately saw a picture of a celebrity depicting that character (*Audrey Hepburn* as the character *Eliza Doolittle*), TOTs did not increase compared to an unrelated condition

(Cross and Burke 2004). Additionally, presenting the name of a celebrity that is famous for similar reasons as the target celebrity, and who shares a first name with the target celebrity, facilitates naming. In fact, older adults benefit at least as much as young adults from the prior encounter with the alternate name (Oberle and James 2013).

Within the category of proper names, person names appear more vulnerable to naming failures than other classes of proper names, such as place names (Cohen and Faulkner 1986). One possibility is that unlike person names, place names have particular features that facilitate their retrieval and make them more resistant to naming problems in old age. For example, the place name *Paris* brings a lot of vibrant characteristics to mind. In fact, it is so descriptive that it can even be used as an adjective, *Parisian*. Regardless of why place name retrieval is less affected in older age than person name retrieval, the significance of this observation is that proper name retrieval is differentially susceptible to decline in older age and that not all aspects of naming decline uniformly.

### Explanations for Naming Difficulties in Older Age

Why does aging lead to increased naming difficulty? A number of possibilities have been proposed. The idea that older adults have reduced cognitive resources compared to young adults has maintained popularity over the years, and one specific example of this type of explanation is that older adults have reduced *working memory* capacity (see entry on “► [Working Memory in Older Age](#)”). Working memory acts as the gateway for the entrance of information into the mind, and it plays a critical role in the active mental processing of information. Thus, age-related deficits in working memory might be expected to cause reduced naming abilities in older adulthood.

Older adults’ naming deficits could also be caused by their slowed cognitive processing. The ability to process information becomes less efficient in older age so that cognitive processes are generally slower and more error-prone (see Madden’s entry on “► [History of Cognitive Slowing](#)

[Theory and Research](#)”). When naming processes are slowed, it may take longer to find the intended word (leading to dysfluencies or pauses, in addition to longer response times), or the word may fail to be retrieved, resulting in a TOT state resulting in a TOT state.

Age-related difficulties in word retrieval might arise because older adults have more difficulty suppressing or inhibiting unintended words that come to mind during word retrieval, as indicated by the *inhibition deficit hypothesis* (see Hasher’s entry on “► [Aging and Inhibition](#)”). Inasmuch as the production of any particular word requires suppression of potentially competing words, older adults’ decreased inhibitory function would make fast and fluent naming more difficult. Older adults also have a lifetime of accumulating vocabulary, which means they know more words that could come to mind and compete for retrieval compared to young adults.

Some research on naming in aging has seemed to support the inhibition deficit explanation. Older adults can experience greater semantic interference effects than young adults in a picture-word interference task (Taylor and Burke 2002), and the oldest adults are less likely to resolve TOTs if they are presented with a phonologically related alternate word that is the same grammatical class as the TOT word (Abrams et al. 2007). The inhibition deficit hypothesis suggests that older adults are less capable of ignoring or suppressing competitors than are young adults, resulting in more naming difficulties. However, this account of age-related changes in naming is challenged by other research findings. For instance, older adults’ TOTs are less frequently accompanied by alternate words than young adults’ TOTs, and neither older nor young adults report increased TOTs when alternate words are presented prior to TOT-inducing questions (Cross and Burke 2004; Oberle and James 2013). In fact, TOTs are often less likely to occur for people in both age groups when the presented alternates share phonology with the target word (James and Burke 2000). These findings are inconsistent with an inhibition deficit explanation, as all alternate words that are similar to the target in sound or in meaning would be expected to increase naming difficulties,

especially for older adults. Thus, inhibition deficits may play a role in age-related changes in word retrieval, but they do not seem able to account for all of the findings regarding naming in aging.

The observation that aging leads to increased naming failures, with generally less information about a word available during them, has led to an explanation referred to as the *insufficient activation* or *transmission deficit hypothesis* (MacKay and Burke 1990). This approach is couched in theories of speech production that claim word retrieval begins with creation of a nonverbal message, during which a word's meaning is accessed. This is followed by lexical access, where a word that is consistent with the chosen meaning and is also grammatically appropriate is selected to convey the message. The final process involves retrieving the phonology of the word so it can be articulated. For example, producing the word *chameleon* requires retrieving appropriate semantic information (e.g., *lizard, changes color*), followed by the lexical representation of the individual word (*singular common noun*) and finally, the word's phonology (*/kə'mi/li/ən/*). The transmission deficit hypothesis proposes that TOTs occur when the meaning of the word has been accessed and the word has been appropriately selected, but the complete phonology of the word cannot be retrieved. This explains why individuals often have a strong feeling of imminent resolution during a TOT state and can often provide detailed descriptive information about the word they cannot produce.

Why would the cognitive processes involved with accessing the phonology of a word fail? Simply, the connections between the word and its associated phonology become weak. Weakened connections can result when a word's sounds are not produced regularly (e.g., a low-frequency word like *omnibus*) or recently (e.g., last name of one's third grade teacher), similar to a use-it-or-lose-it explanation. The transmission deficit hypothesis also proposes that the natural process of aging independently weakens connections between the word and all other information (semantics *and* phonology), which accounts for the fact that older adults are slower and less accurate when producing words during naming tasks

compared to young adults. The utility of the transmission deficit hypothesis is that it provides an explanation for older adults' increase in TOTs, reduced access to phonological information, and increased interference from alternates in specific tasks (e.g., picture-word interference tasks), all on the basis that older adults have weakened connections among semantic, lexical, and phonological information.

## Conclusion

This entry has detailed the ways in which the normal aging process influences naming, a task in which people engage every day. As individuals age, word retrieval generally becomes more difficult. That is, older adults typically take longer to retrieve known words, are less accurate and produce more dysfluencies (filler words, stutters, etc.), and have more naming failures (i.e., more TOT states) than young adults. Specific factors about the word, such as its frequency or its lexical "environment" (e.g., its neighborhood density and frequency), affect the likelihood of naming difficulties, particularly for older adults. Specific environmental or situational conditions can also affect the likelihood of word retrieval difficulties, such as when an alternate word modifies the ability to access a target word.

It is important to note that these factors do not affect aging adults in a single way. As this entry illustrates, some indices of naming may be particularly affected in older age while others are not. For example, older adults' reaction times are much longer than young adults when producing a target word while a semantically related alternate word is presented, but the likelihood of experiencing a TOT for a target word is unaffected by the presence of a semantically related word. It is crucial to understand the varied way in which aging interacts with these influences to impact naming.

Several explanations for age-related declines in word retrieval were also reviewed, including age-related declines in working memory ability, general slowing of cognitive processes in older age, age-related inhibition deficits, and

transmission deficits brought on by the normal aging process. There is still much debate as to which approach most comprehensively explains the specific word retrieval deficits experienced by older adults, and future research will continue to delineate the exact causes of decreased naming efficiency with age.

This entry covers the effects of age-related changes on the processes involved with word retrieval in healthy older adulthood. Individuals suffering from neurodegenerative diseases, like dementia or Alzheimer's disease, experience more diverse and extensive naming difficulties than those discussed here (see entry on "[► Behavioral and Psychological Symptoms of Dementia](#)"). However, understanding the changes in word retrieval that are associated with healthy aging is important for establishing a normative "baseline" to distinguish between normal and non-normal age-related changes in naming.

## Cross-References

- [Aging and Inhibition](#)
- [Behavioral and Psychological Symptoms of Dementia](#)
- [Crystallized Intelligence](#)
- [History of Cognitive Slowing Theory and Research](#)
- [Language, Comprehension](#)
- [Language, Discourse Production and Communication](#)
- [Memory, Episodic](#)
- [Working Memory in Older Age](#)

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for psychosocial functioning. Specifically, psychosocial correlates of retirement, widowhood, and disability are discussed, with a focus both on relevant theoretical perspectives and selected empirical studies related to each transition. This is followed by an analysis of the means by which older adults adapt to altered life circumstances resulting from transitions in the context of perspectives on self-regulation of development.

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## Late Life Transitions

Tim D. Windsor  
Flinders University, Adelaide, SA, Australia

### Synonyms

Adaptation; Adjustment; Change

### Definition

Transitions broadly represent life events or circumstances that entail relatively enduring changes in an individual's behavior and/or outlook (Parkes 1971). Transitions can involve abrupt changes, such as the unexpected death of a loved one, or can be cumulative, taking place over a period of time, as in the increasing severity of symptoms arising from a chronic illness. Transitions can have positive or negative implications for well-being, and the same type of transition can produce contrasting outcomes for different individuals. A range of potential transitions are experienced by older adults. These can take place across multiple developmental domains and social contexts (e.g., death of network members), affecting physical health (e.g., onset of chronic illness, or recovery from illness), cognitive capacity (e.g., onset of dementia), mobility (e.g., driving cessation), generativity (e.g., becoming a grandparent), and productive activity (e.g., becoming a volunteer), to name a few. This entry focuses on a subset of transitions that are commonly experienced by older adults and often have significant implications

## Transition to Retirement

For many adults, establishing and maintaining a career throughout younger and middle adulthood represents both a financial necessity and an important context for goal-directed activity; imbuing life with a sense of purpose. Consequently, it is not surprising that retirement from the workforce is recognized as a significant late life transition and has been the subject of extensive research. Early conceptual perspectives suggested that the retirement transition involved a series of sequential stages, beginning with a honeymoon period, before subsequent stages of challenge and eventual adjustment (Atchley 1976). More recent theoretical perspectives have taken a life-course approach, emphasizing individual differences and dynamic developmental processes occurring within environmental and social contexts, in shaping retirement outcomes (Hesketh et al. 2011; Kim and Moen 2001, 2002). For example, Kim and Moen's (2001, 2002) life course ecological approach emphasizes the role of social interrelations, life and role contexts, and human agency in influencing the ways in which retirement is experienced differently by different individuals. For example, whether or not an individual is married, the quality of the marital relationship, and spouse's employment status represent important contextual factors influencing the retirement transition.

Heterogeneity in retirement experiences is also thought to arise from the transition out of the identity-relevant social role of "employee." This significant role change has the potential for positive and/or negative impacts on subjective well-being. For retirees who identify strongly with their career-based identity, retirement can represent a

role-loss that produces feelings of vulnerability and distress. Alternatively, individuals who experience significant strain associated with their employment role may experience relief and enhanced well-being as a result of transitioning out of employment. Recently, Wang et al. (2011) outlined a resource-based dynamic perspective on retirement in an endeavor to better account for the complex interrelationships among the various factors believed to influence the retirement process. This integrative perspective acknowledges the role of the social, contextual, and individual-level influences on retirement emphasized by life-course contextual perspectives, but also focuses on how the effect of these factors on retirement adjustment over time is mediated by physical, cognitive, motivational, financial, social, and emotional resources.

Through highlighting the broad array of different social-contextual circumstances, and resource profiles that contribute to retirement adjustment, recent theoretical perspectives provide frameworks to account for the mixed nature of findings concerned with retirement and well-being that has characterized the literature to date (for reviews see Kim and Moen 2002; Wang et al. 2011). Recently, empirical studies have addressed the complex, heterogeneous nature of retirement adjustment by applying profile-oriented statistical methods to the analysis of longitudinal data. Wang (2007) used growth mixture models to examine different patterns of adjustment to retirement (indexed by psychological well-being) across four measurement occasions over a 6 year interval. Three subgroups were identified according to differences in trajectories of change. The largest subgroup showed a *maintaining* pattern, characterized by consistently high levels of psychological well-being across the postretirement years. The next largest subgroup displayed a *U-shaped* pattern with an initial small decline in psychological well-being at the beginning of the retirement transition followed by an improvement post transition. A third small group showed a *recovering* pattern, characterized by a linear increase in psychological well-being in the years following retirement. Correlates of subgroup membership with contextual variables provided support for

the role of context and resources in influencing retirement adjustment. For example, retirees who reported demanding, stressful jobs with low levels of satisfaction were more likely to be classified into the *recovering* subgroup.

Pinquart and Schindler (2007) used a similar approach to examine longitudinal trajectories of life satisfaction from pre- to postretirement among Germans who retired between 1985 and 2003. Three subgroups were identified. The largest showed a small temporary increase in life satisfaction after retirement. Two smaller subgroups were characterized by (i) a larger temporary increase and (ii) a larger temporary decrease in life satisfaction across the retirement transition. Once again, patterns of transition were related to resource availability. For example, those who showed the smallest changes in life satisfaction with retirement also reported higher SES and were more likely to be married and in good health, whereas those who showed a decline in life satisfaction were more likely to be in poorer health.

In sum, retirement from work represents a significant transition that can have different implications for psychological health, depending on social-contextual factors and individual resources that influence psychosocial adjustment over time. Longitudinal studies that span the retirement transition, and include detailed measures of relevant contextual and resource-related influences are likely to be critical to enhancing our understanding of the retirement transition process and the characteristics of individuals and their life contexts that are most important in shaping adjustment.

### **Transition to Widowhood**

For those who are partnered, the spousal dyad represents a unique and central social context for development. This is likely to be particularly the case in later life when spouses have accumulated a long history of shared experiences, and frequently take on compensatory coping roles in response to declining health, function, or cognitive capacities experienced by one or both partners (Berg and Upchurch 2007; Hoppmann and Gerstorf 2009).

Not surprisingly, the commonly experienced late life transition to widowhood can result in significant psychological distress, as well as new challenges for adapting to everyday activities that were previously performed by, or in collaboration with a spouse.

Whereas experiences of distress and disorganization are regarded as common responses in the months following the death of a spouse, research also indicates that older bereaved individuals typically adapt to their loss over time. For example, Ott et al. (2007) identified distinct clusters of older bereaved adults based on longitudinal changes in grief and depressive symptoms. Five out of six bereaved spouses either maintained low levels of grief and depressive symptoms or showed a pattern of adjustment over time after initially elevated levels of psychological symptoms. The remaining one out of six participants showed a more chronic pattern of higher levels of grief maintained over time. Parkes and Prigerson (2010) suggest that grief reactions are often less intense among older relative to the younger widowed and speculate that this may be due to the death of older spouses being more timely, and less unanticipated, providing greater opportunities for anticipation of and preparation for the loss. However, as is the case for younger adults, losing a spouse in late life increases vulnerability to psychological distress. For example, it is estimated that at some point during the 12 months following bereavement, between 10% and 17% of older widows experience clinically significant levels of depressive symptoms (Parkes and Prigerson 2010).

Carr and Utz (2001) outlined a conceptual framework for understanding individual differences in the experience of widowhood by identifying how broader macrosocial factors, the nature of the spousal partnership, and individual characteristics can each influence processes of adjustment. The increases in life expectancy that occurred in the twentieth century mean that the transition to widowhood is now more commonly experienced as a long process associated with the chronic illness of a spouse, which takes place over months or years. The drawn-out nature of a spouse's illness can ease the transition to

widowhood by providing time needed to resolve outstanding family and financial issues and plan for the future. However, a prolonged death can also create significant stress for the bereaved resulting from emotional strain, caregiving burden, and medical expenses. The psychological consequences of widowhood also depend on the quality of the marriage, with widows who feel a strong emotional closeness with their spouse more likely to experience a longer and more difficult period of adjustment. Individual characteristics such as cognitive ability and personality are also likely to play a role in influencing processes of adjustment. Carr and Utz (2001) emphasized the relevance of gender as an individual difference factor. For example, women tend to be embedded in stronger social networks, which could result in the greater availability of social support, providing an important coping resource that may be less accessible to bereaved men. However, recent research using data from the Health and Retirement Study found no gender differences in trajectories of depressive symptoms following widowhood. Rather, results suggested that previous findings showing gender differences are influenced by selection effects, whereby women are more likely to be selected into widowhood at younger ages and men are more likely to experience widowhood for a shorter (and as a result more emotionally intense) duration as a result of gender differences in remarriage and mortality (Sasson and Umberson 2014).

The multifaceted nature of the transition to widowhood is reflected in the results of a number of empirical studies that have examined factors that moderate patterns of psychosocial adjustment after loss of a spouse. For example, Utz et al. (2012) examined whether physical health modified trajectories of change in grief and depressive symptoms over 1.5 years following bereavement in a sample of adults aged over 50. Their results indicated that participants with poorer health following widowhood also reported higher levels of grief and depressive symptoms, but that rates of recovery over time did not vary as a function of health. Findings from the Changing Lives of Older Couples (CLOC) study have shown that sudden death of a spouse is associated

with higher levels of intrusive thoughts following the bereavement, whereas more prolonged death is associated with higher subsequent levels of anxiety. Research based on CLOC has also showed that spouses from lower-quality marriages yearn less for their spouse after bereavement and that widowhood resulted in increased informal (but not formal) social engagement (Carr and Utz 2001).

Widowhood represents one of the most significant normatively experienced late life transitions, which commonly results in substantial distress and upheaval. Although depressive symptoms among bereaved older adults tend to become reduced over time, a proportion will struggle to adjust to their loss over the long term, and those who become widowed early and remain unmarried represent a particular at-risk group (Sasson and Umberson 2014). Ultimately, research that continues to enhance our understanding of the risk and resilience factors that modify trajectories of adjustment to widowhood will play an important role in informing the development of effective pre- and postbereavement interventions.

### Transition to Disability

The risk of physical health limitations becomes greater with advancing age. Among the oldest-old (e.g., ages 85 and above), frailty, morbidity, and limitations in the ability to perform instrumental activities of daily living are commonly experienced (Baltes and Smith 2003). Functional ability is important for maintaining quality of life, and those with functional impairments are at increased risk of institutionalization and death (Mor et al. 1994). Thus, it is perhaps not surprising that disability has been linked to poorer psychological health, with possible mechanisms including the direct negative impact of disability as a source of stress on emotional well-being, and possible indirect paths whereby disability reduces one's capacity to perform valued activities such as being socially engaged, that in turn reduces quality of life (see Yang and George 2005).

Research concerned with correlates of disability in later life points to numerous links between

functional limitations and poorer mental health and subjective well-being. For example, Yang and George (2005) showed that being classified as having greater stable levels of disability (based on measures of strength, mobility, and ADL/IADL difficulties) and transition in status to a higher level of disability were associated with increases in depressive symptoms over a 6-year study interval. Boerner (2004) reported associations of functional disability and visual impairment with greater depressive symptoms, social dysfunction, and mental health problems, and mobility limitations have been found to correlate negatively with life satisfaction among older adults in residential care (Mollaoğlu et al. 2010).

The empirical links between physical and mental health in older adulthood have led researchers to focus on underlying mechanisms, in an effort to identify potentially modifiable factors that could help protect against the effects of aging-related physical losses on psychological functioning. For example, Yang (2006) examined the extent to which the longitudinal association of functional disability with depressive symptoms was mediated by social support, control beliefs, and self-esteem. The results supported the role of the psychosocial variables operating as mediators, with psychological resources (in particular self-esteem) emerging as critical in accounting for the association between disability and depressive symptoms.

Other researchers have focused on the extent to which specific methods of coping could buffer against the deleterious effects of disability on mental health. Boerner (2004) examined whether persistence in pursuit of goals or the flexibility to adjust goals in response to situational constraints were protective against the negative association of disability with mental health. Results supported the role of flexible goal adjustment as a moderator, with those reporting stronger tendencies toward flexible goal adjustment showing weaker associations of disability with mental health. Dunne et al. (2011) also focused on the role of goal orientation in buffering the association of disability with depressive symptoms, using 6-year longitudinal data. The ability to disengage from blocked goals emerged as a moderator, with participants scoring higher on disability showing less increase in

depressive symptoms over time if they also reported stronger tendencies toward disengaging from blocked goals.

Like widowhood, the transition to disability is a relatively normative late-life experience that represents a risk factor for psychological health. However, appropriate methods of coping that allow for adjustment of goals and expectations in response to aging-related health transitions could represent an important protective resource. This issue is explored in more detail in the subsequent section.

### **Negotiating Late Life Transitions Through Self-Regulation**

Not all transitions associated with aging will have negative implications for well-being. However, as discussed, several normative transitions (such as widowhood and the onset of chronic illness and disability) do commonly pose a risk to psychological health and quality of life. Despite this, older adults typically adjust successfully to transitions over time, and research shows that, at least prior to the more serious declines across multiple domains of functioning that can emerge in the few years preceding death (e.g., Gerstorf et al. 2013), older adults report high levels of subjective well-being relative to younger adults (e.g., Windsor et al. 2013).

One means by which older adults are able to cope with the challenges posed by significant transitions is through the use of effective self-regulation – that is, processes concerned with the management of goals in response to changing life circumstances (Hooker et al. 2010). Baltes and colleagues' theory of Selective Optimization with Compensation (SOC; e.g., Baltes 1997) provides a framework that explains how individuals regulate their development across the lifespan by selecting and pursuing developmental goals that provide an appropriate fit to their life context. Fundamental to SOC is the notion that individuals select achievable goals, maximize the resources available to them that facilitate goal attainment, and find ways to compensate and counteract losses when goals are blocked. Experiencing late life transitions often results in the need to flexibly

select new goals in response to losses and/or to develop effective methods of compensation when the means of goal attainment are no longer available. For example, an older widowed adult might respond to the loss of their closest social partner by selecting new goals aimed at enhancing their social networks through participating in volunteering. Being a successful volunteer and benefitting from the experience might involve optimizing resources needed to perform the volunteer role, such as undertaking relevant training and maintaining fitness. Obstacles to being a volunteer might be overcome through the use of compensatory strategies. For example, barriers to participation resulting from increasing frailty might be overcome through adopting a less physically demanding volunteer role and using public transport to attend meetings if driving independently is no longer an option.

A complementary perspective on self-regulation is provided by Brandtstädter (2009; Brandtstädter et al. 2010), who outlined a dual-process model of assimilative and accommodative processes to describe how older adults manage aging-related losses. *Assimilation* refers to active efforts to engage with the environment in the pursuit of desired goals in line with social and self-evaluative standards, whereas *Accommodation* refers to the flexible adjustment of goals in response to changed circumstances and resource availability. Processes of accommodation are thought to be particularly important for maintaining well-being in the face of aging-related losses, including significant late life transitions. For example, an older adult experiencing the transition to disability may need to exercise accommodation in the form of disengaging from goals that are dependent on mobility (e.g., participation in sports) and instead invest their assimilative efforts around alternative goals that are less dependent on physical attributes (e.g., participating in generative activities with grandchildren). Thus, assimilation and accommodation coexist as complementary processes within a system of adaptation that operates throughout the lifespan, but may hold particular relevance to late life when accommodative processes become a central means of dealing with losses and transitions (for

a related perspective on self-regulation of development also see (Heckhausen et al. 2010)).

## Conclusion

Individuals typically experience various transitions from childhood through to old age. Normative aging-related changes in resources (e.g., declining health) and social roles (e.g., transition to retirement or becoming a grandparent) mean that a number of transitions that commonly occur in older adulthood can have significant implications for psychosocial functioning and quality of life. Research also indicates that a high proportion of individuals who experience potentially stressful transitions return to pretransition levels of well-being after periods of adaptation and adjustment. Flexible processes around the pursuit of developmentally relevant goals and disengagement from blocked goals are believed to play an important role in contributing to the effective negotiation of transitions.

## Cross-References

- ▶ [Age-Related Changes in Abilities](#)
- ▶ [Grief and Bereavement: Theoretical Perspectives](#)
- ▶ [Retirement and Continuity Theory](#)
- ▶ [Selection, Optimization, and Compensation at Work in Relation to Age](#)
- ▶ [Stress and Well-Being: Its Relationship to Work and Retirement for Older Workers](#)
- ▶ [Widowhood in Late Life](#)
- ▶ [Women and Retirement](#)

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## Leadership and Aging

Kathrin Rosing<sup>1</sup> and Franziska Jungmann<sup>2</sup>

<sup>1</sup>Psychology of Entrepreneurial Behavior, Institute of Psychology, University of Kassel, Kassel, Germany

<sup>2</sup>Institute for Work, Organizational and Social Psychology, University of Technology, Dresden, Dresden, Germany

### Synonyms

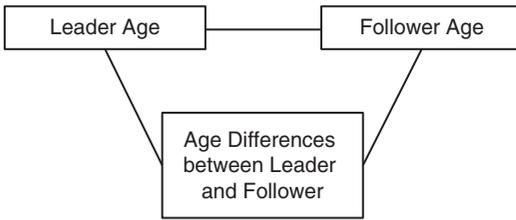
Age-related aspects of leadership; Aging leaders and followers; Effects of leader and follower age; Implications of aging for leadership

### Definition

This entry concerns the relationship between leadership and aging. More specifically, the entry focuses on how aging of leaders and followers affects leadership behaviors or styles as well as leadership effectiveness. In general, the entry tries to give some answers to the following questions: (1) How do younger and older leaders differ in the leadership behavior they utilize and are younger or older leaders more effective? (2) How do leaders need to react to an aging workforce? (3) How do age differences between leaders and followers affect leadership effectiveness? To date, research on leadership and aging is scarce; however, in recent years, both theoretical and empirical developments have shed some light on this topic.

### Introduction

Leadership is a central concept in both organizational psychology and management science and has been studied for more than 200 years. Accordingly, a myriad of concepts and ideas exist of what leadership is. Nevertheless, most leadership researchers seem to agree that leadership concerns a social influence process between people that is geared towards achieving shared goals (Yukl 2010). In addition, several generations of theories exist that describe what *successful* or *effective* leadership looks like. While early leadership theories focused on stable traits of leaders, newer theories generally concern assumptions on how different leader behaviors are related to performance and other follower outcomes. One of the most influential leadership theories of the last decades is the transformational leadership concept. This theory argues that certain (transformational) leadership behaviors, such as providing a vision and acting as a role model, can motivate followers to go beyond what is expected of them in terms of the employment contract and can result in higher performance and introduce changes within organization. Other theories focus on leadership behaviors that are task related, for example, assigning tasks and setting goals,



**Leadership and Aging, Fig. 1** Overview

while some theories are focused on the relationship between leaders and followers.

While the interest in lifelong perspectives and aging in general is growing, research on leadership and aging is still scarce (Walter and Scheibe 2013; Zacher et al. 2011a). Given the centrality of leadership in both organizational psychology and management science, this is quite surprising. However, there is an emerging field that tries to delineate the relationship between leadership and aging both theoretically and empirically. This entry will summarize the extant theory and the empirical work that has been done so far.

When considering the relationship between aging and leadership, the age of two groups becomes important: leaders and followers. The structure of the entry will build on this distinction (see Fig. 1). The focus of the first part of the entry will be on the age and aging effects of leaders. The second part will summarize work on how leaders need to react to an aging workforce. The final part will then discuss age differences between leaders and followers and the role of age relations between leaders and followers.

## Aging Leaders

Leadership is hardly a homogeneous or straightforward matter but includes a wide array of different tasks and responsibilities, for example, coordinating and structuring tasks, representing the work group to persons outside the group, acquiring resources, or supervising and developing team members (Yukl 2010). Given this multitude of activities that require quite a few different competencies, it is unlikely to expect that either

older or younger leaders in general are more effective. Some leadership tasks, such as making complex decisions, require rapid information processing which has been found to decline with increasing age (Salthouse 2012). On the other hand, other activities, such as advising and mentoring, rely to a greater extent on experience and accumulated knowledge as well as social competencies that are constant over time or even increase with age (Salthouse 2012). Thus, there is no easy answer to the question of how leadership and leadership effectiveness develop with increasing age. Recently, two review articles have made an attempt to summarize the effects of aging on leadership and leadership effectiveness (Walter and Scheibe 2013; Zacher et al. 2015). The conclusions of those reviews will be briefly discussed in the following. First, leadership behavior that mainly focuses on task accomplishment and goal achievement, such as initiating structure or transactional leadership, is largely unrelated to leaders' age. Thus, older and younger leaders utilize these task-related behaviors to a similar extent. Second, older leaders seem to engage more in leadership behaviors that concern their relationship with followers, such as consulting team members or including team members in decision making, although the results are not unequivocal. To date, most research on age and leadership behavior has examined transformational leadership and similar leadership styles that are oriented towards change. In general, research seems to indicate – with some exceptions – that leaders become less charismatic, change-oriented, and willing to take risks with increasing age. Finally, older leaders tend to engage in more inactive or passive types of leadership behavior than younger leaders.

In line with the assumption that it is unlikely to expect a clear positive or clear negative relationship between age and leadership effectiveness, Walter and Scheibe (2013) describe research that found both negative and positive relationships but conclude that the overall picture rather reveals a negative influence of leaders' age on task effectiveness. When it comes to relational effectiveness of leaders, such as follower satisfaction, however, older leaders seem to be in general as effective as younger leaders.

Over and above the general change over time in leadership behavior or effectiveness, research has tried to disentangle boundary conditions of this change. In other words, research has attempted to answer the questions of under which conditions age is related to leadership behavior and under which conditions younger and older leaders are effective. This approach is in line with the overall assumption that older leaders do not generally become better or worse with increasing age, but conditions and motivation for leading may change over time. Accordingly, these conditions and motivation need to be considered to get a clearer picture of the relationship between aging and leadership. In the following, some examples of this research will be discussed to identify the factors that might explain the rather inconclusive results concerning the link between age on the one hand and leadership as well as leadership effectiveness on the other hand.

One prominent theory in lifespan development is generativity theory. Generativity is defined as the concern for guiding and supporting future generations and is related, for example, to helping and mentoring younger individuals (McAdams and de St. Aubin 1992). As generativity can be understood as a developmental challenge for older individuals, whether or not older leaders are motivated by generative concerns might decide whether these leaders are motivated to keep up effective leadership behaviors over time. The idea behind this assumption is that older leaders who are not motivated by generative concerns lack the necessary motivation to lead as other forms of motivation, such as advancing one's own career, decline with increasing age. Zacher and his colleagues were able to demonstrate this effect in two studies: One study revealed that only older leaders with high generativity were able to maintain high levels of leadership effectiveness, compared to younger leaders, whereas older leaders with low generativity displayed lower effectiveness (Zacher et al. 2011b). In a similar vein, a second study showed that older leaders who were concerned with leaving a legacy (which is a dimension of generativity) displayed higher levels of transformational and transactional leadership than older leaders who did not believe in being

able to leave a legacy (Zacher et al. 2011a). Taken together, this research reveals that a crucial issue that decides over leadership in older age is whether leaders are able to maintain an age-appropriate motivation to lead. If other forms of motivation deteriorate over time and older leaders are not able to generate new forms of motivation, it is highly unlikely that they will be effective leaders.

Another important factor in this regard is whether leaders are perceived to be effective by followers and other persons. Implicit leadership theory argues that leaders who match implicit assumptions of followers of what a leader should be like are perceived as being more effective than leaders who violate these assumptions. Experimental research by Spisak and colleagues (Spisak 2012; Spisak et al. 2014) indicates that followers are biased towards perceiving older leaders as being more effective than younger leaders in situations of intergroup conflict and in situations when stability is more important than change. Thus, not only leaders' actual behavior changes over time but the same behavior might be assessed differently depending on the age of leaders.

Taken together, the relationship between leaders' age and leadership as well as leadership effectiveness is complex. Whereas some leadership behaviors seem to become less utilized with increasing age (e.g., change-oriented leadership), other leadership behaviors are employed by younger and older leaders alike (e.g., relationship-oriented leadership). A general tendency of an increase or a decrease of leadership effectiveness is difficult to detect. Instead, first studies could demonstrate that boundary conditions play an important role, such as follower perceptions and an age-appropriate motivation to lead.

## Leading an Aging Workforce

In addition to the leader's age, the age of followers is central in the relationship between aging and leadership. The next paragraphs thus concern the challenge of leading an aging workforce. As a result of an increased participation rate of more

elder employees in the workforce and young academics beginning their working life earlier in the aftermath of changes in the educational system, the working lifespan is becoming longer and the number of employees at both extreme ends of the age continuum is growing. Hence, the age diversity of work teams and organizations alike is increasing. In this context, leaders face two central challenges: First, leaders need to deal with an increased proportion of older workers among their followers. Second, leaders need to integrate younger and older followers in order to successfully manage all generations at work.

Previous studies revealed that leaders, especially their attitudes and behaviors, have an important influence on followers' performance and well-being across their working lifespan (Ilmarinen and Tempel 2002; Ries et al. 2013). In that vein, a Finnish longitudinal study revealed that leadership behaviors directed towards the needs of older followers were the only significant factors that maintained and enhanced the work ability among older followers (50 years and older) across 11 years. These leadership behaviors encompass an open, non-stereotyped attitude towards age and aging, openness to participation and cooperation, ability to communicate, and age-differentiated work organization (Ilmarinen and Tempel 2002). Thus, leadership that is sensitive towards the specific needs of older followers seems to be critical for maintaining high work motivation and performance with increasing age of followers.

Especially leaders' attitudes towards age and aging are crucial for an age-related leadership. Age stereotypes, as assumptions and expectation about people based on their age, influence the way one thinks about and behaves towards older followers. Despite of several positive stereotypes about older followers such as experience, honesty, and loyalty, the majority of age stereotypes ascribed towards older followers are negative attributes such as being absent more often, being less productive than younger followers, and having less potential in as well as a lower motivation for personal development (Posthuma and Campion 2009). Leaders tend to have high levels of age stereotypes towards older followers.

As stereotypes are an important antecedent of related behavior, such as discrimination, leader stereotypes towards older followers increase the likelihood of age-biased or discriminatory decisions and behaviors, for example, concerning assessment or participation in training and development (Posthuma and Campion 2009; Kunze et al. 2011).

For an effective age-related style of leadership, it is important that leaders learn about and reflect upon the different work-related abilities and characteristics of younger and older followers (Kunze et al. 2011; Wegge et al. 2012). With that in mind, an individualized leadership focusing on the individual characteristics of younger and older followers seems most promising for healthy and well-performing followers. In line with this idea of an individualized leadership, a generational approach to leadership (Kunze et al. 2011) emphasizes adjusting leadership behavior to individual follower's needs and values. For example, leaders need to create a work environment that enables all generations to perform and engage at work depending on each generation's specific strengths and demands towards leaders. Based on historic events during their childhood or youth, each generation of employees is characterized by certain strengths and features. Leaders can address these and consider them in their leadership approach. For instance, the generation of baby boomers (born 1956–1965) prefers leadership behaviors directed towards cooperation among colleagues and offering opportunities for further development, that is, relationship-oriented leadership, whereas the "Internet" generation (born from 1981) demands their leaders to set clear goals and visions and provide them with learning opportunities; thus, they prefer task-oriented or change-oriented leadership. Despite these leadership behaviors being of a high practical value, there is only scarce research evaluating the effectiveness of this generational approach. However, the described studies show the need and the positive impact of leaders changing their mindset and adapting their behavior towards an age-sensitive leadership approach.

Besides an aging workforce, an increasing age diversity in work teams is another challenge

for leaders. Previous research revealed both positive and negative effects of increased age diversity on team performance. Theoretical approaches are used to explain the contradictory results. Studies on group composition reveal that the composition of a group is an important factor influencing group performance (van Knippenberg and Schippers 2007). Based on theories of social categorization processes and models of information processing, age diversity in teams may result in advantages (e.g., utilization of differences in experience for problem solving) as well as disadvantages for teamwork (e.g., intensification of emotional conflicts in groups, activation of stereotypes, reduced team climate due to communication problems). With regard to age as a group composition characteristic, the negative effects of age diversity in teams seem to outweigh the positive effects (Joshi and Roh 2009). Across contexts, age is a very salient characteristic and thus likely to activate stereotypes that in turn can negatively influence the health of the team members and performance of the team as well as increase ageism within the team (Ries et al. 2013). In this vein, Ries and colleagues (Ries et al. 2013) demonstrated that not age differences per se but rather age becoming salient within a team is associated with increased conflicts and reduced performance. The positive effects of age diversity in teams only emerge in teams with a positive team climate, complex tasks, and when team members value working together in age-diverse teams (i.e., have positive diversity beliefs; Ries et al. 2013). All of these aspects can be facilitated by leaders (depending on either a task- or relationship-oriented leadership style).

Furthermore, transformational leadership can buffer the negative effects of age diversity on team performance. Kearney and Gebert (2009) could show that when transformational leadership was high, age diversity increased the elaboration of task-relevant information and, in turn, performance. In contrast, low levels of transformational leadership were associated with a negative relationship between age diversity, elaboration of task-relevant information, and subsequently performance. Thus, leaders seem to create an environment that fosters information

elaboration – instead of social categorization – and group identification within a team.

In line with the characteristics for age-related leadership proposed by Ilmarinen and Tempel (2002), Wegge and colleagues (2012) broadened the concept to address not only the needs of older followers but to explicitly consider age-diverse teams. In their model for age-differentiated leadership, they postulate behaviors directed towards the age-related changes in needs and motives of younger and older followers as well as address behaviors that are relevant for an effective leadership of age-diverse teams. First studies (Wegge et al. 2012) show the positive impact of age-differentiated leadership on followers' health, turnover intentions, and performance in various work fields, such as nursing, call centers, and production.

Taken together, these studies reveal the need and also the opportunities for leaders to know about and act upon the respective needs and demands of younger and older followers in an aging workforce. Thus, in order to successfully manage the aging workforce, leaders are required to change their mindsets regarding aging and learn new leadership skills to face specific challenges and conflicts at work that are related to aging followers and age diversity in teams.

## The Interplay of Older and Younger Leaders and Followers

The relational demography literature suggests that not only the specific age of leaders and of followers is important, but age differences between leaders and followers may also have an impact on leadership effectiveness (Vecchio 1993). To be accepted by followers or to be perceived as being an effective leader, leaders need a justification to be in the leading position. As argued before, this justification might be a consequence of matching the followers' implicit assumptions of what a leader should be like. Traditionally, leaders have been older than their followers. Comparable to a teacher-student relationship, leaders are expected to be more experienced, knowledgeable, and powerful which legitimizes them to be in

the position to teach and direct their followers. In line with the earlier mentioned implicit leadership theories, people expect leaders to be older than their followers and hence older leaders in comparison to younger leaders are more likely to be accepted as leaders or to be perceived as adequate leaders. At the same time, due to demographic changes in recent years, it has become more common that older individuals report to younger leaders. Several theoretical frameworks can be utilized to explain why older leaders might be more easily associated with a leader role and what the consequences might be for younger leaders leading older followers. Theories of status congruence suggest that agreement between different aspects of status, such as age, experience, and hierarchical position, is important for social functioning (Vecchio 1993). When a leader is younger and less experienced than his or her followers, this represents an example of status incongruence, as the leader is higher on some dimensions (hierarchical position), but not on other dimensions (age, experience). Both leaders and followers might react negatively to status incongruence, for example, by being less supportive or less loyal. Consequently, status incongruence will be related to lower leadership effectiveness perceptions. Related to status incongruence assumptions, theory on age grading and implicit career timetables similarly suggests that younger leaders violate social norms, yet provide a slightly different explanation for this effect (Lawrence 1984). Implicit career timetables describe the age distribution of organizational members in relation to their organizational positions. Such career timetables thus prescribe age norms in terms of the position one is supposed to have acquired at a certain age in one's career. Reporting to a younger leader is a quite clear signal to an older follower that he or she is out of sync with the organization's implicit career timetables. Such a perception of "being behind schedule" will evoke negative reactions by older followers and lower effectiveness perceptions of their respective younger leaders (Lawrence 1984).

In contrast, some scholars have argued that the direction of age differences between leaders and followers, that is, whether the leader

or the follower is older, is not important but only the magnitude of age differences has an effect on leadership effectiveness (Vecchio 1993). A first approach arguing for such nondirectional effects of age differences draws from the similarity-attraction paradigm that argues that similarity – for example, in age but also in other attributes – increases attraction between individuals. Hence, positive work attitudes as well as positive experiences are supposed to occur more frequently within leader-follower dyads when leaders and followers are of similar age than when one of them is much older or younger. In contrast, a second nondirectional approach that argues for the exact opposite effect (i.e., that age similarity has negative effects on leadership effectiveness) builds on social comparison processes. The idea behind this approach is that individuals of a similar age are in a social competition situation. A social comparison of a follower with his or her leader who is of the same age but obviously not in the same hierarchical position will be less favorable and more likely to lead to lower effectiveness perceptions than the social comparison of a follower with a leader who is dissimilar in both age and hierarchical position.

To date, unfortunately, only little empirical work on age differences between leaders and followers exists that helps to disentangle the competing predictions of the summarized theoretical approaches. The few exceptions that do exist paint an inconsistent picture of the empirical situation: While some studies showed negative effects of young-leads-old configurations, other studies found (unexpected) positive effects of these configurations. The empirical evidence for the similarity-attraction hypothesis is rather weak, although some studies found negative effects of age dissimilarity. Across studies, the effects of leader-follower age differences were rather small. In line with the contradictory theoretical assumptions, it can be expected that the overall effect of age differences on leadership effectiveness is complex and it is likely that several different effects operate at the same time. Clearly, much more empirical work is needed to be able to draw reliable conclusions on the consequences of age differences between leaders and followers in

general and of younger leaders leading older followers specifically.

## Conclusion and Future Directions

Leadership is a central concept in organizational research as well as in organizational practice. Unfortunately, to date research on the impact of the demographic change on leadership and leadership effectiveness is still scarce. Nevertheless, one important conclusion might be drawn in these early stages of research on leadership and aging: the question of how aging of both leaders and followers is related to leadership and leadership effectiveness will unlikely find easy and simple answers. Human development over the lifespan is complex and related to positive and negative changes in affective, motivational, and cognitive processes. On the other hand, leadership is far from being a simple or one-dimensional process, including many different competencies and behaviors. Taken together, a complex interaction of many different variables emerges that affects how leaders of varying ages lead followers of varying ages. Thus, future research needs to address this complexity by designing studies that are sensitive to pick up subtle influences of possibly contradictory effects. For example, future studies might address how qualitative changes in the motivation to lead influence the utilization of leadership behaviors. Thus, a young leader who is driven by the motivation to advance his or her own career might engage more in task-oriented leadership behaviors than an older leader who is motivated by generativity concerns and thus utilizes relationship-oriented leadership behaviors. Nevertheless, both leaders can be equally effective. Only focusing on the relationship between age and task-oriented or relationship-oriented leadership will overlook such important functions of motivation.

Moreover, as easy and straightforward direct effects of aging are unlikely, future research needs to focus on boundary conditions of aging effects. As discussed before, research might explore under which conditions – for example, followers' motivational or affective states – specific leadership styles of older leaders are more likely to be related

to leadership effectiveness. Specifically, based on implicit leadership theories, research might focus on which leadership styles or behaviors are perceived by followers as being age appropriate. In terms of leading an aging workforce, implicit leadership theories might play a role as older and younger followers might have different assumptions about how leadership should look like. In the sense of an age-differentiated leadership approach, leaders might not only need to be sensitive towards the specific needs of older and young followers but also towards the followers' differential expectations of themselves, especially when younger leaders violate age norms.

Despite the scarce empirical literature on the relationship leadership and aging, the first steps towards a clearer picture of this relationship are promising. Fortunately, researchers in this area are able to build on rich theoretical foundations in both leadership and aging literatures. Thus, future research that utilizes these theoretical foundations will most likely be able to disentangle the complex interrelations of leadership and aging.

## Cross-References

- ▶ [Age Diversity at Work](#)
- ▶ [Age Stereotypes in the Workplace](#)
- ▶ [Age Stereotyping and Discrimination](#)
- ▶ [Age-Related Changes in Abilities](#)
- ▶ [Motivational Theory of Lifespan Development](#)
- ▶ [Training at Work and Aging](#)
- ▶ [Work Motivation and Aging](#)

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## Learning in Older Adults

Philippe Rast

Department of Psychology, University of Victoria, Victoria, BC, Canada

### Synonyms

Behavioral modification; Skill Acquisition; Conditioning; Instrumental Learning

### Definition

Learning is used in different contexts and a uniquely accepted definition does not exist. Here, learning is broadly defined as a process in response to repeated exposure to environmental demands that results in the accumulation of skills, knowledge, or responses and attains enduring and long-lasting behavioral or cognitive changes.

### Learning

Learning represents a fundamental aspect, not only in humans but in all organisms, that lasts a lifetime. Across the life span, changes occur to the ability and rate of learning, but, as in other areas of human development, these changes are not happening uniformly across all forms of learning. Generally speaking, learning rates are smaller in older adults compared to younger, but the extent of these differences is not uniform across all forms of learning, but different domains are affected at different times and changes occur at different rates (Kausler 1994). In the context of aging, learning needs to be related to development. In contrast to development, learning concerns the “microgenesis,” while development relates to “ontogenesis,” and as such both processes describe distinct phenomena (Voelcker-Rehage 2008). However, learning and development are interdependent in the sense that developmental status also guides the learning process and, in

turn, learning outcomes are incorporated into developmental changes. Most importantly, learning remains a resource throughout all stages of life.

Given the definition of learning, it is evident that learning comprises relatively basic forms, such as conditioning, as well as more demanding forms such as verbal or spatial abilities. More complex forms of learning are very strongly tied to other cognitive and possibly age-sensitive resources such as memory functioning and working memory. As such, a clear distinction of age effects among these different systems is difficult to obtain. However, with increasing age, individual differences in the ability to learn and in changes in learning are probably the most prominent feature which offers the possibility to untangle to some degree effects of aging and maturation from other individual effects such as socioeconomic status, education, verbal or motor skill levels, or other individual cognitive resources.

In the remainder of this entry, learning will be subdivided in five areas that are sorted according to increasing demands in terms of complexity as well as cognitive and computational effort: conditioning, instrumental learning, skill learning, and verbal learning.

### Conditioning

Classical or Pavlovian conditioning is considered to be a simple kind of learning, not because it lacks complexity but because it contains clearly delineated single response elements in the form of stimulus and response (Kausler 1994). Two kinds of conditioning are typically distinguished: classical and operant conditioning.

*Classical conditioning.* Classical conditioning involves an unconditioned stimulus (UCS) that elicits a reflex as the unconditioned response (UCR). For example, the UCS might be a puff of air to the eye with the eyeblink reflex serving as the UCR. A third element is introduced to serve as the objective of conditioning, the conditioned stimulus (CS). The CS is initially unrelated to the UCR. Given sufficient trials where the CS precedes or overlaps the UCS, a new conditioned response (CR) will be acquired that resembles the original UCR. That is, the puff of air (UCS) to the

eye may be preceded by a tone (CS). After a number of trials, the eyeblink will occur before the onset of the puff of air, thus turning the UCR into a CR. Due to its simplicity, eyeblink conditioning is frequently used in research on aging and Alzheimer's disease in humans and rodents.

Although the bulk of work in classical conditioning has been conducted throughout the 1940s to the 1970s, it is still relevant in today's research on learning in older adults, and its implications are considerable in everyday settings. For example, the learning mechanism of classical conditioning is habitually used in clinical contexts such as in the treatment of anxiety disorders or substance abuse. In these contexts, the therapeutic approach is to pair or un-pair stimuli and responses following the logic of classical conditioning (e.g., aversive therapy and (de)sensitization). By and large, research on conditioning in older adults shows that older adults need more exposure to the CS–CR pair to be conditioned than younger adults, but the conditioning mechanism remains intact throughout the life span into old age and even remains present in people with severe amnesia (Woodruff-Pak 1993).

The acquisition of the CR usually follows a negatively accelerated learning curve with the strongest behavioral changes early on and diminishing adaptation in later trials. In a number of classical conditioning settings using eyeblink conditioning, older adults showed weaker responses and usually needed more trials to successfully link the CS to the UCR. The slower rate of classical conditioning has also been found in other responses ranging from involuntary changes in galvanic skin response to voluntary reflexive retraction of the hand due to electric shocks (Botwinick 1970). Parts of these age differences are also due to other factors than conditioning. A factor that influences the rate of conditioning is the latency of the interstimulus interval (ISI) among the CS and UCS. Generally, small ISIs increase age differences, while larger ISIs decrease age differences in acquisition rates, although the difference among young and old remains pronounced overall.

Most studies based on conditioned eyeblink responses found the age of about 50 years to be

critical with respect to decreasing acquisition rate (Kausler 1994). Note, however, that these findings were mostly based on cross-sectional data which tend to bias critical change points toward early decline because birth cohort differences cannot be fully separated from aging effects.

*Operant conditioning.* Operant conditioning differs from classical conditioning in several ways. The response is not a reflex but is more deliberate and procedural in nature, and the CS is not presented before but after the response. Also, the response itself may be modified, typically through the use of positive or negative reinforcement. A certain positive behavior might be reinforced by rewarding the subject. Research on operant conditioning has a long history in psychology and is rooted in Thorndike's *law of effect* (Thorndike 1898) that posits that behaviors that are followed by positive experiences tend to be repeated, while behaviors that are followed by negative experiences tend to be avoided (Skinner 1938). Research on operant conditioning on older adults largely focused on populations with mental or health conditions. Generally, most studies find that the use of reinforcement does alter the behavior in patients with dementia or psychoses. While most of these studies used positive reinforcement techniques, more recent results show that the valence of reinforcement also depends on the level of dopamine in the basal ganglia. An intact dopaminergic system supports positive feedback, while lower levels of dopamine seem to favor learning experiences that avoid negative outcomes. In fact, the reward system is tightly related to operant conditioning as it mediates the effects of reinforcement.

In the context of normal aging, positive reinforcement has been mainly used in studies to enhance responses in speeded tasks. Positive reinforcement may be in the form of offering money for faster responses, while punishment may be operationalized as taking away of money. Older adults tend to be very responsive to this form of reinforcement in laboratory settings. Especially for cognitive tasks, such as paired-associate learning, positive and negative reinforcements effectively increase older adults' performance, while younger adults' performance is generally

influenced less from this type of incentives and punishments.

### **Instrumental Learning**

Instrumental learning, or instrumental conditioning, entails behavior that was instrumental in the past for producing certain consequences and reaching a goal. Instrumental learning plays a central role in Thorndike's *law of effect* (e.g., Thorndike 1898), but its distinction to operant conditioning remains somewhat arbitrary. Generally, most work that involved instrumental learning tasks in aging made use of animal subjects, and work with humans typically focused on young college-aged populations. Findings from rodent populations suggest that older animals tend to be slower maze learners. The effect of age on the learning performance is largely guided by the complexity of the maze, where older animals display more pronounced difficulties if complexity is high. While most work on maze learning was done on rodents, it has been shown that middle-aged adults erred more often than their younger counterparts on paper and pencil maze tests (Brooks and Baddeley 1976).

Similar age-related effects are found in spatial learning which is in some ways similar to learning a complex maze but additionally entails the acquisition of spatial features and their relation to each other in novel environments. Across different learning conditions, such as the ability to successfully navigate in a nursing home and knowledge of buildings, shopping malls, or neighborhoods after exploratory trips or virtually touring these environments, older adults' accuracy is typically impaired compared to young adult populations. Moreover, while information on landmarks seems to be less age sensitive, it is the acquisition of routes that results in large performance differences among young and old adults. Generally, however, the acquisition and maintenance of spatial information seem to be a highly age-sensitive process.

While current research clearly shows that instrumental learning is age sensitive, the vast majority of studies in this area exclusively relied on cross-sectional samples that compared older and younger adults, thus confounding age and

cohort effects. For example, parts of age differences reported in instrumental learning may be also due to cohort differences resulting from different degrees of familiarity with the environment, such as the ability to navigate in a modern shopping mall.

### Skill Learning

Skill learning can be broadly distinguished depending on the task examined, for example, motor, perceptual, or cognitive tasks. Generally, skill learning involves a shift from a rule-based, computationally more or less demanding response to a memory-based, effortless automatic response. Hence, skills are thought to consist largely of collections of automatic processes and procedures (Logan 1988). Findings with respect to age-related performance decrements are mixed: Motor skill learning, when measured with a pursuit rotor task, and perceptual skill learning, when assessed with a serial reaction-time learning task, have been reported to be either spared or impaired in older adults compared to younger ones. Regarding motor and perceptual tasks, there are a number of studies that have compared skill learning in young and old adults.

*Motor skills.* Recently, Voelcker-Rehage (2008) reviewed a number of motor skill learning studies showing that motor performance is highly age sensitive and tends to decline into old age. At the same time, older adults clearly benefit from learning exposures and are able to substantially increase their performance throughout most of the conditions. As with other forms of learning, age-related differences in motor skill learning are sensitive to the complexity of the task. That is, with increasing complexity age differences are exacerbated, whereas low complexity tasks result in very similar performance among young and old adults. Studies that compared fine motor skills in young and old adults mostly report faster rates of skill acquisition in younger. With respect to accuracy, results seem to be mixed with some studies reporting no differences among young and old adults and others reporting reduced accuracy in older adults. Findings from studies investigating gross motor skills largely corroborate findings from fine motor skills with lower performance

levels in older adults and faster skill acquisition in younger adults. Nonetheless, older adults are able to considerably improve their performance. Overall, the nature of the task in terms of familiarity, complexity, difficulty, and structure largely influences the size of age differences. Another common finding, with few exceptions, is that younger adults benefit more from learning in terms of final performance. That is, young adults not only increase their performance more rapidly, but their responses are generally more accurate, and they achieve higher levels of motor skills compared to older adults who learn at slower rates and remain at lower levels overall. In terms of onset of decline in fine motor skill learning, cross-sectional studies suggest that decline is apparent in young adults in their late 20s. For coarse motor skills, some cross-sectional studies report a shift in peak performance gains following practice from young adults to 30–39-year-olds.

As with studies on conditioning, almost all findings are from cross-sectional studies, and results from long-term longitudinal studies on motor skill learning are not available yet. As such, it must be acknowledged that cohort effects are confounded with age differences in the sense that effect sizes may be inflated to some degree, exacerbating the effect of age on skill learning performance. Also, the extent of individual differences in the motor performance is increasingly pronounced in old age which makes statements of average decline less representative for older populations.

*Cognitive skills.* Regarding age differences in cognitive skill learning, it seems that older adults are able to maintain their performance when given enough time to work on the tasks. For example, Charness and Campbell (1988) reported spared cognitive skill performance in older adults using a task where participants were required to square two-digit numbers mentally via an instructed algorithm. Older adults learned at the same rate as younger, but their calculation speed was about half that of the younger adults. In addition to response times, Touron et al. (2004) asked young and old participants to report the strategies used for obtaining solutions in a novel arithmetic problem. Older participants reported shifting from

computing the solution to memory-based retrieval later in the learning process than younger. As a result, older adults tended to solve cognitive skill learning tasks slower than younger adults, but they also tended to show an age-related delay in strategy shift.

Some authors distinguished cognitive skill learning situations from those in which the transition from effortful, slow, and generally poor task performance to relatively effortless, fast, and accurate performance fails to occur. Results from that branch of learning research show that two general types of processes appear to underlie a wide range of tasks in the experimental literature, namely, *controlled* and *automatic* types of information processing.

Controlled processes are used when the task requirements are novel or when no consistent rule to solve a task is present. Controlled processing is characterized as slow and effortful, and it limits the availability of the cognitive system which allows mostly serial processing. Given this definition, a number of studies on skill learning using a range of different experimental manipulations found that general intelligence and working memory (WM) are the crucial processes required for controlled, effortful performance (Ackerman 1992). As such, the relation between general cognitive abilities such as WM with skill learning decreases as a function of practice as one transitions from controlled, effortful computation of the response to automatic processing (cf. Logan 1988). Hence, working memory is seen to be an important resource of controlled and effortful cognitive processing that plays a crucial role in the early phase of skill acquisition because relevant information needs to be maintained in order to correctly compute the response before automation is achieved (Rogers et al. 2000).

Automatic processes, by contrast, are characterized as fast, effortless, and unitized, such that they may not be easily altered by a subject's conscious control. The use of automatic processing is implied in the operations of various types of skilled behavior, such as encoding words during reading. These processes may only be developed through extensive practice under consistent conditions. Research has highlighted the

importance of consistency in skill learning, which refers to invariant rules for information processing, invariant components of processing, or invariant sequences of information processing components that may be used to attain successful task performance. As an empirical criterion, memory-based responding can be taken as definition of fluency or mastery of a cognitive skill. Accordingly, it has been shown that prior to mastering a cognitive skill, processing takes longer, and, hence, response times are slower. After successful learning, response times are shorter, implying that retrieved solutions are faster than computed solutions (Logan 1988).

Response-time measures have been used in studies examining the effect of age on skill acquisition and have shown substantial learning deficits in older adults. To illustrate, Jenkins and Hoyer (2000) compared young and old adults' performance using a dot-counting task. At the completion of 10 learning sessions, 7 out of 17 older participants failed to reach the automaticity criterion which was defined by zero slopes in the response times. In the young group, only 1 out of 17 missed the criterion. A similar finding was reported by Rogers and Gilbert (1997) in a noun–noun table lookup task. Participants were asked to judge whether a pair of nouns present at the bottom of a computer screen matched a pair from a table, presented at the top of the screen. After 60 blocks of training, only 3 out of 16 older adults retrieved the solution from memory, compared to 11 out of 14 younger. Hence, given enough time to work on the tasks, older adults' performance is comparable to that of younger adults (Charness and Campbell 1988), but given the same time or practice trials as young, older adults show substantial learning deficits.

### Verbal Learning

Verbal learning has traditionally been assessed with paired-associate tasks structured in stimulus–response elements and serial learning tasks. A common approach is to present lists of single words, paired associates, or short stories in several learning trials or in self-paced learning until a certain level of mastery is achieved. Subsequent recall tests then reveal the amount of

successfully memorized verbal material. These tests are typically examined in terms of correctly recalled items, omissions, repetitions, or intrusions. The paired-associate task was the most commonly applied test procedure in the earlier investigations on verbal learning and was strongly tied to the stimulus–response framework which went out of fashion in the early 1970s and was replaced by the concepts and vocabulary of information processing. With this replacement, also the term “learning” lost much of the popularity it had in conjunction with verbal memory phenomena, while, at the same time, “memory” became the more often used notion. Paired associates and similar types of tasks have been frequently used in memory research, and many findings reported in the learning literature are equally representative of memory research in general. As such, the line among results from memory or learning research remains somewhat blurred. Both learning and memory necessarily entail acquisition, storage, and retrieval of (verbal) material, and a clear distinction among these areas of research remains difficult and arbitrary to some degree. One pragmatic way to distinguish memory research from learning research is in the form of the presentation of the material and the design of the study. Typically, memory tasks entail only once-presented material and one single recall trial, whereas examining verbal learning usually requires multiple presentations of material and several or multitrial recall cycles (Zimprich et al. 2008). Taking up such a working distinction between verbal learning and memory, one has to acknowledge that most of the research on verbal memory phenomena is conducted using single recall trials, that is, it represents memory research (Kausler 1994). This is especially true for the investigation and comparison of learning and memory performance in different age groups.

The first comparison of older and younger adults, almost 100 years ago (Ruch 1934), in a paired-associate task yielded a result that has been confirmed ever since: Learning performance in paired-associate tasks produces pronounced age differences in average correct responses and younger adults accumulating and recollecting more items than older adults. However, as with

nonverbal material, verbal learning in older adults remains functional into old age, and older adults are in general able to benefit from learning. At the same time, verbal learning is highly age sensitive with younger adults outperforming older adults in most aspects. A number of studies highlighted the impact of increasing difficulty of the verbal learning tasks in terms of higher rates of interference and lower learning rates in older adults.

Work on serial learning, introduced as early as 1885 by Hermann Ebbinghaus (1885), entails the memorization of a series of verbal items. These items are typically either nonsense words or real words from the own or a foreign language with different properties to guide item difficulty such as word frequency and number of syllables. In the first application, a word list was memorized and reproduced in the correct order to produce a learning curve characterized by a steep increase in word accumulation early on and diminishing returns from additional learning trials later in the study. In recent applications, serial learning has been described using nonlinear statistical models that are able to capture the curvature and the asymptotic nature of this task resulting in three psychologically relevant parameters. The initial performance after the first learning and recall trial, the learning rate that describes the speed of accumulation, and the maximal or asymptotic performance which is a point when additional learning trials no longer increase learning performance.

Work on serial learning uncovered the effect of the serial position of an item in the list. Beginning items and those at the end of the list are recalled with few errors, while error rates peak in the midfield of a serial learning task. This serial-position effect has been reported for both young and old participants with older adults generally producing more errors overall. An important modifying aspect in the comparison of recall performance among young and old adults is the speed at which words in the list are presented. Not surprisingly, the correct recall performance of older adults dramatically decreases as items are exposed with shorter rates. In turn, older adults strongly benefit from longer exposure times. Anecdotically, in a classic study on serial learning that

used a vocabulary test, older adults produced on average 40 errors when items were presented at 10 s each, but when presentation time was reduced to 4 s, the average error rate increased to 80 (Eisdorfer and Service 1967). Next to exposure times, verbal knowledge seems to have an important mediating effect on error rates, learning rate, and initial test performance. Older adults with higher verbal ability tend to be less affected by exposure time and have faster learning rates and better initial performance (Eisdorfer and Service 1967; Rast 2011).

*Individual differences in verbal learning.* Classically, the interest was on comparing average learning performance among young and old. In recent years, however, the interest has shifted to investigating and explaining individual differences in verbal learning. As with other forms of learning, verbal learning is maintained into old age but is also largely intertwined with other higher-order and age-sensitive cognitive functions. As a result, performance differences among individuals in acquisition rates and in recall performance are substantial, and the amount of individual differences typically increases with advancing age. That is, as people age, the average verbal learning performance becomes less descriptive because the amount of individual differences increases strongly into adulthood.

Recent work has shown that reliable individual differences can be found in the initial performance, the learning rate, and the maximal performance (e.g., Zimprich et al. 2008; Rast 2011). Advances in statistical modeling also led to more advanced models of learning, and recent studies on verbal learning have utilized nonlinear models to capture different aspects of learning, such as the initial performance, the maximal performance, and the learning rate. A common finding is that the maximal performance and the learning rate are negatively correlated, showing that those with a higher maximal performance tend to have slower rates of learning; that is, they need more trials to achieve their maximum performance. Further, verbal learning seems to be a restricted process. Higher learning rates come at the expense of the maximal performance in the sense that those who learn faster, reach their maximum earlier

compared to those who started slower but end at a higher maximum performance. These findings have been reported for verbal and nonverbal material.

In order to explain individual differences in learning, a number of explanatory variables have been discussed and investigated in the context of verbal and nonverbal learning. The most common are chronological age, processing speed, educational level, verbal knowledge, and working memory. Probably the most prominent variable in explaining individual differences in learning is age. Age-related effects are most pronounced in the initial performance of learning. Young and old participants start at different levels, with older adults having smaller initial performance. As learning unfolds and individual differences play into the learning gains, chronological age loses predictive validity and typically explains smaller amounts of variance in maximal learning performance. This implies that other person-specific variables gain importance in explaining learning performance differences among individuals. Accordingly, a number of studies using linear and nonlinear models of verbal learning showed that learning rate is only weakly related to age in midlife and old age. Instead, processing speed, educational level, verbal knowledge, and working memory have been consistently related to performance differences in verbal learning. Higher levels of working memory and education as well as faster processing speed positively affect the initial and asymptotic learning performance, while verbal knowledge has been linked to faster acquisition rates. The finding that better educated people perform better in learning is well known in the literature on cognition and memory and expands into nonverbal material. In positional learning, for example, education has been shown to influence learning capacity parameters positively such as initial and asymptotic performance, but not the more dynamic learning rate parameter. It is now generally acknowledged that learning is differentially affected by a number of variables and that the age of the respondent mainly influences the initial performance but less the learning rate and the maximal learning performance.

These newer findings also underscore the view on the existence, or absence, of a general learning factor, comparable to a general intelligence factor. During the early twentieth century, human cognitive abilities and learning were commonly assumed to be closely related. In fact, some authors even considered learning to lie at the core of intelligence in the sense that, for example, “intelligence means the capacity for learning” (Ellis 1929, p. 62). Contrary to this assumption, studies in the 1930s and 1940s indicated only small correlations between individual differences in intelligence and “gain” scores on diverse learning tasks. In addition, learning scores from different tasks also appeared to be only weakly related to each other. These findings, which have been replicated ever since, called the notion of a single, general learning ability underlying intelligence into question. Rather, comparable to the positive manifold among intellectual abilities, such findings point to the existence of specific learning abilities. More recent findings corroborate the view that a general learning factor does not exist. Rather, learning seems to be very domain and material specific. Similarly, changes across domains are only weakly related indicating that learning abilities are differentially affected by the passage of time and the aging process in individuals.

## Cross-References

- ▶ [Behavior Modification](#)
- ▶ [Individual Differences in Adult Cognition and Cognitive Development](#)
- ▶ [Lifelong Learning and Work](#)
- ▶ [Process and Systems Views of Aging and Memory](#)

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## Leisure Activities in Later Life

Douglas A. Kleiber  
University of Georgia College of Education,  
Athens, GA, USA

### Synonyms

Enjoyable engagement; Valued activities; Voluntary activities

### Definition

Leisure: a context of discretionary time with the opportunity for preferred activity. Leisure activities: those that occur in the context of leisure.

### Introduction

Leisure activity in later life has been addressed most thoroughly in the relatively new field of leisure studies (e.g., McGuire et al. 2013), but there is a long history of interest in the subject in sociology and gerontology. A number of theories about aging were shaped to some extent around leisure in the 1950s and 1960s, notably arguing that (1) one should stay active and busy after years of work and family production (*activity theory*), (2) the abandoning of activities is natural with age and perhaps in the mutual best interest of self and society (*disengagement theory*), and (3) older people are most inclined to continue preferred and valued activities, albeit at a reduced level (*continuity theory*), as a way of maintaining personal identity and perpetuating nonwork role identities. The first two were seen as oppositional until the disengagement theory was largely discredited as being both a justification of neglect of older people and inconsistent with what older people were actually doing with respect to activity and aging. Robert Atchley (1989) offered continuity theory somewhat later to characterize what people actually *did* in later life and not prescribe

what they *should* do to age well as the other two theories had done.

Much of the difficulty with the research on leisure activity in later life is that leisure is an ambiguous construct. Thus, gerontologists have preferred to use “valued activities” or “voluntary activities” in their research and writing to characterize “leisure.” From its earliest Western traditions, some still hold to leisure as being rooted in the Aristotelian/Platonic ideal of “*scholē*” (the root word for school as well) as a context wherein freedom from obligation was dedicated to the refinement of character and the development of civility (cf. de Grazia 1964). Some would even question the pairing of leisure and activity; for them it is redundant to add activity since their understanding of leisure equals activities such as play, games, sports, recreation, entertainment, hobbies, crafts, etc., i.e., those activities culturally recognized as leisure. For others, however, leisure is equated with free time and indeed may be used – and used well – for bringing peace, relaxation, and contemplation without *doing* much at all. Historian, philosopher, and theologian Josef Pieper (1963) regarded leisure as

...an attitude of non-activity, of inward calm, of silence; it means not being ‘busy’ but letting things happen. . . . Leisure is not the attitude of those who intervene, but of those who are open to everything . . . of those who leave the reins loose and who are free and easy themselves.

The best reflection of its contemporary use, however, is to see leisure as free time with the expectation of preferred experience, whether that be through engagement or disengagement, excitement or relaxation, stimulation or contemplation, or even work-like involvement such as volunteering or gardening (as a way to enjoy the weather while getting exercise and producing flowers or vegetables after all), as long as the action taken is freely chosen and intrinsically enjoyable (Kleiber 1999).

### Leisure Activity Patterns in Later Life

Research in the interdisciplinary field of leisure studies generally reaches the same conclusion as

the gerontology literature: continuity of involvement best describes older people's inclinations toward an activity, even though there is often a decline in number of activities and intensity of activity involvement overall (for a review see Nimrod and Janke 2011). One of the most comprehensive earlier studies of leisure and aging was J.R Kelly's (1987) investigation of a large sample of older people in Middle America. Among the important findings of *Peoria Winter*, beside the preference for continuity and the inevitability of decline in especially physical activities, was the distinction between activities that were part of one's daily routine – such as conversation over meals and watching television together – thus serving as “core” activities for couples and families and other more individualized “balance” activities that expanded one's repertoire and offered a greater prospect for self-actualization.

The strongest cross-sectional evidence for changing activity patterns in aging and later life suggests a progressive decline in both number and intensity over the course of later adulthood (e.g., Robinson and Godbey 1997; Strain et al. 2002). This is especially true of physical activities and those undertaken outside the home, such as travel and attending movies and musical events. Other activities, such as hobbies and crafts and volunteerism, are more consistent with a pattern of continuity (e.g., Iso-Ahola et al. 1994; Strain et al. 2002; see also Nimrod and Janke 2011), while still others increase in frequency (e.g., cooking for men, television watching, and visiting with friends). Initiating new activities is relatively less common but still occurs (e.g., Nimrod 2008). A tendency to embrace new possibilities is particularly evident after losing a spouse, as one's options change dramatically, though some studies (e.g., Jaumot-Pascual et al. 2016; Lopata 1993) show this to be true of widows, but not widowers. This gender difference is also apparent among non-widows; women appear to be more likely to embrace changes in later-life leisure activities than do men in general (Iso-Ahola et al. 1994; Jaumot-Pascual et al. 2016). This is evident, for example, in the growth of the international “Red Hat Society,” where widows and other older

women conspire to be “outrageous” (Cooper 2004).

The tendency to introduce new activities has been studied more often using retrospective than prospective designs. Searle et al. (1993) found that among a sizeable sample of people over the age of 65, 16% were “adders” (who introduced new activities while not dropping any the previous year), 20% were “replacers” (adding at least one while quitting another activity in the previous year), 25% were “quitters” (who eliminated at least one activity from their repertoires while not adding any), and 40% were “continuers” (who neither added nor quit any activities in the last year). In a slightly more refined analysis, Nimrod et al. (2009) used the *Americans' Changing Lives* data set and a comparable one from Israel and found that a reduction in both the number and frequency of activities was the most commonly observed pattern in both populations, at 51% and 41%, respectively. This was followed by “expanders” who increased both the number and frequency of activities at 21% and 35%, respectively, and then by “concentrators” who reduced the number of activities but increased the frequency and intensity of some, at 16 and 11%, respectively. A final group, comprising 12 and 11% of the samples, respectively, showed a “diffuser” pattern, increasing the number of activities but with reduced frequency. While the two populations had a similar profile overall, Israeli retirees were somewhat more likely to start new activities and engage in them more often relative to the American sample who showed a slighter greater tendency to reduce both time and frequency of activities. The activities most likely to be increased were religious activities, walking, gardening, and talking and visiting with friends.

Longitudinal research on leisure and aging published in gerontology journals has also addressed central questions about how specific leisure activity patterns change in later life as a function of the theories highlighted earlier. Supporting continuity theory, Strain et al. (2002) found that in a group of 380 Canadians aged over 65, few changed their top leisure activities – television watching (99%) and reading (98%) – over an 8-year period. In contrast, their

walking, traveling, attendance at movies and plays, playing cards, and working in the yard decreased by as much as a third, providing some support for a pattern of disengagement. In their review of the literature, Strain et al. noted that engagement with television and radio was the most commonly reported leisure activity in later life, while engagement in sports and exercise, despite being strongly encouraged, was among the least likely to be found in older people.

Much of the research on leisure activity in later life focuses on the factors that undermine or prevent it. Declines in physical capacity and health, loss of companionship, and reduced financial resources are the most commonly reported reasons for changes in activity (e.g., McGuire et al. 2013). Among the constraints that limit participation in leisure activities in later life, ageist stigma may be the most impactful (Dionigi and Horton 2011). Resulting isolation and exclusion contributes to marginalization and a type of oppression of expression. There is also an impact of self-stereotyping and self-handicapping that occurs among older people in youth-oriented societies. Fortunately, though, there is also evidence that many people are *less* influenced by social norms and expectations as they age, helping to challenge these social conventions. Along these lines, as with Red Hat Society members referred to earlier, leisure may serve as a context of resistance, as when older people defy stereotypes and engage in high intensity and physically competitive activities and sports (Dionigi and Horton 2012).

### **The Impact of Leisure Activities on Well-being in Later Life**

Despite being more descriptive than prescriptive, the idea of continuity is consistent with the “use it or lose it” prescription for the well-being in later life, advocated in activity theory. More recently, prominent perspectives on adaptation in later life have recognized choice of, and persistence with, *valued* activities to support both development and adjustment to aging. The selective optimization with compensation (SOC) theory (Baltes and

Baltes 1990) and the socioemotional selectivity theory (SST; Carstensen et al. 2003) recognize that voluntary activities are a valued source of meaning in later life and are only optimized in their action if they are carefully selected, vigorously engaged in, and supported in various ways through adjustments that compensate for losses in capacity. SOC processes are now commonly invoked (Burnett-Wolle and Godbey 2007; Kleiber et al. 2008) to explain the process of adapting to leisure constraints through the substitution of more manageable activities, finding ways to continue (with some modifications), or actually dropping activities that are no longer satisfying or meaningful.

Whether they are done alone or with other people, such activities usually reflect a prioritizing of positive emotion over future gain and a willingness to prune activities and relationships that are no longer satisfying, which is somewhat reminiscent of the earlier disengagement theory. Indeed, disengagement theory has been reconsidered specifically in terms of the voluntary and selective abandonment of activities (Achenbaum and Bengtson 1994) rather than seeing it as simply a response to loss or being socially dispossessed. Nor is it a new idea to recognize that the “busyness” created by the demand to look and stay busy after retirement can and does reach maladaptive and even neurotic proportions (cf. Eckerd 1986).

The *selection* component of the SOC model is not only about loss-based disengagement due to abandonment of activities but also includes “elective selection” of *new* activities, making the case that self-expansion and growth more generally are still possible in later life. Indeed, “old dogs *can* be taught new tricks” (or they can teach themselves). The commonality with which older people do so has given rise to an innovation theory of aging (Nimrod 2008; Nimrod and Kleiber 2007). This may be more common among the young old (60–75) than the older old, but there is still ample evidence for interest in, and appreciation of, novelty in later-life engagements. Superficially, this seems more consistent with activity theory than continuity theory, but as Atchley (1989) pointed out, continuity is inclusive of

internal and external processes such that one's sense of identification with the activity can be preserved even if co-participants, venues, and forms of the activity may change. Nimrod and Kleiber (2007) reflected this distinction in identifying patterns in their participants of both *self-preservation innovation*, where activities have some earlier variation, and *self-reinvention innovation*, where they are entirely new.

Other models of successful aging also invoke the quality of engagement in activity as a critical component. The otherwise well-regarded MacArthur study of successful aging by Rowe and Kahn (1998) is commonly criticized for defining "success" as being free from illness and functional impairments, despite evidence of people aging well in the face of disability as evidenced in their engagement in enjoyable activities. Rowe and Kahn do refer to engagement as one of the critical components of successful aging, but they characterize such engagement as necessarily *productive*, as in the case of volunteer work. Indeed, such models of productive aging would generally see little value in leisure activities, with the exception of volunteer work and perhaps gardening, wood working, or other activities where products might be marketed.

Nevertheless, there is ample evidence from the leisure studies and the gerontological literature more generally that activities that are psychologically engaging and meaningful, simply by virtue of being shared with others, contribute substantially to life satisfaction and psychological well-being in later life (see Adams et al. 2011, for a review). The link between physically active leisure and subjective well-being (SWB) is especially strong. For example, McAuley et al. (2000) found evidence of subjective well-being benefits for both physical and social activities, while others show that any activity that is particularly "meaningful" enhances SWB (Cuenca et al. 2014). Mannell and Dupuis (1994) even suggested from their review of the literature that leisure activity levels are better predictors of life satisfaction in later life than health and income.

Dupuis and Smale (1995) found an inverse relationship between leisure activity and

depression in later life, but such findings raise questions about causality and the degree to which this is affected by illness. In their modeling of potential influences of activity and depression in widows over time, Janke et al. (2008a) found a better fit for increases in depression leading to decreases in leisure activity rather than the reverse. However, the fact that Dupuis and Smale (1995) found that breadth rather than depth of involvement was associated with lower depression does suggest that having a repertoire of possibilities may be a hedge against the impacts of loss in later life, including the loss of activities, as per other studies of coping. In fact, there is relatively little longitudinal research that relates leisure activity to improvements in well-being, but Menec (2003) found such indications. Moreover, in a longitudinal life span study of Harvard graduates, Vaillant (2002) found that joyful activities, especially creative activities and involvement with games and sport, were instrumental in aging well for those who were followed over time.

## Variations in Leisure Activity and Experience in Later Life

Three of the more common activities of older people warrant a closer analysis when it comes to changes in leisure activity with age and historical change as well as to their impacts on well-being in later life.

### Media Use

Television watching is clearly the most ubiquitous leisure activity of older adults (e.g., Lucas et al. 2011; Robinson and Godbey 1997), if not the most beneficial (e.g., van der Goot et al. 2012). While it is hardly unique to later life, it is proportionally more common than other activities relative to other developmental periods, even childhood. Television watching may be adaptive, though, to the extent it compensates for a lack of social contact (older people sometimes think of television characters as the "family" that they no longer have around them) or engages individuals cognitively in some respects. Yet research on television generally shows that it engages people in

minimal ways, often being used as background “company,” while other activities of daily living are undertaken or simply as a sleep aid for naps and retiring in the evening.

Among the more significant changes in the media activity of older people is the extent to which they use internet technology. While there still remains a “digital divide” of sorts between the young and the old, the use of the internet has become commonplace in the lives of many in later life (e.g., Smith 2014). As with other age groups, it is used for instrumental purposes to get or exchange information, but it is also used more leisurely as a news source and as a forum for social participation (Nimrod 2011). Seniors’ online communities in particular are available both for support and problem solving on issues such as coping with the loss of a spouse, but also for a variety of leisure activities including communicating with family (often grandchildren) and friends as well as with other “virtual” companions with whom they may not be personally acquainted but who share common leisure interests (see Nimrod 2010, 2011, 2016). Internet use is just one among many forms of communication (e.g., telephone, radio, television, newspapers) and has not replaced these more traditional sources for seniors (Nimrod 2016). Rather it has expanded the time, especially “screen time,” devoted to communication and entertainment. As far as the quality and impact of the experience, it is important to note that internet use is considerably more active and interactive than television use and also seems to be associated with higher levels of subjective well-being and social integration (e.g., Erickson and Johnson 2011). At the same time, if it is in addition to and not replacing television use, it may be preempting activities, such as exercise, that provide other benefits. While a concern, such speculation requires further research.

### Travel

Leisure travel for working people often accompanies job-related travel, extending the time in attractive locales before the work or after it is done. Considerably more freedom for travel comes about after retirement, especially when

other needs (financial, health, family related, or otherwise) have been adequately addressed in hours normally devoted to work. Due to the increase in numbers of people retiring in many countries, the tourism industry is well attuned to this potential market (e.g., Patterson and Pegg 2011). Adventure travel, for example, has increased due to its popularity among newer cohorts of retirees. Although it is an under-researched area, the benefits of travel to quality of life may relate to a need for stimulation, change (innovation), and exposure (Patterson and Pegg 2011). For many, travel is as much about education as entertainment and luxury. Elderhostel (known now as *Road Scholar*) programs grew from 220 participants in 1975 to over 4 million by 2008 (Patterson and Pegg 2011). For others, work is combined with travel in doing volunteer work in other places. While it isn’t restricted to retirees, “voluntourism” has become a popular option for those who retire with the resources to travel and the commitment to help (Wearing 2001). The benefits of this kind of travel are perhaps better reflected in the research on volunteerism.

### Volunteerism

Volunteerism clearly fits the definition of engagement to promote successful aging (e.g., Rowe and Kahn 1998), primarily because it is productive. It is not always characterized as leisure in the minds of those doing volunteer work, but it is generally freely chosen during discretionary time and offers intrinsic satisfaction, as well as being instrumental, and is commonly recognized in studies of discretionary time use (e.g., Robinson and Godbey 1997). Indeed, volunteer workers rarely continue if they are not enjoying the work in some ways, which captures both the intrinsic satisfaction in the experience as well as the good they are doing. As to its frequency, it is more common among the young old than the older old, in spite of a greater call of duty with the current older cohort. Furthermore, its popularity has increased because of the general understanding that it contributes to positive emotion and life satisfaction, which is well supported by research (e.g., Morrow-Howell et al. 2003).

## Leisure Activities in Coping with Loss and Disability

It may be considered somewhat ironic that while the reduction of work and family responsibilities defines retirement to a great extent, illness and disability can reduce the time that people can engage in leisure. Nevertheless, leisure activity of older people with illness, disability, and loss does appear to alleviate pain and suffering (cf. Nimrod and Janke 2011), particularly with respect to the loss of a spouse (Janke et al. 2008b). For some, the role loss is even liberating where new activities are initiated as part of one's personal transformation or "blossoming" (as Lopata (1993) characterized it). Importantly too, when long-term care is required, most facilities offer leisure activity programs as part of standard care and use such activities to enhance the quality of life of residents (Dupuis et al. 2011).

## Future Research

While some of the research on leisure activities in later life shows sensitivity to gender and disability, there is very limited research on race and ethnicity and other sources of national and cultural variation. It is worth noting that this review probably speaks mostly to leisure activity and aging in North American and other English-speaking countries. Patterns of activities and their relationship to well-being likely vary considerably across countries and regions. But this is also the case for minority, ethnic, and racial groups and even lower SES groups, where differences may be established with further research. And even among those studied, it is the relatively well resourced who have drawn the most attention because they are privileged to have leisure in the first place, even in later life.

## Cross-References

- ▶ [Age-Related Positivity Effect and Its Implications for Social and Health Gerontology](#)
- ▶ [Aging and Quality of Life](#)

- ▶ [Positive Emotion Processing, Theoretical Perspectives](#)
- ▶ [Psychology of Longevity](#)
- ▶ [Social Media and Aging](#)

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## Lewy Body Disease

Sarah E. Cook  
Duke University, Durham, NC, USA

## Synonyms

Parkinsonism; Parkinson's disease dementia; Mild cognitive impairment due to Parkinson's disease

## Definition

Dementia with Lewy bodies (DLB, also referred to as Lewy Body Dementia) is a progressive neurodegenerative disease with fluctuations in attention and arousal, changes in cognition and sleep, psychotic features, and development of problems with voluntary movement. It has commonalities with Parkinson's disease dementia making diagnostic differentiation challenging. It has only been recognized as a separate condition since the 1960s (Troster 2008). DLB is now considered the second most common form of progressive dementia, following Alzheimer's disease (AD) (Latoo and Jan 2008), accounting for about 15–35% of all dementia cases depending on the study (Troster 2008). DLB often manifests earlier in life than some of the other dementias, often with onset between age 50–70 (Schoenberg and Duff 2011). It affects up to 5% of older adults (Troster 2008). Average course of disease is generally 5–7 years from diagnosis to death (Schoenberg and Duff 2011). An examination of risk factors for DLB by Boot and colleagues (2013) found that a clinical diagnosis of DLB (as opposed to pathological) was associated with history of depression or anxiety, family history of Parkinson's disease, history of stroke, and being an APOE 4 homozygote. Protective factors were noted to be history of cancer and caffeine use, although the exact mechanism by which they protect against DLB is not known.

This entry will provide a broad overview of DLB, starting with the relevant neuropathology. This will provide a framework for understanding the common clinical presentation of DLB, including the neurologic, psychiatric and cognitive signs and symptoms, diagnostic criteria, and treatment considerations.

## Neuropathology of Dementia with Lewy Bodies

On neuropathological examination, DLB is characterized by abnormal aggregates of alpha synuclein protein which were called Lewy bodies, named after Friederich Lewy who discovered

them in the early 1900s in patients with Parkinson's disease (Latoo and Jan 2008). Lewy bodies are almost universally found in the brainstem of individuals with DLB (most often in substantia nigra and locus ceruleus) and may account for the parkinsonian and sleep symptoms often seen in DLB which will be reviewed later. It is believed that this area is the site of initial neuropathological change in DLB and that aggregation of alpha synuclein then ascends sequentially rostrally to the limbic area (including the amygdala, anterior cingulate, entorhinal cortex) and neocortex (frontal, temporal, and parietal lobes) (Donaghy and McKeith 2014). It is believed that the neuropathological changes in these areas may account for the changes in behavior and cognition that are often part of DLB which will be described later. All of these areas of the central nervous system are investigated for Lewy bodies during postmortem analysis to assist with making a definitive diagnosis. In addition, Lewy bodies can also be found in the autonomic branch of the peripheral nervous system, which may be related to the orthostatic dysfunction that can be seen in DLB. The pattern of Lewy body involvement within the central nervous system is important in diagnosis (McKeith et al. 2005), but research has found that the amount of Lewy bodies present is not strongly correlated with disease severity or duration of disease since onset (McKeith et al. 2004).

It is important to note that the presence of Lewy bodies in the central nervous system is not specific only to DLB. In fact, depending on the study, between 24% and 55% of cognitively normal (nondemented) older adults have significant Lewy body burden on autopsy. There is also a high degree of comorbidity of LBD and other neurodegenerative conditions, especially AD but also with vascular disease (Zupancic et al. 2011). McKeith and colleagues (2005) state that the likelihood of DLB is directly related to the amount of Lewy body pathology and inversely related to the amount of AD pathology. But others have recognized the high degree of comorbidity of DLB with other neurodegenerative conditions by dividing pathological cases into two groups: "common" LBD in which both Lewy body and AD pathology (amyloid plaques and neurofibrillary tangles) are

present and both meet neuropathological criteria and the second group is called a “pure” DLB in which only Lewy bodies are of sufficient severity to meet neuropathological criteria but other pathology might be identified (Simard et al. 2000).

In distinguishing DLB from Parkinson’s disease dementia (PDD), there are some differences in the pathological changes in the two conditions. According to Donaghy and McKeith who provide a thorough discussion of the pathological changes in DLB (Donaghy and McKeith 2014), while both LBD and PDD can have diffuse presence of Lewy bodies in certain subcortical and cortical areas, there is often more amyloid deposition in the striatum, alpha synuclein deposition in the hippocampal area, and greater serotonin receptor density in the frontal lobes in DLB compared to PDD. Individuals with DLB have less necrosis in the substantia nigra and less striatal dopamine receptor upregulation than those with PDD.

In addition to the presence of Lewy bodies, DLB has been associated with other neuropathological changes, most notably decreased acetylcholine available in the basal forebrain and decreased dopamine in the basal ganglia (Morra and Donovick 2014). Neuroimaging studies suggest that there could be atrophy of cortical and subcortical areas in DLB, including temporal, frontal, and parietal lobes as well as in the amygdala and hippocampus. However, the atrophy is not as pronounced as in AD making detection by structural imaging more challenging (Morra and Donovick 2014). According to Donaghy and McKeith (2014), there are no radioligands available yet to detect alpha synuclein deposition on neuroimaging, as is the case for imaging amyloid deposition in vivo in AD.

## Neurologic Presentation of Dementia with Lewy Bodies

### Diagnostic Criteria for Dementia with Lewy Bodies

DLB is a neurodegenerative process that by definition includes a progressive cognitive decline

that interferes with daily functioning (i.e., must have dementia), with motor features starting after, concurrently, or within 1 year of these cognitive symptoms (Donaghy and McKeith 2014). If motor features are present for longer than 1 year before cognitive symptoms first present, then Parkinson’s disease dementia is typically diagnosed rather than DLB (Rongve et al. 2015). Clinical diagnosis is accomplished with history of signs and symptoms as well as physical and neurological examinations, usually by a neurologist. As with some several other dementias, definitive confirmation of diagnosis is not possible until pathological examination postmortem.

According to the most widely accepted criteria for DLB by McKeith and the DLB Consortium (McKeith et al. 2005), there are core features of DLB and then features that help support the diagnosis, often called suggestive features. In order to meet criteria for probable DLB, in addition to the progressive cognitive decline/dementia, an individual needs to have either two or more core features or one core feature and one suggestive feature.

### Core Features of DLB

1. Fluctuations in attention or arousal leading to disorientation and mental status changes over hours or days (least common core feature; Donaghy and McKeith 2014)
2. Visual hallucinations, most often well-formed but not threatening to the patient and often images of people or animals (70–85% of DLB cases; Morra and Donovick 2014)
3. Parkinsonism, most often bradykinesia, rigidity, or postural changes as opposed to the tremor commonly seen in PD (60–92% of DLB cases; Zupanic et al. 2011)

### Suggestive Features of DLB

1. REM sleep behavior disorder, which is an enacting of dreams during rapid eye movement sleep, can start decades before other clinical manifestations, up to 93% of individuals with this disorder go on to develop a form of synucleinopathy, including DLB, if followed long enough (Donaghy and McKeith 2014)

2. Sensitivity to neuroleptic (antipsychotic) medications marked by the development of extrapyramidal signs in mild cases but sedation and fever possible with more severe reaction
3. Low uptake of dopamine transporter in basal ganglia on SPECT or PET imaging (research has shown >75% sensitivity and 90% specificity for detecting DLB from other cause dementia; Zupancic et al. 2011)

In addition to the core and suggestive features already mentioned above, there are other signs that are frequently seen in DLB, including: autonomic dysfunction which can lead to falls and/or syncopal episodes, delusional beliefs and/or hallucinations in modalities other than visual, incontinence, mood disturbance, and slow wave activity on EEG with temporal sharps (Donaghy and McKeith 2014).

If psychotic symptoms are present, the possibility of antiparkinsonian medications causing hallucinations needs to be ruled out, as several of these medications can induce hallucinations among myriad other potential side effects. The timeline of onset of symptoms should help clarify if this is the case, but if the hallucinations persist after discontinuation and clearance of the possibly offending medication, then DLB should remain on the differential (Zupancic et al. 2011).

### **Differentiation from Other Neurodegenerative Conditions**

DLB is often mistaken for AD or other neurodegenerative conditions due to commonalities in clinical presentation. Given the high rate of dementia in Parkinson's disease (see Parkinson's disease entry in this volume by Cook for review on Parkinson's disease dementia; Cook 2016) and overlapping clinical features, it is important to differentiate DLB from Parkinson's disease dementia (PDD). If the onset of cognitive problems occurs more than a year, and most often several years, after the onset of motor symptoms, it is considered to be PDD and not DLB. If the cognitive symptoms present first, then it is

more likely DLB (Rongve et al. 2015). In addition to examining onset of symptoms, individuals with PDD often respond to levodopa therapy better than individuals with DLB (Zupancic et al. 2011). There is increasing speculation that PDD and DLB may be syndromes along one continuum for a few reasons. First, some authors have suggested that the 1 year rule between cognitive and motor symptoms is arbitrary. Second, there are not well-accepted definitive diagnostic criteria for diagnosing PDD in vivo to assist with separating them. Third, they have striking neuropathological similarities postmortem. Fourth, cognitive domains impacted are relatively similar. And lastly, therapeutically, there appears to be little difference in medication efficacy between them (Rongve et al. 2015).

Distinguishing DLB from an Alzheimer's dementia (AD) is best done by examining the clinical history of symptoms and if available, neuropsychological testing data. Specifically, AD most often does not present with parkinsonism, nor are visual hallucinations common early in the disease course of AD. Individuals with DLB are more likely to have autonomic signs, such as orthostatic hypotension and constipation (Morra and Donovick 2014). On neuropsychological testing, AD affects the medial temporal lobes and typically begins with progressive short-term memory loss, with memories not being triggered by cueing. In DLB, if there are changes in memory, it is often much later in the disease course and qualitatively different, such that a patient with DLB will often benefit from repetition and cueing. Generally speaking, cognitive symptoms in DLB would be considered more subcortical in nature (i.e., attention, processing speed, and/or executive deficits), as opposed to the cortical features in AD. However, many studies have noted that individuals with DLB have more problems with constructional skills than individuals with AD. A matched study of decline in individuals with DLB and AD by Stavitsky and colleagues (2006) also confirmed this finding, but also found that those with DLB had more problems with carrying out everyday skills earlier than individuals with AD.

### Is There a Prodrome to Dementia with Lewy Bodies?

In Alzheimer's disease, the most common form of dementia, there is a large literature about a prodrome, which has been called mild cognitive impairment (MCI). While initially conceived to be the prodrome for AD, research has found that there is heterogeneity in clinical symptoms and neuropsychological test performance in MCI, leading to more descriptive labels (e.g., amnesic MCI, nonamnesic MCI) and acknowledgement that not all MCI will lead to AD, but that some will progress to other dementias including DLB (Molano et al. 2010). There has been very little research about a possible prodromal phase in DLB, although some preliminary information has been provided from studies looking at conversion of MCI to dementia. As outlined in Troster (2008), one study found that in a group of 34 individuals with amnesic MCI that later converted to dementia and came to autopsy, three had a pathological diagnosis of DLB and one had a final clinical diagnosis of DLB. Another study of 440 cognitively normal individuals and 141 individuals with MCI were followed for 30 months and found possible DLB in 10 participants, 4 who had normal test findings at baseline, 4 who had nonamnesic MCI at baseline, and two with amnesic MCI at baseline.

In another related study, researchers at the Mayo Clinic (Molano et al. 2010) examined their databases to find cases of MCI that later progressed to DLB to find clinical correlates of a pathological diagnosis of DLB at autopsy. Only eight cases were identified, including six males. Seven of the cases had REM sleep behavior disorder with onset preceding cognitive symptoms in six patients by a median of 10 years. Six patients had visual hallucinations, six patients had problems with executive functioning, and six patients had problems with visuospatial functioning on formal testing. Seven patients had parkinsonism, with a median onset of 3 years after cognitive symptoms. They provide clinical history including progression and course of symptoms for some of these cases to show the heterogeneity in DLB. According to Donaghy and McKeith (2014), a

study is now underway to learn more about not only the prodromal phase but also clinical markers of those who eventually develop DLB using an at-risk group, those with REM sleep behavior disorder.

### Treatment in Dementia with Lewy Bodies

Since DLB is a progressive neurodegenerative condition, the prognosis is poor. As noted earlier, survival following diagnosis is often relatively short compared to AD, with estimates of about 5–7 years from diagnosis (Morra and Donovick 2014). The cognitive deficits in DLB are thought to arise at least partially from the cholinergic decline, and therefore research has examined if acetylcholinesterase inhibitors, mostly used in Alzheimer's disease, would be beneficial for individuals with DLB and PDD. In a recent Cochrane review on this topic by Rolinski and others (2012), a total of six clinical trials were considered. However, there was only one study with exclusively DLB patients (McKeith et al. 2000). The Cochrane review suggested that in PDD, the use of acetylcholinesterase inhibitors significantly improved global assessment, cognition, behavior, and activities of daily living. In the single trial with only DLB cases randomized to treatment with rivastigmine or placebo by McKeith and colleagues (2000), those on rivastigmine had symptomatic benefit, primarily with respect to decreasing apathy, anxiety, and hallucinations. Once the drug was withdrawn, these benefits washed out.

In a more recent meta-analysis by Stinton and colleagues (2015) on pharmacological treatment of DLB, they too found that acetylcholinesterase inhibitors (donepezil and rivastigmine) were helpful for cognitive symptoms, delusions, and activities of daily living. They concluded that memantine, a different class of medication used in AD, had limited effectiveness in treating symptoms of DLB but was tolerated well. In terms of antipsychotics for psychiatric symptoms, they found that most agents had a high degree of adverse events or were generally ineffective. Instead of using antipsychotics for the neuropsychiatric symptoms often seen in DLB, which can

include depression, anxiety, as well as psychotic symptoms, treatment with selective serotonin reuptake inhibitors (SSRIs) and/or serotonin-norepinephrine reuptake inhibitors (SNRIs) is often considered. Psychiatric medications that reduce acetylcholine should be avoided so as to not increase cognitive problems (Morra and Donovan 2014).

While dopamine agonists, such as levodopa, that increase the amount of dopamine in the brain are the first line treatment for Parkinson's disease (PD), some of these medications can cause or worsen hallucinations. In general, individuals with DLB tend to respond less to such treatment than patients with PD, which can help in the differential diagnosis. If such a treatment is considered in DLB, dosing is often started low with titration being slow with regular monitoring of symptoms (Zupancic et al. 2011).

### **Neuropsychological Presentation of Dementia with Lewy Bodies**

There are several neuropsychological deficits seen in individuals with DLB, with deficits primarily in attention, working memory, and other executive functions as well as visual perception and construction. Memory is much less impacted early in the course of disease, and semantic knowledge is often intact (Schoenberg and Duff 2011). Each of these cognitive domains will be discussed in more detail.

In a review by Troster (2008), the specific impairments that have been found in literature are discussed, particularly as it relates to AD and PDD. For attention, individuals with DLB often have significant problems with attention skills, including tasks of basic attention, complex or divided attention, sustained attention, and cancellation/visual search. Such skills have been found to often be worse for DLB than for AD. Other higher level executive skills such as abstraction, thinking flexibly, and judgment follow a similar pattern in that they are more impacted in DLB compared to AD. It is posited that the dysfunction of basal forebrain

cholinergic system is responsible for these deficits in DLB (Troster 2008).

Individuals with DLB often have deficits on tests of visual perception and construction. For example, they often have problems copying a picture accurately, matching figures, or conducting a visual search. Given the possibility of motor problems in individuals with DLB, one might think that such deficits could simply be related to the motor demands of testing. However, on deeper examination of the deficits across a wide array of tests, it is more likely that the deficits may be secondary to problems with praxis and perceptual processing. Individuals with DLB with visual hallucinations may have particularly poor visual processing even compared to others with DLB but without visual hallucinations. It is believed that the deficits in visual processing are related to dysfunction in the two visual streams, the dorsal parietal-occipital and ventral temporal-occipital pathway (Troster 2008).

With regards to memory, at least early in the course of illness, individuals with DLB may not be amnesic and may do well on recognition measures. They are more likely to have reduced learning and difficulty with retrieval secondary to executive deficits. They also may do better with verbal as opposed to visual memory tasks due to changes in perceptual processing. Language skills are also generally less affected, with intact semantic knowledge. Object naming may be impacted secondary to visual processing problems and fluency may be reduced due to slowed speed of processing (Troster 2008).

Due to the cognitive changes outlined above, individuals with DLB are likely to have an impact in their ability to carry out tasks of everyday living. Specifically, there can be problems with driving associated with judging distances. Walking on stairs may be challenging due to depth perception changes. Objects may be misidentified, which could lead to medication errors. Attention and arousal may wax and wane making the individual with DLB appear lethargic or apathetic.

In addition to considering treatment of symptoms with medication, families should be educated about the importance of nonpharmacological

treatment options, including occupational therapy and psychotherapy aimed at learning ways to compensate for cognitive losses in concrete ways. In addition, education about the importance of future planning, need for respite assistance, and resources for local support groups should be provided. The Lewy Body Dementia Association website ([www.lbda.org](http://www.lbda.org)) can be a good resource for individuals with DLB and their families.

## Cross-References

### ► Parkinson's Disease

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## Life and Living in Advanced Age, A Cohort Study in New Zealand, Te Puawaitanga o Ngā Tapuwae Kia Ora Tonu (LiLACS NZ)

Ngaire Kerse<sup>1</sup>, Marama Muru-Lanning<sup>3</sup>, Anna Rolleston<sup>2</sup> and Ruth Teh<sup>1</sup>

<sup>1</sup>Department of General Practice and Primary Health Care, School of Population Health, The University of Auckland, Auckland, New Zealand

<sup>2</sup>Te Kupenga Hauora Māori, Faculty of Medical and Health Sciences, The University of Auckland, Auckland, New Zealand

<sup>3</sup>James Henare Research Centre, The University of Auckland, Auckland, New Zealand

### Definition

This entry describes a longitudinal study of advanced age, set in New Zealand. The cohort study has equal size groups of Māori indigenous to New Zealand, and non-Māori, to allow identification of inequalities in health outcomes related to ethnicity and accurately describe health status until advanced age. The study aims to identify predictors of successful aging.

### Background

Advanced aging is the focus of this study. Within the next 40 years, the proportion of the New Zealand population aged over 65 years will increase from 13% to 25% along with international trends. More importantly, those aged 85 years and over (advanced age) will be the fastest-growing group, growing from 1% to 6% of the total population by 2050 (Statistics New Zealand 2012). Expenditure on health and disability support for people aged 85+ in NZ is the highest for any age (Ministry of Health 2002). Balancing this projection are the valued contributions to society of all older people. The projected increase in number and proportion of the oldest population group could lead to a net positive national benefit as there is likely to be some

capacity for these older people to increase their civic contributions. However, not enough is known about the exact health and social status of those in advanced age or how the aspects of New Zealand lifestyle impact success in advanced age.

In examining advanced aging of the New Zealand population, important cultural and environmental aspects come to the fore. The trajectory of demographic aging is steeper for the Māori population with a five times increase in Māori aged 85+ compared with a doubling for non-Māori (Statistics New Zealand 2010). This study of advanced aging includes a large number of Māori participants which enables analyses of disparities in health and health outcomes between the Māori and non-Māori.

### The New Zealand Context

The Māori hold a very important place in the cultural fabric of New Zealand society. The LiLACS NZ study embraces Maori kaumātua (elders) and their whanau (extended family) living in the Bay of Plenty/Te Moana a Toi (the sea of Toi). Spanning the east coast of the North Island from Tauranga Moana to Te Kaha, LiLACS NZ research sites include participation and representation from a number of iwi including Ngāti Ranginui, Ngāi te Rangi, Te Arawa, Ngāti Awa, Te Whakatōhea, Ngāi Tai, Tūwharetoa Ki Kawerau, Tūhoe, and Te Whānau ā Apanui. In Maori society kaumātua have vital leadership roles in their whānau and are often expected to perform duties within the wider whānau and tribal community. They are respected for their age and accumulation of knowledge. Kaumātua are often featured in traditional Māori stories as nurturers of the young and keepers of knowledge that is passed on from one generation to the next. The famous ancestor Māui was rescued and raised by his grandfather Tamanui-ki-te-rangi. He gained knowledge from his kuia (female elder), including the secret knowledge associated with fire. Whaitiri, the grandmother of Tāwhaki and his brother Karihi, is another revered ancestor who taught her grandsons the best way to climb up to the heavens to attain knowledge.

Currently, Māori people make up approximately 14.6% of the total New Zealand population of 4.4 million (Statistics New Zealand 2013), and the Māori population is aging faster than the non-Māori population (Ministry of Health 2011). Life expectancy at birth now lags by about 7 years for Māori, and there is an excess of morbidity related disability for older Māori. About half of the differences observed in the aging of Māori peoples are due to socioeconomic disadvantage (Ministry of Health and University of Otago 2006). Linked New Zealand census and mortality data show that older Māori and Pacific men and women have a higher relative risk of dying than those of European descent. Controlling for socioeconomic factors accounted for only 40% of this difference in mortality (Jatrana and Blakely 2008). Other sources of disadvantage in health may relate to access to health services (Ministry of Health and University of Otago 2006). For this reason investigation of the health and longevity of the very old in New Zealand must include a focus on Māori health.

LiLACS NZ examines the health, social, cultural, and environmental status of Māori and non-Māori in advanced age and identifies health, social, cultural, and environmental predictors of successful advanced aging denoted by quality of life, health-related quality of life, functional independence, maintenance of health, and longevity.

## The Cohort Study

The LiLACS NZ is based on a 1 year birth cohort following the design of the Leiden 85-plus (Poortvliet et al. 2013) and the Newcastle 85+ (Collerton et al. 2009) studies. The age at which 90% are expected to live at least one more year in the New Zealand population is 85 years; however, the need to engage equal numbers of Māori and non-Māori to enable meaningful findings for Māori meant a broadening of the age band to a 10-year age group (80–90 years) for Māori.

The LiLACS NZ study is informed by Kaupapa Māori methods and ideology. Research that is based on a Māori worldview acknowledging the idea that “knowledge is rooted in cultural

contexts.” The ideology offers a counter-hegemonic approach to Western forms of research. It has roots in critical theory and in a similar vein combines transformative practice and structural analysis. Importantly, the research has been guided by Te Rōpū Kaitiaki o Ngā Tikanga Māori [Protectors of Principles of Conduct in Māori research]. This group of Māori elders was responsible for the translation of questions and ensured that practices of engagement and interview processes with Māori participants were appropriate (Dyall et al. 2011; Kēpa et al. 2014).

The cohort study began in 2010 with the identification of all eligible participants (tribal group) and recruitment of those who were interested in participation. Geographical boundaries were identified to be the Bay of Plenty District Health Board regional funding body (DHB) and the Lakes (DHB) (regional funding body excluding the Taupo area) as these were areas with stable populations and strength in Māori cultural activities. Eligibility criteria included living within the geographic boundary and Māori aged 80–90 years, born in 1920–1930, or non-Māori aged 85 years, born in 1925. Overlapping strategies formed the sampling frame. Potential participants were identified from: electoral rolls (general and Māori), primary care and tribal databases, word of mouth, advertising, and whakawhanaungatanga (to establish good relations with people within Māori networks).

Extensive consultation with Māori tribal local groups in the region of the study (Dyall et al. 2011; Dyall and Kerse 2013) led to local organizations being engaged to invite participants and complete assessments. Awareness of the study was raised with newspaper, radio, and television events. Interviewers and nurses were locally based, and the university-based research team provided training, developed the interview and assessment schedule, and supported the interviewers with regular visits and online and telephone contact.

## Recruitment and Retention

Participants were invited by a person known to them, and a personal explanation in the presence

of family (if desired) led to written informed consent for those who participated. Local organizations continued engagement through the cohort study with regular communications, cup of tea events, and the University of Auckland provided yearly feedback and discussions in all regions.

At baseline (Wave 1) 927 completed some form of data collection. At the end of Wave 2 (12 months follow-up), 660 contributed data with 25% attrition. By Wave 3, 137 had died (15% mortality), and 534 completed data collection (84% of survivors). Subsequent attrition was low with 428 completing Wave 4 (36 months follow-up). This represented a further 10% mortality and 91% of survivors from Wave 3 completing data collection.

Wave 1 in the Maori cohort had a response rate of 56%, yielding 421 participants, 176 (42%) were men and 245 (58%) women. At Wave 2, 267 Māori (63%) were interviewed. In the non-Maori cohort, a response rate of 59% yielded 516 participants; 237 (46%) were men and 279 (54%) women. At Wave 2, 393 non-Māori (75%) completed data collection (Dyall et al. 2013).

## Measures

Consent was sought separately for an interview, a health assessment, a blood test, and an access to general practice and hospital records. Trained lay interviewers completed either a brief interview of core questions of a comprehensive interview using standardized techniques. Comprehensive measures were identified, and assessment procedures developed during a feasibility study including questions about participation in cultural activities from focus groups with older Māori (Dyall et al. 2011). Full details are published (Hayman et al. 2012) of the sociodemographic; general health and health-related quality of life; psychological and mental health; functional status and physical function; health behavior and nutrition risk; health services used; culture and cultural practice; social network and social support; activity and pastime; transport; housing and environment; economic, housing,

environmental, and cultural; and politics and respect questions. Trained nurses used standardized techniques to complete a health assessment consisting of anthropometric measures, blood pressure lying and standing, spirometry, and an electrocardiogram.

Assessments were planned yearly to 5 years follow-up to repeat health, health-related quality of life, and functional measures. Administrative data on hospitalizations and mortality were accessed for those that gave consent to this component yearly, based on the National Health Index of participants, an individual identification number. A blood sample was taken for biochemical analysis.

At Wave 2, in addition to the comprehensive interview and health assessment, a detailed 24 h multiple pass recall nutritional assessment (Adamson et al. 2009) was completed on two different days. The remainder of the yearly assessments for participants focused on function and health. During Wave 3 a series of questions about expectations and wishes at the end of life were added, and a main caregiver was nominated by the participant and, if agreeable, was interviewed about amount, type, and attitude to caregiving. Bereavement interviews were offered to the family of those who passed away.

## Health Status

Despite difference in socioeconomic status and education between the ethnic groups, self-rated health did not differ. Self-rated health was rated as excellent or very good by 24% of Māori and 23% of non-Māori in advanced age. Falls had occurred for 34% of Māori and 40% of non-Māori (not significant when adjusted for age). A median of five chronic conditions were observed for Māori and non-Māori. Cardiovascular disease was present in 67%.

Disparities in the prevalence of chronic conditions were present with non-Māori being less likely to have congestive heart failure (odds ratio (OR) 0.58, 95% confidence interval (CI) 0.41–0.82), and atrial fibrillation on ECG [OR (95% CI) 0.56 (0.32–0.96)] and diabetes [30% of

Māori, 16% of non-Māori, OR (95% CI) 0.53 (0.36–0.78)]. Non-Māori were also less likely to have dementia [OR (95% CI) 0.59 (0.37–0.95)]. Around one-quarter of the LiLACS NZ sample had depression with the lowest prevalence observed in Māori men (22%) and highest in Māori women (30%) and 23% and 26% in non-Māori men and women, respectively. Eye disease, established by self-report, was very prevalent with non-Māori being more likely to have eye disease (66%) than Māori (48%) [OR (95% CI) 1.62 (1.17–2.25)].

A median of five (range 0–18) medications was taken by Māori and non-Māori. Gait speed was observed to be on average 0.8 m/s for non-Māori and 0.7 m/s for Māori. A gait speed of less than 0.8 m/s is considered to highlight significant risk from poor health outcomes (Abellan Van Kan et al. 2009a, b). Hospitalization had occurred in the 12 months prior to the first interview in 40% of Māori and 35% of non-Māori.

Overall self-rated health was good considering that comorbidities were common, and Māori were resilient to greater socioeconomic disparity as self-rated health was equivalent between the ethnic groups.

## Ongoing Analysis

Analyses of factors associated with change in function over time, description of management of common conditions, and prediction of cardiovascular outcomes related to that management are ongoing. Predictors of high functional status, community living (in comparison to admission to residential aged care), and mortality are ongoing. Nutritional intake will be described in terms of macro- and micronutrients and the food groups contributing to intake. Change in physical performance will be related to protein intake and cardiovascular outcomes related to salt and fat intake.

Analysis of end of life wishes and carers' contribution to the lives of those in advanced age will follow.

## Future Directions

The cohort study inception to Wave 3 was funded by the New Zealand Health Research Council, and funding for 2014–2016 was from the New Zealand Ministry of Health. This will complete 5 years of follow-up. The contribution of nutritional intake and health status to ongoing function and quality of life will be a major focus of ongoing analyses. Identification of ethnic disparities and factors showing resilience to these disparities will contribute to the Māori focus.

Widespread dissemination and consultation with the communities engaged in the research will inform development of local solutions to issues identified as well as interventions to improve quality of life in advanced age for Māori and non-Māori.

## Cross-References

- ▶ [Aging, Inequalities, and Health](#)
- ▶ [Aging and Psychological Well-Being](#)
- ▶ [Aging and Quality of Life](#)
- ▶ [Disability and Ageing](#)
- ▶ [End of Life Care](#)
- ▶ [Mental Health and Aging](#)
- ▶ [Social Connectedness and Health](#)

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## Life Events and Older People

Yvonne Wells

La Trobe University, Melbourne, VIC, Australia

### Synonyms

Developmental trigger; Incident; Milestone; Occurrence; Stressor; Transition

### Definition

A life event is commonly understood as a very important occasion or experience in someone's life, such as marriage, the birth of a child, or the death of a family member. George (2001) defined life events as “identifiable, discrete changes in life patterns that create stress and can lead to illness onset or the exacerbation of pre-existing illness” and pointed out that the life events perspective is compatible with the view that aging is defined largely by the losses that older people experience. More recently, life events have been incorporated into the life course perspective and understood as developmental triggers with positive, as well as negative, effects. However, any changes to one's circumstances, positive or negative, require a process of adjustment.

Studies have shown that life events at any stage in life may have an impact on wellbeing in later life. However, the focus here is on life events experienced in late adulthood.

### Related Concepts

The concept of life events is related to that of transitions, which are discontinuities in a person's life space and often preceded by a life event; for example, changing one's marital status from married to single may be preceded by divorce or widowhood. Transitions are often seen as occurring at specified times in the life course, whereas life events can potentially occur at any time. Another related concept is that of milestones:

events identified with the completion of one life stage and moving on to the next.

The impacts of life events and transitions on stress levels and illness have been studied extensively. Two broad approaches to conceptualizing life stress have been identified; the first approach sees life stressors as major, taxing life events that create change and require substantial adaptation. On the other hand, relatively minor events have been identified as equally important for understanding how much stress people experience. Hassles are “the irritating, frustrating, distressing demands and troubled relationships that plague us day in and day out” (Lazarus and DeLongis 1983), while uplifts are minor positive experiences: the pleasures and rewards of everyday life.

### Taxonomy

Life events may be unexpected or anticipated. A serious car accident, for example, is an unexpected life event, whereas retirement is usually anticipated and often well planned. Both anticipated and unexpected life events may be experienced positively or negatively, and this experience depends on both the circumstances of the event and how the individual interprets and copes with the event.

Similarly, life events and transitions may be normative or not. Some transitions are normative because they are linked with one’s age: graduation from secondary school and retirement, for example. Some are linked with one’s position in history and so are normative for the cohort with similar experiences: for example, life events associated with conscription to the armed forces, sweeping economic or technological changes, major epidemics, or natural disasters. On the other hand, life events may be non-normative; winning the lottery and being the victim of a random burglary are both non-normative life events. (However, neither may be entirely unexpected, depending on the circumstances.)

### What Life Events Do Older People Experience?

Later life is characterized by some relatively common life events. Retirement is sometimes seen as

the defining transition to later life. Health events are common, and aging is frequently depicted as synonymous with the onset of poor health and disability. However, individuals may age successfully with few health problems or disabilities, and many people deal effectively with particular events or difficulties while others with similar difficulties become functionally impaired.

Seematter-Bagnoud and colleagues interviewed a large number of young-old men and women (aged 65–70 years) using a geriatric adverse life events scale (Seematter-Bagnoud et al. 2010). They found that three-quarters (72%) of participants had experienced at least one adverse life event during the preceding year. Common events included the death of a friend or nonprimary relative (18% of men and 20% of women) and new major physical illness (17% of men and 19% of women).

Studies have documented consistent differences in life events listed by younger and older adults. In comparison with younger adults, older adults report fewer stressors (and especially fewer traumatic events such as physical and sexual assaults), less heterogeneous sources of stress, and lower impacts of stress on daily life. Younger adults are more likely to experience “tragic” deaths, while older adults are more likely to report deaths resulting from physical illness. As well as recent life events, people in later life may be influenced by the long-term impacts of events that occurred earlier in life, both in childhood and in earlier adulthood.

### Consequences of Life Events

Many life events involve changed life circumstances and demand a process of adjustment that may impact on various aspects of a person’s functioning. Studies have focused on a range of outcomes, including physical health, health behaviors, social networks, and memory functioning, as well as depression, anxiety, and feeling stressed.

Some life events are intrinsically more difficult to cope with than others; health and interpersonal events are rated as more severe than financial or

work events. The way in which events are viewed, or appraised, is also critical to how much stress they cause. Lazarus and colleagues defined primary appraisal as the personal significance of the encounter – “How much is at stake?” – whereas secondary appraisal refers to the individual’s assessment of what resources they bring to their situation (Lazarus and DeLongis 1983).

Hatch and Dohrenwend (2007) argued that at least six dimensions determine the nature and extent of the impact of life events: their source (i.e., whether arising from external events in the environment or from the individual’s own actions and behaviors), their valence (positive or negative), their magnitude (the amount of change in usual activities), their centrality (from threat to life at one extreme to threat to social goals at the other), and whether they induce physical exhaustion.

Stressful life events have consistently been shown to be associated with adverse mental and physical health outcomes in adults of all ages. Depression has received the most research attention; the occurrence of any negative life event during the previous 2 years is associated with developing symptoms of depression. Among older adults, the most salient life events for risk of depression in late life are personal illness, bereavement, and theft.

Other mental health problems have been linked with life events. Negative life events are a risk factor for developing late life psychosis, for example. Cognition may also be affected: memory problems in older adults are associated with daily stressors, particularly among individuals who are anxious.

An interesting phenomenon is that stress can “spill over” from one domain to others. This suggests that experiencing one stressful event can cause higher emotional reactivity to other events occurring shortly afterwards. Stress may also accumulate. Symptoms of depression are associated with exposure to many negative life events during adulthood and late adulthood; at particularly high risk are those who have also experienced negative life events during childhood. However, dealing with adversity may also strengthen an individual’s

resilience, as is shown by studies of Holocaust survivors in later life.

## Life Events and Aging

Both increases and decreases in emotional reactivity to life events with increasing age have been reported in the literature. Low reactivity to life events and daily hassles may reflect self-regulation and the capacity to deal with challenges of day-to-day life; older adults seem to benefit from lifelong learning in coping with daily stressors. On the other hand, older adults are more likely than younger ones to experience physiological limitations in their capacity to deal with stress (such as high blood pressure).

Several studies have shown that older adults may be better at dealing with stressful life events than younger ones. In comparison with younger adults, older adults report fewer stressors and hassles overall and lower impacts of stress on daily routines. The incidence of a serious health event causes larger changes in life satisfaction in middle-aged adults than it does in older adults, perhaps because health events are more normative for older than younger adults. More generally, emotional stability in response to life events tends to increase along the life span. In addition to the benefits of maturity, having a positive view of aging (i.e., seeing older age as a time of ongoing development) has a beneficial effect on health and life satisfaction, even in the presence of a serious health event.

The following sections address one-at-a-time life events experienced by older people.

### Retirement

Role theory predicts that the loss of a valued social role – bread-winner, worker, or employee – will have negative impacts on people’s health and wellbeing and increase the risk of mortality. Some studies have found that early retirement increases the risk of poor health and mortality. However, an issue with many of these studies is that poor health may have prompted the decision to retire in the first place.

It is now recognized that the transition to retirement is positive for many people. Retirement affords an opportunity for people to reassess their health behaviors, and individuals often increase their physical activity over the retirement transition. The European SHARE study found that retirement leads to improvements in both self-rated health and objective health indicators, as well as psychological wellbeing. Similarly, the prestigious Whitehall study found improved mental health among those who retire, especially in higher status groups, but worsening mental health among those who continue to work (Mein et al. 2003).

The impacts of retirement on emotional wellbeing depend on a range of objective circumstances and reasons for retirement. People who retire for “push” reasons, such as poor health or inability to respond to changing workplace demands, experience poorer emotional wellbeing over the retirement transition than those who retire for positive (“pull”) reasons, such as because their spouse has retired or to take up opportunities to travel.

Being compulsorily retired is usually experienced negatively, whether anticipated or not, whereas having control over the timing and nature of retirement usually leads to positive consequences for the individual and is more important than whether retirement is sudden or gradual (de Vaus et al. 2007). Retirement planning may assist people to deal with this transition prospectively.

### Relocation

Relocation may occur several times during later life. People may move to retirement housing, downsize to smaller quarters to reduce the burden of property upkeep, move to a different community to live closer to family members, or relocate to residential care because of physical frailty or dementia. Primary reasons for moving to retirement housing include avoiding home upkeep and anticipating future needs for support. One of the most often cited theoretical perspectives on relocation is the retirement–migration model (Wiseman 1980), a two-stage model of migration decision-making that proposes that the decision to

move and the decision where to move are influenced by different considerations.

Some studies have reported significant increases in engagement in social activities and higher quality of life in groups of older people who have relocated to retirement housing or to long-term care. Moving to age-specific housing may also increase people’s feelings of control. Many people who move are glad they made the decision to move and satisfaction with this decision may increase over time. Advantages of moving include an easier lifestyle and more time for social activities, whereas disadvantages include constraints imposed by living in a congregate housing setting.

Prominent risk factors in relocation to a nursing facility include poor health, functional or cognitive impairment, low socioeconomic status, living alone, having no children living nearby, and feeling lonely. Potential negative impacts of relocation to a care facility may be eased by minimizing stress associated with the move and by assisting the older person to retain a sense of control.

Especially for older people who have memory loss, a move away from familiar surroundings may intensify confusion and dependence on others and lead to frustration. The decision to relocate to residential care and the subsequent adjustment period is a difficult time for people with dementia (and their family caregivers). Admission has been linked to increased behavioral symptoms in people with dementia: in particular, depression and agitation, decreasing cognition, frailty, and falls.

However, many older people are able to adjust positively to relocation and to develop new relationships. A qualitative study of older women who had relocated to an apartment complex found that they developed four types of relationships with different functions: for feelings of security, for casual interactions, for opportunities to be supportive, and for friendship (Dupuis-Blanchard et al. 2009).

The extent to which people benefit from relocation may depend on their own and others’ efforts to integrate into the destination locality. In contrast, older people are at risk for poor

relocation outcomes if, prior to moving, they have low self-esteem, symptoms of depression, or low quality of life.

### **Widowhood**

Bereavement is one of the most common life events for an older person and affects many aspects of life. The well-known 43-item Holmes and Rahe scale of life events (Holmes and Rahe 1967) places the death of a spouse at the top of the list, with 100 for the degree of adjustment required, compared with 45 for retirement and 20 for a change in residence.

Widowhood has pervasive impacts on all aspects of an individual's life. Older people may experience a decline in their own health after the death of a close family member or friend, and being newly widowed is a risk for symptoms of depression. Widowhood may also entail reduced economic security, especially for women and those from ethnic minority groups.

The death of a spouse increases the risk of mortality, but differently for men and women. In the 2 years after death of a wife, the mortality rate in men tends to increase, especially if the wife's death was unexpected; for women, the impacts of widowhood are less clear and generally less severe.

Widowhood has a negative impact on the size of people's social networks and older widow(er)s may experience decreases in social interaction and companionship. Loneliness is higher in older widowed than partnered people; some studies have shown that loneliness explains the excess risk of depression in widowed people. However, social networks established before widowhood do not necessarily buffer the negative impacts of widowhood.

Studies on impacts of widowhood among migrant groups and ethnic minority groups suggest that detrimental impacts of widowhood on wellbeing may be greater among those who are aging outside their country of origin and who have retained the linguistic, cultural, and religious practices and traditions of their home country.

While most studies have focused on negative impacts of widowhood, some have shown few

differences between married women and their widowed counterparts. For example, widowhood is not associated with changes in physical activity and does not predict whether or not older people are classified as aging healthily.

Qualitative studies have documented positive outcomes associated with widowhood, such as opening up opportunities for a new life phase. Adaptation to the death of a spouse is facilitated by engagement in familiar, meaningful occupations and experiencing positive emotions associated with everyday activities and contact with other people.

### **Health Events**

Physical ill health is a strong predictor of emotional ill health in all age groups. In older people, frailty is a dynamic process, characterized by frequent transitions between frailty states over time. Having a stroke and diseases such as diabetes, cancer, and respiratory system disease comprehensively impact on all dimensions of successful aging. However, studies have shown that individuals' perceptions of health – subjective health – have a stronger influence on emotional wellbeing than objective health indicators such as number of health conditions.

Hospitalization has been described as a “sentinel event” whose impacts may be particularly poor. Bed rest is known to cause loss of muscle strength in healthy older adults and patients spend most time in hospital lying in bed, even those who are able to walk independently. Identified predictors of functional decline in an acute hospital setting include age, low functional status on admission, cognitive impairment, and depression, as well as length of hospital stay.

As with other life events, psychological processes may buffer negative impacts of health events on wellbeing. The best self-protective strategy to use depends on whether the health condition is acute or chronic; persistent engagement with goals works well for people whose condition is acute, whereas two alternative strategies – disengagement through downgrading expectations and self-protection through positive reappraisal – are likely to work better for people with chronic health conditions.

## Spouse Caregiving

While people may be required to take on family caregiving in middle age and even earlier, most family caregivers are older people; this is particularly true for spousal caregiving, which often precedes widowhood.

Becoming a family caregiver is a relatively common transition in later life. In a longitudinal study of people aged 65 years and over, Burton and colleagues (2003) found that only half of noncaregivers at baseline remained noncaregivers at 5-year follow-up. The remainder experienced one or more transitions, including moving into the caregiving role, their own or their spouse's death, or placement of their spouse in a long-term care facility.

The trajectory of health and wellbeing outcomes associated with caregiving is generally downward. Those who transition to heavy caregiving have poorer self-reported health and health behaviors than those who do not. Results of many studies have confirmed that the transition to caregiving for primary kin (i.e., a child, spouse, or biological parent) is associated with an increase in symptoms of depression. The impacts of caregiving for someone with dementia are particularly deleterious, and the probability that caregiving will be relinquished and the care-recipient placed in residential care within a few years is high.

However, caregiving may also be associated with beneficial effects, such as greater purpose in life. Uplifts, rewards, and satisfactions of caregiving have all been documented. Such satisfactions include feelings of pride, improved self-worth, greater closeness in relationships, and enhanced sense of meaning and pleasure in life.

Finding positive meaning in caregiving can buffer its negative impacts. Qualitative studies have also identified a range of feelings about caregiving and shown how these may impact on outcomes. Some caregivers express no positives in caregiving, focus largely on their own unmet needs, and report high burden. In contrast, others describe both their past and present relationship with the care-recipient in loving terms, express satisfaction with their caregiving, and report low burden.

People transition out of the caregiving role when the person they care for dies or is admitted to residential care. Some studies have shown continuing negative impacts after placing a spouse in a nursing home, including high blood pressure and anxiety and depression. In contrast, bereavement may be accompanied by positive changes for people who have been caregiving. Documented positive changes among people who have relinquished caregiving or are widowed caregivers (especially those who previously cared for people with dementia) include personal growth, improved psychological wellbeing, and greater participation in social activities.

Buffers to caregiving stress have been identified. For example, getting social support is important; for spouse caregiving, the quality rather than the quantity of support is critical. Motivations for providing care are also important. Some studies have contrasted caregiving from love and loyalty with caregiving from a sense of duty. Other researchers have described motivations to care as either autonomous (volitional) or externally controlled (introjected). People experience autonomy when they perceive their behavior to be voluntary rather than driven by external controls. Being able to articulate benefits in providing care to a spouse is associated with having autonomous motives to care. On the other hand, high depression in caregivers is associated with caring from a sense of duty and having little choice.

## Moderators

As noted above, the impacts of life events and transitions vary a great deal between individuals. Studies on life events and transitions have identified specific moderators of the impacts of stressful life events on outcomes. Moderators that assist people to adapt positively are called buffers.

## Gender and Demographic Variables

The influence of age on reactivity to life stressors has already been discussed above. In general, older people react in less extreme ways to life events than do younger ones.

The influence of gender on both the life events experienced and the severity of outcomes depends on the event. Some literature shows both more significant life events for older women than older men and greater impacts of similar events on women than men. Women report events as more upsetting than men do and take longer to get over their effects. For example, studies have consistently documented that women in caregiving roles report more symptoms of stress and depression than men. In contrast, in response to some life events, women report higher levels of positive emotion than men: this is true of both retirement and widowhood.

Cultural differences also influence how life events are appraised and experienced in later life. The role of cultural beliefs in how illness and family caregiving are understood and experienced is well-established. For example, the notion of filial piety is much stronger in some cultures than others. Understanding dementia and cognitive impairment presents particular difficulties for people from cultures where dementia is not differentiated from mental illness and carries stigma.

### **Psychological Factors: Personality, Appraisal, Coping Strategies, and Social Support**

The individual's personality can influence how much impact life events have. For example, it has been demonstrated that life events and hassles have stronger impacts on memory function in people with high emotionality. On the other hand, focusing on positive emotions appears to have a protective effect against stress. In widows high in trait resilience, feeling positive emotions contributes to effective emotional recovery.

Having high quality social supports promotes resilience in the face of both major life events and daily stressors. Individuals with low levels of social connectivity are more likely to have difficulty regulating the emotional intensity of negative emotions, once triggered.

Many studies have focused on coping strategies used in response to life events and daily stressors. These strategies are commonly divided into emotion-focused strategies, such as ignoring, escapism, and wishful thinking, and problem-focused

strategies, such as cognitive restructuring, seeking information, and negotiation. Similar terms used in the literature are avoidance versus approach coping strategies. Middle-aged and older adults who rely on approach coping strategies rather than avoidance coping strategies are more likely to report some benefit from encountering life events, while avoidance coping is associated with developing depression and drinking problems. An integrative literature review (Cotter and Gonzalez 2009) on older adults' self-concept in the face of normative age-related bodily and functional declines and numerous social changes, as well as life events, identified a range of successful coping strategies, including religiosity, positive attitudes to aging, and preserving continuity of both self-image and social networks.

### **How Can Older People Who Experience Adverse Life Events Be Helped?**

Several strategies have proven useful to promote emotional wellbeing in older people, whether living in the community or in residential care. Many can be adapted to assist people with dementia or mild cognitive impairment.

*Exercise:* Several good quality studies and reviews have demonstrated the benefits of exercise on depression and emotional wellbeing more generally in older people. Short-term benefits are well documented but the evidence on longer term outcomes is less clear. Exercise has also been shown to reduce the risk of developing anxiety and depression and to reduce agitation in people with dementia living in residential care.

*Music:* Music therapy and singing have been shown to improve psychosocial wellbeing in a variety of settings and with a variety of people, including those with dementia. Interventions that involve the use of music are also helpful in alleviating symptoms of anxiety and depression and improving quality of life. More informally, music is used by older people as a source of entertainment as well as a forum for sharing and interacting with others. Music is easily personalized to the individual and devices to play recorded music are now portable and inexpensive.

*Behavioral activation:* Behavioral activation, or behavior therapy, focuses on increasing a person's level of activity and pleasure in life, rather than changing the person's beliefs and activities. Behavioral activation can be carried out with individuals or groups. An informal form of behavioral activation is to include a range of enjoyable events in a person's daily routine, such as bus trips and outings, social events, religious activities, board games, and special meals. Behavioral activation can be an effective therapy for depression and low mood. It has also been used to reduce depression, stress, and cardiovascular risk in older caregivers of family members with dementia.

*Life review:* Reminiscence is a general term covering a range of interventions that involve thinking or telling someone about past experiences that are personally significant. Three kinds of reminiscence can be distinguished: simple reminiscence, life review, and life review therapy. Simple reminiscence involves simply describing past events, whereas life review focuses on the re-evaluation of life events to form a coherent life story. Life review can improve emotional wellbeing and reduce symptoms of depression in people living in the community or residential care, and there is emerging evidence that it may be used successfully with people living with dementia, relying on prompts such as photograph albums, scented objects, and music.

*Life review therapy:* One of the best-supported therapies used by health professionals is life review therapy. Therapies based on reminiscence have been shown to be effective as a way of adapting to critical life events and chronic medical conditions in older adults with mild to moderate symptoms of depression. Cappeliez and O'Rourke (2006) developed a taxonomy of reminiscence functions: positive functions such as supporting identity, problem-solving, and preparation for death; negative functions such as reliving feelings of bitterness, reducing boredom by romanticizing the past, and maintaining intimacy with previous relationships, often with people who are deceased; and prosocial functions, such as teaching and informing others and using memories to promote conversations in order to connect or reconnect with others. It has been

suggested therapists focus on techniques that reduce bitterness revival in people with depressive symptoms and problem-solving reminiscence for people with symptoms of anxiety.

*Other therapies:* Cognitive behavior therapy (CBT) involves working with a therapist to look at patterns of cognition and behavior that predispose them to experience problems with anxiety or depression or are keeping them from improving once they become anxious or depressed. Once these patterns are recognized, the person can make changes to replace these patterns with ones that reduce their symptoms, promote positive mood, and improve coping. CBT can be conducted with individuals or in group settings. CBT has been tested in well-designed studies and found to be effective for older adults with anxiety and depression. It can be used effectively in both residential care and community settings and with family caregivers.

A range of therapies have grown out of CBT. For example, behavior therapy focuses on specific learnt behaviors and how the environment has an impact on those behaviors. Acceptance and commitment therapy (ACT) is another variation on CBT. Rather than teaching people how to change their thinking and behavior, ACT teaches them to notice and accept their thoughts and feelings. In this respect, ACT is similar to mindfulness-based approaches. There is limited evidence to support the use of ACT with older adults.

Mindfulness-based stress reduction and mindfulness-based cognitive therapy both rely on mindfulness – a type of meditation that teaches people to focus on the present moment and to notice pleasant and unpleasant experiences without trying to change them. Both approaches have been used successfully with older people, including those with mild cognitive decline.

## Summary

Later life is a period characterized by a range of relatively severe life events, including widowhood and other bereavements, loss of social roles, and the development of frailty and risk of

hospitalization (Seematter-Bagnoud et al. 2010). Some older people take on inherently stressful roles, such as being a family caregiver for a person with dementia. However, many older people appear to cope well with the life events and transitions they encounter. Important factors include the degree of control that can be exerted over the life event, personality traits such as having an optimistic and positive focus, and a range of coping strategies, including reappraisal and seeking social support. Older people who are at risk of poor emotional wellbeing may be assisted by a range of simple pleasurable activities (such as enjoying music and exercise) and interventions provided by mental health professionals.

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## Life Management Through Selection, Optimization, and Compensation

Alexandra M. Freund<sup>1,2</sup>, Christopher M. Napolitano<sup>1</sup> and Michaela Knecht<sup>1,2</sup>

<sup>1</sup>Department of Psychology, University of Zurich, Zurich, Switzerland

<sup>2</sup>University Research Priority Program Dynamics of Healthy Aging, University of Zurich, Zurich, Switzerland

## Synonyms

Life management, self-regulation; Successful aging, positive aging

## Definitions

- Life management: An action-theoretical construct encompassing the active shaping of one's environment as well as reactive adaptation to a changing environment across the life span
- Elective selection: Development, delineation, and commitment to a subset of alternative goals
- Loss-based selection: Selection that occurs in response to a loss in goal-relevant means
- Optimization: Acquisition and investment of means in the service of achieving higher levels of performance

- Compensation: Substitution or intensification in the use of means after experiencing a loss in goal-relevant means

How do people manage their lives? How do they actively shape their development well into old age while, at the same time, reacting to the changing environment? The model of selection, optimization, and compensation (SOC) proposes that three distinct yet interrelated processes are central for life management: selection, optimization, and compensation (Baltes and Baltes 1990).

This entry takes a life span perspective on aging and as such is based on the idea that because development spans the entire life span from conception to death, aging does not start when entering old age. Instead, aging can be conceived of as a lifelong process. Experiences and life choices accumulate across the life span and shape people into the older person they will be. Thus, a full understanding of aging requires investigating how people manage their lives throughout the life span. What choices do they make? How do they acquire and maintain resources that help them to achieve their goals and maintain a level of functioning that allows them to lead their lives according to their wishes and standards? Thus, after giving a general introduction into the SOC model, this entry is concerned with the development of SOC through adolescence, the use and usefulness of SOC throughout adulthood, and finally the importance of SOC in old age.

### **The Life Management Strategies of Selection, Optimization, and Compensation**

Life span psychology conceptualizes development throughout the entire life span as encompassing gains and losses as well as stability and change. The ratio of gains to losses in resources, however, changes with age. Whereas gains are predominant at younger phases of the life span, aging adults are more and more

confronted with losses (e.g., Baltes et al. 2006). Thus, a developmental theory of life management needs to address how people achieve gains, manage losses, and maintain stability in their functioning in a changing environment and an increasingly negative ratio of gains and losses. The SOC model was first introduced by Paul and Margret Baltes (Baltes and Baltes 1990; Baltes 1997) as a meta-model of general developmental processes operating on different levels of analysis (e.g., individual, society) and applicable to different domains of functioning (e.g., cognition, motivation). The SOC model takes an action-theoretical perspective and posits that the role of a person in his or her development is not only to react to a changing environment of social, cultural, and biological constraints and opportunity structures but also to create the environment that best fits the personal preferences and goals. More specifically, the SOC model holds that the *selection* of goals (or developmental pathways), the *optimization* of functioning through acquiring and refining resources and skills, and the maintenance of functioning in the face of loss or decline through *compensation* are central processes of developmental regulation. These processes are described in more detail below.

*Selection* involves specifying a pathway of development by narrowing down of a range of alternatives within the scope of biologically and culturally defined constraints. Selection concentrates resources on a subset of goals and thereby contributes to specification and differentiation, constituting a basis for the acquisition of new resources and skills. In the SOC model, selection can occur either electively (choosing to jog for fitness; termed “elective selection”) or after losses (e.g., disengaging from jogging after injury and instead pursuing swimming; termed “loss-based selection”).

*Optimization* entails acquiring and investing resources into achieving higher levels of functioning in the selected developmental pathways. Resources can be defined as means that help to achieve one’s goals. Thus, what constitutes a resource depends on the goal and context.

**Life Management Through Selection, Optimization, and Compensation, Table 1** Typical instances of elective selection, optimization, compensation, and loss-based selection for an older adult

Instance	Example
<i>Elective selection</i>	
Specification of goals	Setting the goal of regular weight training to address declines in bone density
Goal system (hierarchy)	Prioritizing weight training exercises over cardiovascular exercises
Goal commitment	Pledging to engage in weight training exercises at least three times a week
<i>Optimization</i>	
Acquiring new skills/resources	Learning the correct form for weight training exercises
Persistence	Engaging in weight training three times a week, as planned
Modeling successful others	Watching weight training videos or hiring a weight training instructor for guidance
<i>Compensation</i>	
Substitution of means	Focusing on leg-based weight training after injury to shoulder
Use of therapeutic intervention	Visiting a physical therapist to address the shoulder injury
Use of external aids/help of others	Wearing a shoulder brace when returning to weight training
<i>Loss-based selection</i>	
Focusing on most important goals	Focusing on overall fitness and well-being after repeated shoulder setbacks
Reconstruction of goal hierarchy	Prioritizing cardiovascular exercises and calcium supplements over weight training
Adaptation of standards	Contenting oneself with light weekly weight training instead of lifting weights three times a week after repeated overuse injuries

*Compensation* refers to managing impending or actual losses in functioning by intensifying the investment of available resources or by substituting resources that are no longer available. Consistent with optimization, compensation entails acquiring and investing resources, but in contrast, compensation is instead focused on maintaining functioning in the face of losses.

**Life Management Through Selection, Optimization, and Compensation, Table 2** Sample items of the SOC questionnaire: each item consists of the description of behavior indicative of selection, optimization, or compensation paired with a description of an alternative, non-SOC behavior. Participants are asked to choose between these two options. Research has shown that this particular format decreases the effects of social desirability and contributes to more balanced item difficulty (see Freund and Baltes (2002) for more information on the questionnaire)

SOC-related (“target”) behavior	Alternative behavior
<i>Elective selection</i>	
I always pursue goals one after the other	I always pursue many goals at once, so I easily get bogged down
I know exactly what I want and what I don’t want	I often only know what I want as the result of a situation
When I decide on a goal, I stick to it	I can change a goal again at any time
<i>Loss-based selection</i>	
When things don’t go as well as before, I drop some goals to concentrate on the more important ones	When things don’t go as well as before, I wait for better times
When something gets increasingly difficult for me, I define my goals more precisely	When something gets increasingly difficult for me, I try to distract myself
When something gets increasingly difficult for me, I consider which goals I could achieve under the circumstances	When something gets increasingly difficult for me, I accept it
<i>Optimization</i>	
I think about exactly how I can best realize my plans	I don’t think long about how to realize my plans, I just try to
When something is important to me, I don’t let setbacks discourage me	Setbacks show me that I should turn to something else
I make every effort to achieve a given goal	I prefer to wait for a while and see if things will work out by themselves
<i>Compensation</i>	
When things don’t go as well as they used to, I keep trying other ways until I can achieve the same result I used to	When things don’t go as well as they used to, I accept it
When something in my life isn’t working as well	When something in my life isn’t working as well as it used to, I decide what

(continued)

**Life Management Through Selection, Optimization, and Compensation, Table 2** (continued)

SOC-related (“target”) behavior	Alternative behavior
as it used to, I ask others for help or advice	to do about it myself, without involving other people
When it gets harder for me to get the same results I used to, I keep trying harder until I can do it as well as before	When it gets harder for me to get the same results I used to, it is time to let go of that expectation

For examples of selection, optimization, and compensation processes in the health domain (an important goal domain for older adults), see Table 1; for examples of questionnaire items that are typically used to measure selection, optimization, and compensation processes, see Table 2.

Although the selection, optimization, and compensation can be considered individual processes of developmental regulation, they need to be coordinated over time in order to successfully manage gains and losses over the life span. In fact, most developmental processes entail all three components. For instance, older adult osteoarthritis patients have to been shown to restrict their activities (loss-based selection), practice certain movements (optimization), and use aids (e.g., a walking aid; compensation) in order to manage their condition (Gignac et al. 2002).

From this perspective, goals can be considered building blocks of development. Goals are states a person (personal goals) or group (social expectations or cultural values) deems desirable or undesirable, as well as the means to achieve (or avoid) them. They organize and structure behavior over time and across situations into hierarchical action sequences of setting and pursuing goals (Freund and Riediger 2006). In line with this approach, the SOC model posits that developing and committing to a set of personal goals (elective selection) and engaging in goal-directed actions and means (optimization) contributes to achieving higher levels of functioning. Intensifying or substituting means in order to maintain a goal in the face of loss in goal-relevant means (compensation) or reconsidering and reconstructing one’s goals or adapting goal standards (loss-based selection)

contributes to managing losses and maintaining functioning.

For instance, social expectations are not restricted to the content of goals (e.g., founding a family in young adulthood) but also include the process of selecting these goals (e.g., the “right” way of finding a partner). Social expectations can directly influence behavior and also which goals a person selects and pursues at a certain age (Freund 2007). Social expectations channel goal selection and pursuit into certain paths, but they also often indicate the availability of resources to pursue and achieve them. For instance, the expectation to retire from work at a certain age is in most industrialized western societies accompanied by laws and regulations that provide a pension securing a certain standard of living when stopping to work at a specified age. In this way, setting and pursuing goals in line with social expectations can foster development. However, the SOC model holds that goals are not only determined by social expectations but also by individual values, preferences, motives, as well as skills and internal and external resources available to the individual. These individual characteristics lead to variability in the content and timing of personal goals and in the way people pursue them. However, despite the variations in the expressions of goal setting and pursuit, the SOC model maintains that the processes of selection, optimization, and compensation are general across different societal and cultural contexts and individuals. The following section describes how SOC develops and contributes to successful development across the life span, with a focus on old age.

## SOC in Adolescence

Understanding intra- and interindividual changes in the orientation toward growth, maintenance, or loss minimization across the life span is necessary for the study of self-regulation at any one period. In other words, a person’s behavior or development during any one period cannot be properly understood outside of the context of their preceding or proceeding periods. Therefore, to contextualize the development of the use of SOC

processes in old age, we must first understand the development of SOC processes at earlier periods in the life span. For these reasons, theoretical and empirical work on the SOC model has recently extended into adolescence young adulthood.

The majority of this work has been conducted through the 4-H Study of Positive Youth Development, a multiyear longitudinal study conducted in the United States (e.g., Bowers et al. 2010). Comprised of data from over 7,000 youth from over 40 states collected roughly annually for 9 years, the 4-H Study assessed predictors of thriving in adolescence, including self-reported levels of SOC behaviors. In general, this research has produced three key findings. First, evidence suggests that selection, optimization, and compensation processes are not well differentiated in early adolescence (Gestsdóttir and Lerner 2007). In other words, youth aged 10–11 years report, on average, that they either consistently use or do not use selection, optimization, and compensation in their goal pursuits. Selection, optimization, and compensation processes only seem to typically differentiate (that is, adolescents can be strong in one, but weak in the other) from age 12.

A second key finding indicates that across adolescence, greater use of SOC behaviors is associated with adaptive functioning across a variety of domains (e.g., academic, general life satisfaction). After differentiation, self-reported levels of optimization and compensation, in particular, seem to be strongly associated with positive outcomes. These results have informed a variety of interventions that aim to promote the development of SOC processes in adolescence through mentoring services or youth groups.

Third, some work suggests that there are age-specific variations in adaptive use of SOC processes among adolescents. Compared to older adulthood, adolescence is a period of marked developmental plasticity, where myriad trajectories or outcomes are possible. In this light, it may be less adaptive for some to make highly selective, focused investments in a small number of goals. In this way, low levels of elective selection may result in some adolescents' greater benefit, allowing them exploring a diverse range of potential developmental potentialities (Napolitano

et al. 2011). Conversely, high levels of elective selection in some youth could result in their foreclosing on potential opportunities. Future work on the development of SOC in adolescence will need to focus on identifying the particular constellations of SOC processes that are most adaptive for youth in a diverse range of contexts.

## SOC in Young and Middle Adulthood

During adulthood, the two life domains of work and family are pivotal (e.g., Wiese et al. 2000, 2002). Most young adults invest a great deal of time and effort into building their professional careers and, at the same time, into establishing a stable partnership and raising children. These life domains can be highly demanding well into middle age and neither of them can be postponed into older adulthood. Not surprisingly given the many demands middle-aged adults face, the self-reported frequency of implementing SOC strategies is highest in middle adulthood compared to younger or older adulthood (Freund and Baltes 2002). Given these increasing demands, it is not surprising that the use of SOC strategies helps to manage the simultaneous demands of work and family and contribute to successful development in middle adulthood (Wiese et al. 2000, 2002). More specifically, over the period of 2 years, use of SOC strategies did not only predict increases in general subjective well-being but also an increase in subjective success in the work domain and job satisfaction. Put differently, adults who develop a clear set of goals and build a goal hierarchy (selection), who acquire and invest goal-relevant means into the pursuit of the selected goals (optimization), and who substitute goal-relevant means that are no longer available or increase their efforts after a loss (compensation) also show higher levels of subjective developmental success over time.

There is evidence that the SOC is especially beneficial when demands are high and resources in the work environment are low (e.g., low supervisor support; Young et al. 2007). The use of SOC strategies in the work domain is associated with a focus on opportunities, for example, how many

new goals, options, and possibilities one has in one's personal future at work, which can be seen as a criterion of successful aging at work (Zacher and Frese 2011).

Young and middle adulthood is also the time when most people start a family. Raising children and care for a family is demanding in terms of time and energy, the very same resources needed to successfully establish and consolidate a professional career. Thus, pursuing goals in the work and the family domain simultaneously (as is typical for many adults) can lead to goal conflict due to competing demands drawing on the same limited resources. Goal conflicts are associated with lower subjective and affective well-being as well as psychosomatic complaints (Freund et al. 2013). Successful development in middle adulthood, then, critically involves selecting goals in the different life domains in a way that they minimize conflict and maximize facilitation. One obvious strategy – namely to be selective regarding the number of goals one pursues – is difficult in middle adulthood, given that both life domains are of central importance to most people. In other words, many adults cannot simply postpone work goals in favor of family goals, or vice versa. Not surprisingly in this light, younger and middle-aged adults report more goal conflict and less facilitation than older adults (Riediger et al. 2005). However, this age-related difference does not seem to be due to restricting oneself to fewer goals but instead to another facet of selection, namely to focusing on similar and central goals (Riediger and Freund 2006). Focusing, in turn, is related to lower goal conflict and also seems to contribute to the maintenance of goal involvement in older adults.

Evidence suggests that combined use of all SOC strategies helps to reduce goal conflicts between work and family. SOC behaviors in the work and in the family domain are associated with fewer stressors in these domains (Baltes and Heydens-Gahir 2003). To experience fewer stressors is, in turn, associated with lower conflicts between work and family.

Taken together, the existing literature suggests that the use of SOC strategies in adulthood helps to successfully pursue goals in core life domains such as work and family and helps to reduce

conflict. Given the importance of managing multiple goals during this phase of the life span, the use of SOC strategies in general – and of focusing as one facet of selection in particular – can be considered essential for successful development across adulthood. Note that SOC is not a model that was developed to address the question of how to solve work-family conflicts. Instead, it is a general theoretical framework of development across the life span and across different levels and domains of functioning. The topic of work-family conflict was chosen as one area of inquiry as this conflict emerges because multiple highly demanding developmental tasks have to be pursued during a time of limited resources, a situation in which the use of SOC strategies should help to manage.

### **SOC in Old Age**

There is considerable research on the use of SOC strategies in old age. Studies by Freund and Baltes (2002, 1998) demonstrate that SOC is associated with higher levels of subjective indicators of successful aging such as subjective well-being, positive emotional experience, loneliness, and satisfaction with aging. The pattern of correlations is stable and robust from mid adolescence across adulthood into old and very old age (the oldest participants in these studies were centenarians). Similar to the findings that the SOC strategies are particularly useful in demanding situations in young and middle adulthood (Young et al. 2007; Zacher and Frese 2011), in old and particularly in very old age, SOC strategies buffer against negative effects of restricted resources (Jopp and Smith 2006). Comparing resource-rich and resource-poor older adults longitudinally replicated the results that SOC can protect against the negative effect of declining resources in old age.

### **Does the Importance of the Three SOC Strategies Change with Age?**

Given the dramatic shift in the ratio of gains to losses over the life span from a predominance of

gains in younger ages toward more and more losses in older adulthood, it is not surprising that older adults appear to be more oriented toward the maintenance of functioning in the face of losses (compensation) compared to younger adults who are more oriented toward achieving gains (optimization) (Heckhausen 1999). Ebner et al. (2006) demonstrated this motivational shift in the orientation of personal goals and provided evidence for its adaptiveness: For middle-aged and older adults, an orientation toward maintenance is positively related to subjective well-being, but an orientation toward loss avoidance was negatively related to subjective well-being in younger adults. Moreover, a set of experimental studies showed that older adults are more persistent when pursuing a goal that is oriented toward compensating for a loss, whereas younger adults are more persistent when pursuing gains (optimization) (Freund 2006). The shift in orientation from a predominant focus on optimization goals in young adulthood toward a stronger focus on compensation goals in older adulthood might help younger adults to achieve gains and increase resources and prevent declines in functioning and contribute to the maintenance of functioning in old age.

A different approach to investigating the role of SOC for successful aging uses the dual-task paradigm where people have to perform more than one task at the same time. A comparison of the performance on one task with the performance on both tasks simultaneously (i.e., dual-task costs) can provide insights into how people allocate limited resources. Given the overall decline in resources in the late periods of the life span, older adults should become more selective in their resource allocation and prioritize the task that has higher immediate importance. For instance, when performing a memory task and a balance task at the same time, older adults should focus more on keeping their balance than on memorizing a word list. Falling might cause serious health-related problems threatening their mobility, whereas forgetting a word typically does not have such severe consequences (Lindenberger et al. 2000). In fact, a set of studies combining a cognitive and a motor balance task

supported this hypothesis (Li et al. 2001; Rapp et al. 2006): Older adults allocated more resources into keeping their balance than into the cognitive task. Moreover, in keeping with the increased importance of compensation in old age, older adults invested more compensatory means into the maintenance of keeping their balance, and they profited more from them than younger adults. Taken together, studies using the dual-task approach support the usefulness of selectively investing resources into more vital goals, and this is particularly the case when resources are limited as is the case in old age.

## Summary and Conclusions

Successful aging can be defined as the process of simultaneously promoting gains and preventing losses across the life span. The processes of selection, optimization, and compensation (SOC) seem to be central for this process across the life span and into old and very old age. Delineating and committing to important goals (selection) focuses limited resources on a subset of possible alternative goals and thus allows effective optimization. Equally important are processes geared toward counteracting losses in resources that occur particularly in old age. Processes aimed at maintaining functioning in the face of losses are loss-based selection (i.e., restructuring and adjusting one's goals to the available resources) and compensation (i.e., acquiring and investing the remaining resources into the maintenance of functioning).

SOC seems to develop from a fairly undifferentiated global process in childhood into a more differentiated and elaborated structure of three interrelated yet distinct processes in adolescence and across adulthood. The emphasis of achieving new gains and increasing one's resources at younger ages shifts to a stronger focus on maintenance and avoiding losses in older adulthood. This shift seems adaptive both for subjective well-being as well as for persistence in goal pursuit.

Self-report studies have shown that the use of SOC contributes to subjective and affective well-being across the life span and into old and very old

age. In addition, studies using the dual-task paradigm provide evidence that older adults allocate their resources primarily to functional domains of high importance when resources are limited. More generally, several studies have shown that engaging in SOC is particularly useful when the demands of a task are high and/or resources are strongly limited also in younger age groups. In sum, then, there is strong empirical evidence that selection, optimization, and compensation processes are associated with successful development and aging.

## Outlook

Is self-report the best way to measure SOC? Do we need external observation and are there biological indicators of SOC? Is optimization the same for a 15- and a 105-year-old, are selection and compensation? There are only very few studies that address these important questions. The self-report measure of SOC (Gestsdóttir and Lerner 2007; Napolitano et al. 2011; Wiese et al. 2000, 2002; Freund and Baltes 2002, 1998) allows use of the same items across adolescence and adulthood into old age. However, the specific goals and goal-related behaviors associated with SOC depend on the functional domain and, most likely, also on the life phase under consideration. Whereas a 15-year-old adolescent typically still has to develop career goals, commit to them, and then pursue them over the period of years and decades, the 85-year-old retiree typically does not. Conversely, a 15-year-old adolescent is unlikely to be confronted with losses in sensory functioning and does not have to engage in behaviors helping to compensate for these losses. This makes it difficult to directly compare the frequency and intensity of SOC-related behaviors across the life span.

Designs such as observing the use of compensatory and optimizing means in a dual-task paradigm in different age groups (Lindenberger et al. 2000; Li et al. 2001; Rapp et al. 2006) or the use of experimental designs to study the processes underlying age-related differences (Ebner et al. 2006; Freund 2006) are certainly needed to

complement the still dominant self-report approach. Moreover, the use of intensive assessments of SOC in everyday life using experience sampling methods will help to further understand how much people of different ages and in different contexts use and profit from SOC-related behaviors.

Finally, investigating the limits of the usefulness of SOC (such as over-selection, neglecting important goals by focusing too much on a subset of goals; over-optimization, exhausting one's resources in order to achieve a certain goal or standard at the expense of other goals or sustainability; or overcompensation, maintaining a goal in the face of losses instead of flexibly adjusting one's goals when the compensatory strategies are too costly to be maintained over time) will help to better understand the constraints of these processes.

## Cross-references

- ▶ [Berlin Aging Studies \(BASE and BASE-II\)](#)
- ▶ [Life Span Developmental Psychology](#)
- ▶ [Psychological Theories of Successful Aging](#)
- ▶ [Selection, Optimization, and Compensation at Work in Relation to Age](#)

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## Life Span Developmental Psychology

Catherine A. Riffin and Corinna E. Löckenhoff  
Department of Human Development, Cornell  
University, Ithaca, NY, USA

### Synonyms

Developmental psychology; Life span psychology

## Definition

Life span developmental psychology examines patterns of change and stability in psychological characteristics across the life course. The field focuses on both intraindividual ontogenesis (i.e., development within an individual) and interindividual differences in developmental trajectories.

Life span developmental psychology is concerned with understanding continuity and change in psychological characteristics across the life course. The central questions addressed by the field focus on intraindividual ontogenesis (i.e., development within an individual) as well as interindividual differences in developmental trajectories. Life span developmental psychology focuses on development in cognition, emotion, personality, and social interactions while acknowledging neurobiological, environmental, societal, and cultural contexts. It covers the entire life course from infancy to old age, but, given the context of this volume, this entry focuses predominantly on adulthood and aging.

This entry begins with a description of several key controversies relevant to the study of life span development as well as a brief historical overview of the field, including a summary of early theories of human development. This overview is followed by a description of prominent contemporary theories and common methodological approaches used to study intra- and interindividual continuity and change across the life span. The entry concludes with remarks on future directions for theory and research.

## Key Controversies

Several key controversies regarding developmental change have been important to the study of adulthood and aging. One of the most prominent issues centers on the relative influence of *nature* (i.e., hereditary, genetic, and biological factors) versus *nurture* (i.e., environmental factors and experience) on psychological development.

A second theoretical question concerns whether psychological development is *continuous*

or *discontinuous*. On the one hand, theories that accept the continuous perspective contend that developmental processes occur gradually over time. Stage theories, on the other hand, propose that development occurs as a series of phases characterized by distinct patterns of behavior, cognition, or emotion with abrupt transformations or discontinuities between stages. Some stage theories further contend that such phases follow a specific sequence and that the transition from one stage to the next is irreversible.

A related controversy revolves around whether developmental change is best conceptualized as *quantitative* or *qualitative*. Whereas quantitative change refers to specific amounts or degrees of change in a given characteristic (e.g., decline in information processing speed in later life), qualitative change refers to categorical changes in behavior, thinking, or attitudes. For example, a toddler who lacks the ability to take the perspective of others is qualitatively different from a child who understands that other people have beliefs and desires that differ from his or her own.

While early theoretical perspectives tended to show strong polarization along these fault lines, most present-day scholars adopt a more balanced perspective emphasizing the reciprocal influence between nurture and nature over the course of development and acknowledge that psychological development encompasses both quantitative and qualitative changes and may progress stepwise or continuously, depending on the domain of development and point in the life span under consideration. To appreciate the historical roots of contemporary perspectives, it is nonetheless useful to consider early theoretical accounts of developmental psychology.

## Historical Perspective and Early Theories of Development

Among the first to publish on life span development was the German scholar Johann Nikolaus Tetens with his contribution, *Menschliche Natur and ihre Entwicklung* (Human Nature and Its Development, 1777). It described human development as a lifelong process of gains and losses that is

both embedded in and refined by societal and historical contexts. In many respects, this perspective foreshadows modern conceptualizations of life span development, although, until recently, Tetens' early contributions were not fully recognized (Muller-Brettel and Dixon 1990).

It was more than a century later that the study of human development began to take shape in the United States. At the turn of the twentieth century, theory and research predominantly focused on child development. One of the most influential and formative early approaches to studying development was the psychoanalytic perspective. According to this view, as people move through developmental stages, they confront conflicts between social expectations and biological impulses. Only through the successful resolution of each conflict can individuals move on to the next stage.

Two of the most widely recognized psychoanalytic theories are Sigmund Freud's psychosexual theory (Freud 1957) and Erik and Joan Erikson's psychosocial theory (Erikson 1968). Whereas Freud focused on the formative role of sexual and aggressive impulses in the early years of life, the Eriksons' focused on people's identity and relationship issues over the life course. Perhaps most importantly, they rejected Freud's view that psychological development ends at age 5. Instead, they delineated the phases of development across the life span from birth to late adulthood (although the majority of the proposed stages still focused on early life) and argued that normal development must be understood in within a cultural context.

While psychoanalytic approaches tended to focus on the development of personality, emotion, and interpersonal processes, the influential work by Jean Piaget in Switzerland emphasized successive stages of cognitive development emerging from an interplay between biological maturation and experience (Piaget 1936). However, his model ended with attainment of the formal operational stage in adolescence and did not speak to development in young adulthood and beyond.

A radically different perspective on psychological development was conveyed by behaviorism (Watson 1914a) which also emerged in the early 1900s and exerted a dominant influence on psychological research by the middle of the twentieth

century, especially in the United States. It contended that behaviors and actions are determined by experiences, not inborn traits or heredity. In North America, behaviorism began with the work of John Watson, who was inspired by Russian physiologist Ivan Pavlov's studies of animal learning (Pavlov 1927). Watson is best known for his research on children's behavior and classical conditioning, a type of learning that involves involuntary responses outside of one's conscious control (Watson 1914b). Extending the behavioral principles set forth by Watson, B.F. Skinner's operant behavior theory (Skinner 1938) proposed that behavior can be increased through reinforcement (e.g., food, praise) or extinguished through punishment (e.g., removal of privileges). Rather than viewing human development as an age-graded phenomenon like the psychoanalytic approach and Piaget's concept of cognitive stages, behaviorists contended that the same principles of reinforcement learning shape human behavior from infancy to old age. Nonetheless, a disproportionate emphasis was placed on the formative effect of early learning experiences (Watson 1914b).

Toward the middle of the twentieth century, the field began to extend beyond the earlier focus on child development toward the later part of the life span. Notable advancements were made by German researcher Charlotte Bühler whose book *Der menschliche Lebenslauf als psychologisches Problem* (The Course of Human life as a Psychological Problem, 1933) presented a model of adult psychological development supported by biographical data collected from middle-aged adults.

Soon thereafter, theoretical perspectives and empirical research on later life development began to take shape. This process was fostered by the establishment of key professional associations including the Gerontological Society of America (est. 1945) and the "Division of Adulthood and Aging" of the American Psychological Association (est. 1946). As the founder and first president of the Division, Sidney Pressey encouraged empirical investigation of later life development while emphasizing the clinical relevance of behavioral research. Along with two of his students, Pressey coauthored the text *Life: A Psychological Survey*

(Pressey et al. 1939), a pioneering effort to educate young psychologists about the full life span, including midlife and beyond. Such efforts were bolstered by the launch of large-scale longitudinal studies such as the Baltimore Longitudinal Study of Aging (BLSA, est. 1958) under the leadership of Nathan Shock in the United States and the Bonn Longitudinal Study on Aging (BOLSA, est. 1965) spearheaded by Hans Thoma, which sought to investigate interindividual differences in physiological, psychological, and social variables and their implications for longevity.

Although some attempts were made to advance a life span developmental approach, much of the resulting theoretical advances focused selectively on aging. The first formal theory of aging, *disengagement theory* [1961], was proposed by University of Chicago researchers Elaine Cumming and William Henry. In their book, *Growing Old: The Process of Disengagement*, they argued that normal aging involves gradual withdrawal and disengagement from society (Havighurst 1961). They further reasoned that older individuals and society mutually and gradually sever ties so that the social system remains intact once the individual reaches death. In opposition to this perspective, Robert Havighurst argued that there is no psychological or social need for older people to become isolated or withdrawn. Instead, he proposed an alternative theory of optimal aging, *activity theory* (Baltes and Baltes 1989), which contends that when older adults stay active and maintain their social relationships into their later years, they age successfully.

As an elaboration of activity theory, *continuity theory* (1971) was proposed by Robert Atchley to distinguish normal aging from pathological aging. He believed that continuity is an adaptive strategy which allows individuals to prevent or minimize the effects of aging through internal (ideas, personality, emotions) and external continuity (environment, roles, activities). For example, continuity of interpersonal relationships preserves social support, continuity of physical activities allows individuals to minimize degenerative health effects of growing old, and continuity of personality upholds unique characteristics of the individual.

These formative theories of aging laid the groundwork for a broader expansion of the field

in the 1980s and 1990s. In those decades, scholars reevaluated the traditional concept of maturational development as a linear construct and instead proposed that adaptive change across the life course is both multidimensional and multidirectional (Baltes 1987). Extending from this notion, theoretical models began to acknowledge ontogenetic development as the dynamic interplay of gains and losses, which set the stage for subsequent theories to consider age-related changes in motivation, emotion, cognition, and personality as well as the broader social and environmental contexts of human development.

## Contemporary Perspectives

Contemporary perspectives on life span development vary in the degree to which they address the life span as a whole as opposed to the aging process in particular. They also differ in the proposed mechanisms of development and in their general scope, with some perspectives covering a broad range of domains while others focus on select aspects of functioning. The following overview moves from domain-general frameworks to models targeting specific domains of development.

### Meta-theoretical Frameworks

*The Life Span Perspective.* The Life Span Perspective is an overarching meta-theoretical framework that guides much of contemporary research in life span developmental psychology. Developed by researchers Paul and Margret Baltes and their colleagues (Baltes et al. 1977, 1980; Baltes 1997), it postulates the following key principles of human development.

The first principle contends that development is a *lifelong process* ranging from birth to death with no specific life stage taking precedence over others. At all life stages, both continuous (cumulative) and discontinuous (qualitatively distinct) processes are at play.

A second core assumption is that development is *multidimensional*, with an interplay of external and internal factors influencing development across multiple domains of functioning, and it is *multidirectional* in that developmental trajectories

may involve increments, decrements, or stability in functioning.

Extending the premise of multidirectionality, the third principle asserts that developmental *gains and losses* are present throughout the life span. According to this assumption, no process of development consists exclusively of growth or decline. Instead, both gains and losses vary according to systematic age-related changes.

Fourth, development shows *plasticity* in that there are multiple possible trajectories within a given individual. This assumption challenges traditional beliefs that development follows a fixed course. Although the Life Span Perspective concedes that certain genetic prerequisites may limit the scope of biological plasticity, unfavorable developments may be overcome by appropriate interventions.

The final principle proposed by the Life Span Perspective is that development is embedded in a *sociocultural and historical context* which may steer individuals toward or away from certain types of pathways. Therefore, developmental trajectories may vary by historical and cultural conditions.

With regard to contextual influences (Baltes et al. 1980), life span theory distinguishes among *normative age-graded factors* that exert a similar effect on all persons within a given age range (e.g., mandatory retirement age), *normative history-graded factors* that selectively affect the individuals living within a given generation or historical period (e.g., World War II), and *nonnormative factors* that are distinctive for each person and not tied to an age or birth cohort (e.g., accidents).

In combination, the tenets of life span theory imply that human development results from a *biocultural coconstruction*, an interplay of biological, psychological, and sociocultural factors. Following from this notion, research on life span development should ideally take a *multidisciplinary approach*, suggesting that life span psychologists may benefit from collaborating with neuroscientists, anthropologists, sociologists, or historians.

*Selection, Optimization, and Compensation.* Although the Life Span Perspective asserts a

co-occurrence of gains and losses throughout the life span, it acknowledges a shift toward a relative preponderance of developmental losses in later life. Specifically, genetic advantages associated with evolutionary selection are thought to become less salient in later life, and therefore, individuals must draw upon culture-based processes (cognitive skills, socialization strategies) to maintain a high level of function (Baltes 1987).

The conceptual framework of Selective Optimization with Compensation (Baltes and Baltes 1989; Baltes 1997) proposes that individuals adapt to developmental losses by selecting specific domains for which they optimize functioning while simultaneously compensating for deficits in other areas of life. Although Selective Optimization with Compensation was originally developed as a domain-general model, it has since been adapted for a range of domains and contexts, some of which are highlighted in subsequent parts of this entry.

*The Ecological Systems Perspective.* Dovetailing with the emphasis on sociocultural context inherent in the Life Span Perspective, contemporary sociological models of human development emphasize the external environments and conditions in which an individual grows and matures. In his Ecological Systems Perspective (Bronfenbrenner 2000), Urie Bronfenbrenner proposed that development occurs through a set of interactions between the individual and his surrounding environment. Specifically, his theory focused on nested environmental systems: microsystems (immediate interactions within a specific setting), mesosystems (interactions across multiple microsystems), exosystems (interactions of a person's microsystems with external settings), and macrosystems (cultural and societal factors). More recently, the chronosystem was added to capture relevant changes in subsystems over time.

*The Successful Aging Perspective.* Whereas the Life Span and Ecological Systems Perspectives emphasize the mechanisms and processes underlying life span development, contemporary research has also been informed by Rowe and Kahn's model of successful aging (Rowe and Kahn 1997), which emphasizes a specific set of

outcomes. Refuting the long-standing belief that aging successfully is simply the absence of disease, this model postulates three characteristics that define successful aging: (1) absence of disease and disability, (2) high physical and psychological functioning, and (3) active social engagement.

### Domain-Specific Theories

Guided by the broad meta-theoretical frameworks described above and informed by a growing body of rich longitudinal datasets, the last two decades have seen the emergence of a new generation of life span developmental theories. These models move beyond a selective focus on old age and an emphasis on age-related losses to explain the mechanisms that allow individuals to maintain adaptive functioning across the adult life span.

In particular, these domain-specific models have focused on four key areas of psychological development: cognition, motivation, emotion, and personality. The following sections present the chief contemporary perspectives in each of these areas.

### Cognition

*Fluid Versus Crystallized Cognition.* The study of cognitive aging has traditionally categorized cognitive functioning into two types of abilities: *fluid* and *crystallized* (Salthouse 2010). *Fluid* cognition represents one's capacity for abstract reasoning, problem solving, and information processing and is characterized by the ability to think logically and analyze complex patterns and associations. In general, fluid cognition is reflected in one's short-term memory, spatial orientation, and information processing speed. In contrast, *crystallized* cognition is associated with general knowledge garnered through lived experiences and education and is demonstrated by one's verbal comprehension and social judgment. Important to the study of cognitive aging, crystallized abilities tend to remain stable or increase across the life span, whereas fluid abilities tend to decline from early adulthood onward.

Although the fluid-crystallized terminology is most commonly used, the two types of abilities

have also been described as *processes* and *products* (Salthouse 1998). The term *process* refers to the efficiency or effectiveness of processing at the time of the cognitive assessment and reflects one's ability to solve novel problems. *Products* are the cumulative result of processing carried out in the past and are demonstrated by one's acquired knowledge. Cognitive *processing* has been further delineated into *effortful* versus *automatic*. Whereas automatic processing requires little or no mental capacity, effortful processing requires substantial mental resources, which are employed consciously and deliberately. Importantly, research has shown pronounced age differences in effortful processing, which is thought to reflect declines in cognitive resources (Salthouse 1998) and reductions in processing speed (Salthouse 1996).

*Processing Speed.* Processing-speed theory, proposed by Timothy Salthouse (1996), contends that two distinct mechanisms underlie the relationship between speed and fluid cognition. The *limited time mechanism* proposes that the ability to perform later mental operations may be restricted by spending excess time on earlier operations. This mechanism is most relevant when processing time is limited by external constraints or when accuracy is affected by the number of operations that can be carried out in the allotted time period. The *simultaneous mechanism* comes into play when a mental operation requires the simultaneous integration of one concept with another. In such a case, processing deficits may occur if earlier mental operations take too long (or information is lost) by the time later processing is complete.

*Sensory Deficits.* Empirical evidence also suggests that cognitive deficits in later life are strongly correlated with deficits in hearing and vision (Li and Lindenberger 2002). According to the common cause hypothesis, such associations are due to broad neurodegenerative processes affecting both cognitive and sensory functioning. Alternatively, there may be cross-domain resource competition with cognition and sensation drawing on the same limited pool of attentional resources. Further research is needed to tease apart these possibilities, integrate them with other theoretical

perspectives, and identify strategies for intervention (Li and Lindenberger 2002).

### Motivation

Contemporary perspectives have also begun to acknowledge the role of motivation in life span development, with growing agreement in the field that broad motivational priorities and specific goals vary systematically with age. However, specific theoretical perspectives disagree on the underlying mechanisms that drive such effects.

*Life-Span Theory of Control.* Drawing on the principles of selection, optimization, and compensation from Baltes' SOC framework, Heckhausen and Schulz (1995) proposed the life-span theory of control which asserts that selection and compensation are essential to optimizing life span development and that the individual is an active agent in controlling his or her developmental outcomes. Specifically, individuals are thought to master developmental challenges through *primary control strategies* (changing the environment and outside factors) and *secondary control strategies* (changing internal, mostly motivational, states). Although both strategies are proposed to steadily increase until midlife, primary control begins a slow and gradual decline in older adulthood. As primary control wanes in the later years, individuals are thought to call upon secondary control strategies to buffer the negative effects of losses in primary control.

*Motivational Theory of Lifespan Development.* Expanding on the life-span theory of control, the motivational theory of lifespan development (MTLD) (Heckhausen et al. 2010) proposes that adaptive development is defined by the extent to which an individual maintains primary control across multiple domains (e.g., work, family, health) and across the life span. MTLD further argues that the attempt to regulate one's developmental trajectory is organized around the pursuit of goals (through engagement and disengagement), a quest which enables individuals to take an active role in shaping their life course. In particular, MTLD emphasizes that opportunities for certain developmental goals wax and wane at various stages, which may be due to biological maturation (e.g., child bearing) or socially

constructed norms and expectations (e.g., school, career, retirement). MTLD also acknowledges that historical trends may influence the age-related sequencing of normative life course trajectories. Overall, MTLD proposes that as human societies continue to evolve, so will the timing of opportunities for developmental goal pursuit and in turn life course trajectories.

*Growth Versus Maintenance Goals.* A related perspective (Ebner et al. 2006) which also draws on the SOC model highlights the role of age-related shifts in the ratio of developmental gains versus losses. Young adults who experience a preponderance of gains are thought to prioritize growth-oriented goals, whereas older adults who are faced with accumulating losses of internal and external resources are thought to prioritize maintenance goals and prevention of losses. Consistent with this assertion, empirical evidence suggests that compared to younger adults, older adults are more likely to report maintenance and loss prevention goals than growth goals (Carstensen 1995).

*Socioemotional Selectivity Theory.* Socioemotional selectivity theory (Carstensen 2006) offers a complementary perspective. Whereas the theories discussed so far emphasize age-related losses in internal and external resources, SST suggests that age-related motivational changes reflect a proactive response to shifting time horizons. Specifically, SST proposes that whereas younger adults perceive their time horizons as expansive, future time is seen as more and more limited with advancing age. This shift in time horizons is thought to shape motivational priorities such that younger adults prioritize future-oriented goals such as information acquisition, career development, or social network expansion, whereas older adults prioritize present-oriented goals aimed at optimizing current well-being and maintaining close and rewarding relationships (Charles and Carstensen 2010).

### Emotion

A growing body of research suggests that emotional well-being and functioning remain remarkably stable across the life span (Labouvie-Vief 2003). Given the preponderance of age-related

losses in other areas of functioning, this phenomenon has been termed the “paradox of aging” and a range of developmental explanations have been advanced. These accounts, including SST described above, agree that cognitive resources play a key role for emotional processing and regulation but vary in the proposed mechanisms by which this is thought to occur.

*Dynamic Integration Theory.* According to dynamic integration theory (Reed and Carstensen 2012), emotion regulation depends on two core elements, *optimization*, an automatic process of enhancing affect, and *differentiation*, a complex, conscious process of incorporating one’s own feelings and knowledge with the thoughts and feelings of others. Specifically, DIT proposes that as cognitive-affective complexity increases from adolescence to middle adulthood, the conscious mode of *differentiation* becomes prominent. However, as executive functioning declines with advanced age, the simpler, automatic mode of *optimization* takes priority. Overall, this age-graded shift is thought to be a compensatory process resulting from older adults’ limited cognitive capacity. As such, older adults are thought to experience increased positive affect, but also impaired regulation in situations that require deeper emotional exploration and analysis.

*Motivated Cognition and the “Positivity Effect.”* An alternative explanation for preserved emotional well-being in later life draws on the framework of SST and proposes that, because of the age-related shift toward present-oriented goals, older adults actively direct cognitive resources (i.e., attention, memory) toward positive and away from negative stimuli. This phenomenon, also known as the “positivity effect” (Reed and Carstensen 2012), has been interpreted as an example of *motivated cognition* (Mather and Carstensen 2005) in that cognitive control mechanisms are engaged to support a certain goal state (viz., emotional well-being) as opposed to equally processing all available information. In contrast to DIT, this perspective proposes that maintaining emotional well-being in later life is not the result of cognitive decline but rather requires the active allocation of cognitive resources.

#### *Strength and Vulnerability Integration Model.*

The strength and vulnerability integration (SAVI) model (Charles 2010) builds on prior theories to offer a more comprehensive understanding of variations in emotion regulation across the life span. It argues that aging is associated with both strengths (e.g., experience-based knowledge, focus on positive information) and vulnerabilities (e.g., limited cognitive resources, reduced ability to recover from physiological arousal). Depending on whether a given context allows individuals to capitalize on age-related strengths or brings out age-related vulnerabilities, older adults may experience better or worse emotion regulation than older counterparts. For instance, older adults do well when a potentially problematic interpersonal situation can be avoided but fare worse if a difficult interaction is inevitable (Goldberg 1990).

#### **Personality Development**

With regard to personality traits, most contemporary life span researchers have adopted some form of the big five model according to which personality traits can be described along the broad dimensions of neuroticism, extraversion, openness, agreeableness, and conscientiousness (Roberts et al. 2005a). Across a variety of cultures and birth cohorts, mean-level changes in personality generally show age-associated increases in agreeableness, conscientiousness, and emotional stability and decreases in openness to experience (Terracciano et al. 2005; McCrae and Costa 1999). Theorists also agree that personality becomes progressively more stable with age, although perspectives vary regarding the degree to which personality remains malleable in the later years and the factors that initiate personality change.

*Five-Factor Theory.* The five-factor theory (FFT) (Roberts et al. 2005b) proposes that endogenous personality characteristics are independent of environmental influences (e.g., life events, historical context, and culture). When change in basic traits does occur, it is thought to arise from a species-wide genetic predisposition, innate maturation, or changes in neurobiology (e.g., brain injury, dementia). According to FFT, dispositional

traits express themselves in interaction with contextual factors and form *characteristic adaptations* including goals, competencies, self-perceptions, and attitudes that may flexibly respond to age-graded changes in opportunity structures while the underlying system of basic traits remains comparatively stable.

*Social Investment Theory.* Social investment theory offers an alternative explanation of personality development across the life span (Lachman et al. 2015). Although this position acknowledges that genetic factors are important to personality development, it further contends that normative changes in personality may also result from transactional (social contact and interaction with others) and stochastic (randomly determined) factors, including life experiences and life lessons. This theory proposes that normative personality change is influenced by quasi-universal role investments (e.g., marriage, family, developing a career), and in turn, role expectations and contingencies set by the individual's social network promote a reward structure for appropriate behavior and personality change (i.e., becoming more agreeable, conscientious, and emotionally stable with age).

*The Role of Life Stories and Personal Narratives.* In recent years, McAdams and colleagues (McAdams and Pals 2006) have advocated a more comprehensive understanding of personality development, encompassing not only basic traits and characteristic adaptations but also personal narratives and life stories that situate the developing individual within its rich historical and cultural context. Their model outlines three levels of personality: (1) *dispositional traits* that constitute broad individual differences in behavior and feeling, but show general consistency across situations and over time, (2) *characteristic adaptations* (e.g., feelings, goals, and coping mechanisms) that change in response to certain situations and environments, and (3) *self-defining life narratives* that help to provide a sense of purpose, meaning, and identify. According to this perspective, all three levels are embedded within a social and environmental context, which in turn shapes personality development.

## Limitations and Future Directions for Theory Development

Over the past century, the field of life span developmental psychology has evolved from examining ontogenetic change from a maturational perspective to conceptualizing human development as a multifaceted and dynamic process. Although theoretical models have shed light on the cognitive, motivational, and socioemotional features of development, there is still room for a stronger connection to individuals' environmental and cultural contexts.

By and large, contemporary theories have focused almost exclusively on intraindividual change and individual development, with a relatively weak connection to the individual's social or historical environments. Whereas the Life Span Perspective (Baltes et al. 1980) acknowledged the reciprocal influence of endogenous (internal) and exogenous (external) forces on an individual's development, specific theories tend to examine one feature (e.g., emotion regulation) with lesser connection to the individual's external environment, including cultural or historical contexts. Despite the early coevolution of life span psychology and life course sociology, a vast disconnect exists between these traditions (Cheng et al. 2015). As such, life span psychology remains individual focused, whereas sociology of the life course considers the individual within a social context.

Moreover, the preponderance of theoretical development and research has been conducted in the United States and Western Europe, both of which are individualistic cultures. Although some cross-cultural initiatives are being developed, as is the case in personality research, robust efforts are needed to systematically examine the extent to which contemporary theories extend to other cultural contexts, particularly collectivist cultures (Mayer 2003). As research begins to fill in these gaps, a broader understanding of the limitations of current theories will likely become evident.

One theoretical perspective which is well suited to address these gaps was originally developed for studying child development:

Bronfenbrenner's Ecological Systems Perspective (Cumming and Henry 1961). As described earlier in this chapter, Bronfenbrenner's model focuses on four environmental systems: microsystems, mesosystems, exosystems, and chronosystems. This framework could be used to examine a variety of research contexts, including end-of-life or treatment decision-making in medical settings (proximal processes within a microsystem), intergenerational relationships and caregiving in later life (mesosystem), community health services and senior centers (exosystem), cultural or ethnic differences in the perception of death and dying (macrosystem), or bereavement after a spouse's death (chronosystem).

Moreover, this theory could inform testable hypotheses concerning individuals nested within environmental systems. For example, the ecological model could be used to examine the impact of social isolation (lack of mesosystem and exosystem support) on older adults' psychological health and well-being (microsystem) or to develop elder law and policy (macrosystem) to benefit proximal systems, including assisted living home environment (mesosystem) and health services (exosystems).

In addition to theoretical developments, the recent advent of novel technologies, including functional imaging (fMRI) and neuroendocrine sampling (e.g., salivary cortisol), has offered new opportunities to combine neurological, physiological, and psychological data and ultimately gain insight into the relationships among these processes and how they may change across the life span. For example, as part of the Midlife in the United States (MIDUS), a national longitudinal study of health and well-being, researchers have begun to integrate self-report data (e.g., questionnaires) with biomarker (e.g., cardiovascular, neuroendocrine, inflammatory, musculoskeletal) and cognitive and affective neurological data (e.g., brain images and functioning). In combination, these assessments offer a comprehensive understanding of links between biological and psychosocial aspects of development. In addition, the longitudinal nature of this dataset offers a

unique opportunity to examine the relative influence of earlier (developmentally *distal*) and later (developmentally *proximal*) experiences on subsequent functioning and adjustment (Cheng et al. 2015). This line of inquiry is especially valuable given that lack of differentiation between proximal and distal influences has been a key limitation in prior research.

## Conclusion

Over the past century, great advances have been made in the field of life span developmental psychology. Several key controversies have been particularly influential in advancing theory development and challenging scholars to consider whether life span development is (a) the result of *nature* or *nurture*, (b) a *continuous* or *discontinuous* process, and (c) conceptualized as *quantitative* or *qualitative*. Whereas formative theories focused primarily on child development from a maturational perspective, expansion of the field in the twentieth century led to a broader conceptualization of life span development as a multidirectional and multidimensional process, one that involves both gains and losses. In recent decades, researchers have considered age-related interindividual differences and intraindividual changes in cognition, motivation, emotion regulation, and personality. With robust expansion of theory and research over the past century, the field is now poised to chart new territory in cross-cultural and diverse socioenvironmental contexts.

## Cross-References

- ▶ [Activity Theory, Disengagement Theory, and Successful Aging](#)
- ▶ [Motivational Theory of Lifespan Development](#)
- ▶ [Selection, Optimization, and Compensation at Work in Relation to Age](#)
- ▶ [Socioemotional Selectivity Theory](#)
- ▶ [Stage Theories of Personality](#)
- ▶ [Strength and Vulnerability Integration](#)

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## Life Span Developmental Psychopathology

Eva-Marie Kessler<sup>1</sup> and Simon Forstmeier<sup>2</sup>  
<sup>1</sup>MSB Medical School Berlin Hochschule für Gesundheit und Medizin Calandrellistrasse, Berlin, Germany  
<sup>2</sup>Faculty II – Department of Education Studies and Psychology, Developmental Psychology, University of Siegen, Siegen, Germany

### Synonyms

Geropsychology; Lifespan developmental psychology; Plasticity; Psychology of aging; Resilience

### Definition

Lifespan developmental psychopathology refers to pathological aging processes over the lifespan, including pathways to cognitive and affective disorders in old age as well as resources and resilience to maintain well-being in old age.

### Introduction

Within the broader field of the psychology of aging, lifespan developmental psychopathology has a major focus on pathological aging, as indicated by mental health problems, dysfunctions, and disorders in adulthood and old age (Kessler et al. 2014). At the same time, lifespan developmental psychopathology considers individuals'

potential for normal and successful aging. It is important to integrate these two perspectives in order to understand and to deal with the enormous *heterogeneity* of mental health/mental illness in old age, as reflected in the coexistence of both highly vulnerable/mentally ill and highly resilient/healthy older individuals. For example, people over the age of 60 have the highest rates of suicide in almost two-thirds of the countries worldwide. Men over the age of 75 are the group most at risk. Moreover, among 90–100-year-olds, dementia has a prevalence of about 50%. At the same time, epidemiological research has consistently shown that older people have lower prevalence rates of depression and anxiety that fulfill the criteria of a mental health diagnosis than do young and middle-aged adults (Jorm 2000). Furthermore, there is a consistent cross-sectional and longitudinal evidence that levels of negative affect do not increase in the normal population of older and very old people, while life satisfaction and high-arousal positive affect (e.g., excitement) are stable and show only a small decline in very old age (Röcke and Brose 2013).

## Mental Health in Old Age: A Lifespan Perspective

### Aging from a Lifespan Perspective

According to lifespan developmental psychology (Baltes et al. 2006), individual aging is a lifelong and dynamic process driven by biological (e.g., basic cognitive capacity, physical health), socio-cultural (e.g., healthcare provisions, social relations, financial resources, social status), and psychological factors (e.g., coping strategies, knowledge, self-efficacy). Furthermore, it is assumed that aging individuals are, to a large extent, agents of their own development. In other words, human aging is shaped by the actions and reactions of the developing individual – herself or himself – while negotiating developmental challenges over the lifespan. In such a view, aging is an integral part of development that comes with growth and decline, as does every other life period. At the same time, some defining characteristics of the later phase of life deserve reflection

(Kessler et al. 2014). First, biological resources and capacities show a strong normative decline over the adult lifespan. With age, plasticity – as indexed by an individual’s change potential – decreases; furthermore, the genetic materials, associated genetic mechanisms, and genetic expressions become less effective. Increasing levels of multimorbidity, sensory impairment, and functional limitations lead to a growing gap between biological potential and individual-cultural goals. Theories of normal and successful aging assume that people continuously adapt to such changing biological requirements by allocating their resources primarily to maintenance and recovery, rather than to growth (as in childhood and early adulthood) (Baltes and Baltes 1990). Second, old age and particularly advanced old age are the culturally least-defined life periods, as compared to all other periods. There is a significant lag between the current potential of old age and the existing societal opportunity structures serving to unfold such potential. Third, the life period of old age has, by definition, the most cumulative “learning history,” which in the domain of personality development may come with normative advantages (e.g., a large repertoire of coping styles and compensatory strategies) and disadvantages (e.g., stable or even declining levels of openness to experience and self-insight) (Kessler and Staudinger 2010).

### Defining Mental Illness/Mental Health in Old Age

According to prominent definitions of mental health, such as the World Health Organization (WHO) definition, mental health is usually defined as a state, without explicitly including development and aging. From a lifespan perspective, an older individual’s mental health can be defined as a unique configuration of biological, psychological, and sociocultural risk factors and protective factors having accumulated over the whole life course that is potentially reflected in various degrees of adaptive behavior (Kessler et al. 2014). Consequently, a lifespan perspective situates risk and protective factors of mental health *developmentally* (Fiske et al. 2009). A lifespan approach proposes that people across

the whole lifespan actively and purposefully select and create developmental contexts. Specifically, individuals define, prioritize, adjust, and possibly give up developmental aims and respective goal criteria, thereby contributing to their own mental health.

However, mental health is increasingly challenged by the “age unfriendliness” of the biological system. In addition, many decisions of individuals operate in kind of a “cultural vacuum.” Therefore, contexts such as social networks, the healthcare system, new media technology, and living environments are crucial elements of mental health in old age. As a consequence of such biological and sociocultural changes, aging individuals can only realize the potentials of mental healthcare measures if the health services for older people as well as specific training opportunities for healthcare professionals take those limitations into account (Kessler and Bowen 2015a).

Given the lack of sociocultural resources, biological losses, and potential accumulation of disadvantages, avoiding mental health distress and achieving well-being are the challenges for aging individuals. Mental illness occurs if the individual’s biological, psychological, and sociocultural deficits outweigh that individual’s resources, resulting in clinically significant problems that interfere with daily functioning and quality of life in old age. Mental health problems normally go along with subjective complaints, as well as behavior that deviates from social norms. Mental health disorders refer to a pattern of symptoms meeting established criteria for psychiatric diagnoses, as provided by the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5) and the *International Classification of Diseases* (ICD-10).

Despite these challenges aging individuals are faced with, subjective well-being remains relatively stable in representative samples (Ryff 1989). A balanced view of lifespan developmental psychopathology, thus, includes not only the abovementioned losses but also a range of personal, social, and biological resources that remain or increase during the aging process (Kessler et al. 2014). Concepts and processes of “positive” mental health are described in the next sections.

## Major Concepts Underlying Lifespan Developmental Psychopathology

### Resources and Resilience

The phenomenon that positive mental health remains relatively stable from adulthood into old age despite various challenges, ranging from daily hassles, gradual and normative age-related changes, and sudden, major life events (“well-being paradox of old age”), (Diener and Suh 1998) points to high levels of *resilience* for the majority of older individuals. Resilience refers to an individual’s positive adaptation to such adverse conditions using personal (e.g., coping strategies, knowledge), social (e.g., social relations, social status, institutional structures, financial resources), and biological resources (e.g., basic cognitive capacity, physical health) (Kessler and Staudinger 2010). More specifically, resilience is defined as the maintenance and/or reestablishment of a certain normative or pre-disruption level of psychosocial functioning in the face of stress, threat, and loss – both without *and* with the help of external interventions. It is determined by an individual constellation of resources on one hand and the specific demands of the stressor on the other hand. Within the lifespan developmental psychology literature, resilience has been researched as one form of positive plasticity, that is, an individual’s potential for positive change. Research on resilience in adulthood and old age can be roughly categorized as following one of two approaches (Kessler and Bowen 2015b). First, resilience in adulthood and old age has been studied concerning specific, age-related experiences (e.g., maintaining/regaining well-being after widowhood or retirement, regaining health after a major health event). Second, resilience in adulthood and old age has been studied concerning the aging process in general as an agglomeration of social, psychological, and biological challenges and declines. Indeed, it has been a fundamental goal of aging research to identify the antecedents of and processes underlying successful aging (e.g., maintained cognitive functioning, low levels of disease, high well-being, unusually long life) (Baltes and Baltes 1990).

### Developmental Regulation

Models of psychosocial development have elaborated on the underlying dynamics behind positive mental health in old age. These dynamics address the overarching processes of developmental regulation across the lifespan. In classic stage models, development is conceptualized as a life-long task, reaching its end point only in advanced age; positive mental health is achieved as the end of an ideal trajectory. For example, Erikson (1994) described lifelong personality development as a series of eight characteristic, age-related, psychosocial crises. Successful solution of psychosocial crises in late adulthood is regarded as a prerequisite of positive mental health and requires an integration of two conflicting forces: ego integrity vs despair. Achievement of ego integrity is perceived as the final aim of lifelong development, including the ability to perceive continuity and meaning in life and to accept one’s own life as lived, including finitude, definitiveness, failure, and omissions.

Three models focus on self-regulation strategies that foster successful aging. According to the model of *selective optimization with compensation* (SOC) (Baltes and Baltes 1990), three strategies help people, as they age, become increasingly better at adjusting to losses and negative events. These strategies include selecting or adjusting one’s goals in order to decrease the discrepancy between the present situation and aspired goals, optimizing preserved skills, and compensating for losses by practical means. The *dual-process model of assimilative and accommodative coping* (Brandstädter and Rothermund 2002) focuses on selection and adaptation processes and differentiates between an “assimilative” strategy of changing the situation so that it conforms more closely with personal goals and an “accommodative” strategy of adjusting the goal to given situational constraints. The accommodative mode is particularly important in old age when aspired goals drift out of the person’s span of control and includes strategies such as disengaging from blocked goals, rescaling personal expectations to the given, or letting go of self-images that do not fit the actual self anymore. Going further,

*socioemotional selectivity theory* (Charles and Carstensen 2010) focuses on gains in emotion regulation strategies. As people age and perceive their restricted lifetime, they become more motivated to maximize positive affect and minimize negative affect, e.g., by attending to and remembering positive stimuli better than negative ones (compared to younger individuals) and by investing more time and energy in emotionally relevant relationships with significant others.

According to recent *models of autobiographical remembering* (Pasupathi et al. 2006), another form of developmental regulation is reminiscence because it allows autobiographical memories to be integrated into a coherent life narrative that supports stability of identity and emotion regulation in old age. Three broad forms or functions of reminiscence can be distinguished that all serve developmental regulation in old age, i.e., social, instrumental, and integrative functions (Westerhof and Bohlmeijer 2014). First, sharing personal memories can enhance emotionally relevant relationships and foster generativity by teaching about past experiences (social function). Second, recollecting previously applied coping strategies can help in present coping processes, and thinking about past positive memories is an important emotion regulation strategy (instrumental function). Third, reflecting on past experiences can stabilize one's sense of self, and integrating negative experiences into biography may help to increase well-being and make meaningful commitments in life, especially in times of change (integrative function). There is a rich literature, including cross-sectional and longitudinal studies, showing that these reminiscence functions are positively related to well-being in old age (Westerhof and Bohlmeijer 2014). Overall, a likely explanation for this positive effect of reminiscence is that it activates personal and social resources such as self-efficacy, coping, self-esteem, meaning in life, and supportive relationships. However, also impairing reminiscence styles can be found, such as ruminating upon negative experiences ("bitterness revival") or escaping from present problems into the glorious past ("boredom reduction"). These reminiscence styles, in their chronic and inflexible form, are

linked to maladaptation and mental disorders such as depression and anxiety (Westerhof and Bohlmeijer 2014).

## Pathways of Lifespan Developmental Psychopathology

Given the multiplicative relationship among biological, psychological, and sociocultural factors, lifespan developmental psychopathology conceptualizes mental health and mental health problems as probable rather than determined and, as such, never fully predictable. Moreover, different etiological pathways can result in similar clinical syndromes and presentations (Kessler et al. 2014). As a simplified example, patients may develop depressive symptoms, following an accumulation of various stressful life events that started in childhood, or within the context of a physical or neurological illness in old age, together with a lack of social support. This observation corresponds to the paradigm of equifinality in lifespan theory (Baltes et al. 2006). For heuristic reasons and in line with central assumptions of developmental psychopathology, three pathways to psychopathology can be distinguished in old age, namely, chronic pathological processes persisting from earlier life periods, dysfunctional psychological reactions to normal aging, and mental health problems in the course of pathological aging of the brain (Kessler et al. 2014).

### Chronic Pathological Processes Persisting from Earlier Life Periods

Mental health problems might start in the first half of life; are manifest in clinically relevant disorders during childhood, adolescence, or adulthood; and then persist into old age (typically labeled as mental health disorder "with early onset"). Within the ICD-10 and DSM-5, these mental health disorders are characterized as chronic or recurrent mental health disorders. Distinguishing between individuals who first experienced mental illness earlier in life and those whose first encounter with mental illness occurs in old age is an important heuristic in clinical practice and is supported by empirical research. This is well illustrated in the example of

depression in old age. There is consensus that the distinction between “late-onset” depression (arising in adults 60–70 years and older) and “early-onset” depression portends differences in etiology and prognosis. Those with early-onset depression are more likely than those with late-onset depression to have a family history of depression and are also more likely to have a higher prevalence of personality disorder or elevated scores on neuroticism (Brodaty et al. 2001). Those with late-onset manifestation of depression often show a history of cerebrovascular disease and symptoms of psychomotor retardation, anhedonia, and concomitant executive-functioning deficits (Fiske et al. 2009). Neurological findings, including white-matter hyperintensities or leukoencephalopathy, are reported as common among late-onset but not among patients with early-onset depression (Brodaty et al. 2001).

### **Dysfunctional Psychological Reactions to Normal Aging**

The relatively high level of mental health and well-being in old age is well documented in a large body of empirical research. However, acute and chronic exposure to normative age-related losses or common events in old age can massively interfere with daily functioning and well-being. The loss of a romantic partner, retirement, or chronic illness are three examples of events that are considered to be common stressors that increase distress for older adults and set limits to resilience in a significant proportion of older people. Older adults who are widowed are at high risk of developing depression and/or anxiety disorders, according to a systematic review (Onrust and Cuijpers 2006). The percentage of people who reported symptoms meeting the criteria for major depressive disorder (MDD) a year following the death of the spouse was estimated at 16%, compared to the 4–8% observed in same-aged, non-bereaved sample. In the case of retirement, men who retire early may experience an elevated risk of depression, even though retirement is not associated with depression in the older population in general. Furthermore, chronic illness predicts changes in depressive symptoms in late life, with functional impairment probably accounting for

most of the association between chronic illness and depression. Notably, dysfunctional reactions to aging-related losses often do not fulfill the criteria of any particular nonorganic mental disorder (such as depression, anxiety, or post-traumatic stress disorder), but are rather subsyndromal. However, this might be due to the fact that health professionals have poor diagnostic practice with older adults, and the phenomenology of depression and other mental disorders differs somewhat compared to younger adults, but the criteria are based on young adult presentations (Hegeman et al. 2012).

### **Mental Health Problems in the Course of Pathological Aging of the Brain**

Pathological processes in the aging brain can be – directly or indirectly – associated with mental health problems. The most prominent example of a late-life disease is AD, which is characterized by loss of neurons and synapses in the cerebral cortex and certain subcortical regions. Typical psychological symptoms of AD are short-term and long-term memory loss, confusion, irritability and aggression, mood swings, and problems with language. This disease typically does not become manifest until age 70, with the exception of the 5–10% of people suffering from “early-onset” AD (i.e., diagnosed before the age of 65) (Wernicke et al. 2000). After age 70, however, incidence increases markedly. Furthermore, lifespan developmental psychopathology addresses the psychological correlates and consequences of other age-related neurodegenerative conditions, such as Parkinson’s disease, as well as those of cerebrovascular events, such as stroke (going along with a broad range of cognitive, affective, motivational, and behavioral dysfunctions).

### **Uncovering Different Pathways in Clinical Practice**

In clinical practice, it is a challenging task to uncover the different etiological pathways behind similar clinical presentations (Kessler et al. 2014). In the case of depression, for example, research has identified indicators that help to discern different developmental trajectories and causes. Depression following stroke is less likely to

include dysphoria and is more strongly characterized by vegetative symptoms than other forms of late-life depression (Fiske et al. 2009). Depression associated with Parkinson's disease (PD) is a milder form of depression and is associated with dysphoria and anhedonia less frequently than depression in older adults without neurological illness. Depression linked with vascular dementia, compared to depression linked with Alzheimer's disease (AD), is characterized by more vegetative symptoms, such as fatigue, muscular weakness, and weight loss. Moreover, pathological and normal aging processes cannot always be classified as distinct processes. For example, recent research has suggested that cognitive impairment is a continuum, starting with subjective cognitive impairment (SCI; no supporting objective evidence from neuropsychological testing or evidence of functional decline), moving to MCI, and culminating in full-blown dementia (Walters 2010). It is still unclear whether cognitive deficits observed in people with AD and other forms of dementia are exaggerated or accelerated versions of normal aging on this continuum. As another example, it is sometimes difficult in clinical practice to distinguish between normal grief, prolonged grief, and depression after the death of a spouse. Going further, late-onset mental health problems often cannot clearly be separated from vulnerabilities and dysfunctional dispositions in the first half of life. In line with the assumption of lifespan diathesis-stress models of depression (Fiske et al. 2009), certain types of childhood trauma continue to constitute risk factors for depression in old age, possibly moderated by alterations in the serotonin gene-linked promoter region. Notably, childhood trauma outweighed more proximal causes, such as widowhood, recent life events, or vascular and neurologic disorder. Finally, psychological dysfunction as a direct effect of pathological aging of the brain cannot be clearly distinguished from its indirect psychological effects, such as changes in social networks, financial resources, living environment, etc. For example, depression symptoms in the course of PD are regarded as an interaction between several vulnerabilities, including genetic factors, cognitive diathesis (e.g., ruminative and avoidant coping

styles), age-associated neurobiological changes, and stressful events in late life (Fiske et al. 2009).

### **A Lifespan Account on Mental Disorders: The Sample Case of Alzheimer's Disease**

A research on AD illustrates the need of a lifespan account on mental health disorders in old age in terms of etiology and preventive measures. A comprehensive model of the development of AD and a causal treatment is not available yet, despite continuing progress in the understanding of the neuropathology of AD. However, the research has revealed several biological and psychological risk and protective factors across the lifespan that influence risk of developing AD (Forstmeier and Maercker 2009). The most well-established risk factors for AD and other dementias are old age, genetic susceptibility, familial aggregation (which is related to genetic susceptibility but also to common environmental exposure), and female sex. However, modifiable risk factors of AD are more important than those unmodifiable risk factors because they enable researchers to develop prevention strategies that may help people to maintain or enhance their cognitive health in older age and to prevent or postpone the development of dementia.

*Vascular risk factors* (e.g., hypertension, hypercholesterol, and smoking) and related diseases (e.g., diabetes mellitus, obesity) belong to the most important modifiable risk factors of AD. There is also accumulating evidence that they are risk factors for AD, if they are already present in mid-life (Luchsinger et al. 2005). These factors may play a causal role in AD by influencing neurodegenerative processes in the brain. Negative effects of vascular risk factors that begin in late life seem less evident. Findings also show that the risk of AD and dementia increases with the number of vascular risk factors (Luchsinger et al. 2005). Treatment of these conditions is thus an important target for the prevention of dementia.

*Stimulating activities* reflect lifespan aspects of the development of AD and, thus, are a psychologically very relevant category of risk/protective

factors. Activities that stimulate the brain lower the risk of AD, as a multitude of studies has shown (Forstmeier and Maercker 2009). Several types of activities have been in focus of research. Participation in cognitive activities (e.g., reading books and newspapers, writing, studying, doing crossword puzzles) in mid- to late life has the potential to lower the risk of AD (Wilson et al. 2002), although effect sizes of this relationship are only small in most studies.

Special variables reflecting cognitive activities are educational and occupational attainment (Caamano-Isorna et al. 2006). Although there is strong evidence that low education is a risk factor for AD, the mechanisms underlying this association are not yet clear. Most authors explain the protective effect of education in terms of cognitive reserve (Stern 2006): education is thought to stimulate underlying brain networks and make them more efficient and flexible. In individuals with higher cognitive reserve, the underlying brain pathology may not become clinically manifest until later because their brain networks are more capable or because different, intact networks are used to replace or bypass the disrupted networks. The idea of cognitive reserve implies that once the reserve is depleted past some critical threshold, the clinical symptoms of dementia emerge. As a consequence, individuals with higher cognitive reserve decline more rapidly after onset of symptoms because brain pathology has progressed to a larger degree until the point when the brain cannot tolerate the pathology any more. The most prominent cognitive reserve model (Stern 2006) assumes that there might be two processes by that cognitive reserve is implemented on a neural level: neural reserve and neural compensation. The former refers to cognitive processing in the normal aging brain that differs between individuals; the latter refers to different coping mechanisms with brain pathology once it emerges. However, the specific neural substrates of cognitive reserve are not fully understood so far. Other explanations of the association between education and dementia suggest that education is strongly linked with early life circumstances (e.g., socioeconomic status), motivational ability, or health behavior (e.g., nutrition and physical activity).

The association of participation in regular physical activities (e.g., walking, dancing, swimming) in mid- to late life and risk of AD is also strongly supported by research (Rovio et al. 2005). Several possible mechanisms may underlie this association, including reduction of vascular risk factors, promotion of brain plasticity and brain reserve, and general cognitive ability resulting in better health behavior.

Motivational processes, i.e., processes involved in goal setting and goal striving, are important for an active lifestyle. Important motivational processes are, for example, self-efficacy, i.e., the belief in being able to master difficult demands, and motivational self-regulation, i.e., the ability to motivate oneself to persevere in the face of difficulties during the implementation of goals. It has been proposed that motivational processes, beside cognitive and physical activities, contribute to a brain reserve that provides the individual with resilience to neuropathological damage (Forstmeier and Maercker 2008). This is supported by the results of a longitudinal study that has shown that occupation-related motivational abilities at mid-life reduce the risk of MCI by 35% (Forstmeier et al. 2012). The effect on the risk of Alzheimer's disease depends on the existence of an ApoE  $\epsilon$ 4 allele, which was found to intensify the biochemical disturbances that are characteristic of AD including beta amyloid deposition, tangle formation, neuronal cell death, and synaptic plasticity. Mid-life motivational abilities were associated with reduced risk of AD in ApoE  $\epsilon$ 4 carriers but not in noncarriers (Forstmeier et al. 2012). Two other studies support this finding using other measures of motivation-related concepts. Conscientiousness, i.e., the individual's tendency to act self-disciplined, thorough, and goal directed, was associated with a reduced risk of AD (Wilson et al. 2007). The purpose in life, which is associated with intentionality and goal-directed action that guides behavior, was related to a reduced risk of MCI and AD (Boyle et al. 2010). Finally, participation in regular social activities (e.g., going to the theatre, participating in social groups, visiting friends) in late life has also been shown to be related to risk of dementia (Wang et al. 2002). Several possible mechanisms

may underlie this association, including promotion of brain plasticity and brain reserve and emotional health resulting from fulfilling relationships. Thus, several psychological processes throughout life contribute to the development of AD. The case of AD illustrates the need of a lifespan account on mental health disorders in old age.

## Practical Implications

As argued, a lifespan approach to psychopathology in old age is vital to both diagnostic and treatment considerations and should be included in treatment manuals of late-life mental disorders (Kessler et al. 2014). A defining feature of mental dysfunction and disorder in old age is deviance from normative behavior including its developmental history. This emphasizes the importance of understanding normal aging as well as cultural contexts when working with older adults with mental disorders. Furthermore, adequate assessment in geropsychological practice encompasses the use of multiple data sources from a variety of disciplines, including the whole bandwidth of biological, psychological, and social-environmental factors. In order to gain a full appreciation of the driving forces of aging, clinicians should assess both deficits and resources. Most importantly, a thorough assessment of the wide range of risk and protective factors clearly goes beyond a person's present deficits. Furthermore, the understanding of psychopathology that first emerges in later adulthood must consider a different set of influential factors as compared to psychopathology that has either intermittently or chronically been present for much of an individual's adult life. A lifespan-informed approach to psychopathology in old age also considers the possibility that mental health dysfunction is not the end point of an individual's development, but can rather be a precursor for a variety of pathological pathways, as well releasing a cascade of developmental growth. In the face of heterogeneity and etiological complexity, neither consensus on intervention aims nor means-end relationships can be taken for granted.

Treatment considerations in geropsychological practice should be strictly grounded in individual assessment – not only of symptoms and problems, but also of individual goals and aspirations. Development and implementation of intervention measures must proceed from a comprehensive understanding of individual lifelong goals, goal pursuit, and goal adjustment. In addition to individual diagnostic results, clinicians should have state-of-the-art knowledge of the range of lifelong plasticity in various mental health disorders, including organic as well as nonorganic mental health disorders. This is a key prerequisite to focus the treatment schema on either maintenance of psychological function (or even further growth), or at least on the attenuation and delay of symptom presentation. Lifespan-oriented prevention and intervention programs should be based on models of developmental regulation in order to promote aging individuals' resources across the whole life span.

In line with this reasoning, SOC-based psychotherapeutic interventions have, for example, recently been proposed as an effective tool to treat depression in older adults (Laidlaw and Kishita 2015); moreover, structured reminiscence interventions that helps to balance positive and negative experiences and fosters integrative and instrumental remembering are effective in reducing depression and anxiety and increasing well-being (Pinquart and Forstmeier 2012). One central challenge in clinical practice is to combine existing measures from the already large “tool box” of clinical geropsychology (e.g., combining training programs from the health and exercise sciences with psychotherapeutic interventions) and to implement them in a wide array of intervention settings (laboratory environments, nursing homes and day care centers, rehabilitation units, the family setting, and the community at large).

## Cross-References

- ▶ [Emotional Development in Old Age](#)
- ▶ [Life Span Developmental Psychology](#)
- ▶ [Mental Health and Aging](#)

- ▶ Plasticity of Aging
- ▶ Psychological Theories of Successful Aging
- ▶ Resilience and Health
- ▶ Socioemotional Selectivity Theory
- ▶ Strength and Vulnerability Integration

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personal and professional development (U.S. House 1965). This definition acknowledges the role of lifelong learning in the context of the workplace as well as outside of it (Sterns 1986; Sterns and Spokus 2013). Specifically, informal learning opportunities can occur across multiple contexts: (a) community development, (b) adult literacy, (c) workplace training, or (d) personal interest pursuits (Zepke and Leach 2006).

Lifelong learning is best understood within the framework of lifespan development theory. Lifespan development theory recognizes that lifelong learning is characterized by individual level mechanisms such as: (a) continuous and discontinuous processes, (b) multidirectionality, (c) gains and losses, and (d) plasticity (Baltes 1987). Furthermore, it necessitates understanding lifelong learning as it is situated within environmental influences such as: (e) historical embeddedness, (f) contextualism, and (g) multidisciplinary research.

## History and Purpose of Lifelong Learning

The conceptualization of adults as learners was more formally enhanced in the early 1970s by Knowles (Knowles et al. 2005). This led to an increase in research, theory development, and debate in the field. Culturally and empirically, learning has been conceptualized as taking place in formal education during childhood and early adulthood as well as a method of informal updating in the workplace during adulthood to remain competitive. As illustrated in Fig. 1, this is an *age-differentiated* view that places education, work, and leisure as occurring at different parts of the lifecourse based on the age of the individual (Riley 1994). Thus, the concept of lifelong learning has been subject to age and institutionally bound understandings. A call to move away from an age-differentiated understanding to an *age-integrated* understanding was advocated by Riley (1994) as the former encourages a fragmented understanding of age, education, work, and leisure. An age-integrated understanding recognizes the role of education, work, and leisure across the lifecourse, an understanding that

## Lifelong Learning and Work

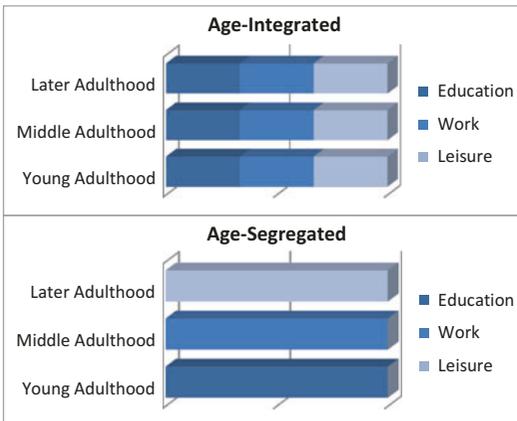
Harvey L. Sterns and Ruth V. Walker  
The University of Akron, Akron, OH, USA

### Synonyms

Andragogy; Formal learning; Informal learning; Self-directed learning; Training

### Definition

Lifelong learning is a multidimensional construct that is defined and measured differentially throughout the literature. The Higher Education Act of 1965 defined lifelong learning as both formal and informal education, training, and activities with the goal of gaining knowledge and skills for both



**Lifelong Learning and Work, Fig. 1** Age-integrated versus age-segregated structuring of the roles of education, work, and leisure (After Riley 1994)

can break down social and institutional barriers between generations. Further, as the definition of lifelong learning within a lifespan development context would suggest, learning can take place within the roles of education, work, and leisure (Manheimer 2008).

The link between lifelong learning and work cannot be ignored. According to a recent report by the National Center for Education Statistics education early in life can impact employability in adulthood (Snyder and Dillow 2015). High school dropouts are less likely to be an active member of the workforce than those who completed high school, 23.8% and 45.7%, respectively. Additionally, level of education is associated with median annual earnings in adulthood, with income steadily increasing for individuals with higher levels of educational attainment (i.e., bachelor's degree holders have higher median incomes than associate degree holders). It is important to note females have lower median incomes than males, across all educational attainment levels. Worldwide, there has been a trend over the past decade toward increased enrollment in elementary, secondary (i.e., high school), and postsecondary (i.e., attending college or technical school) education which will serve upcoming cohorts in terms of their competitiveness in the workplace. However, in order to remain competitive in the workplace,

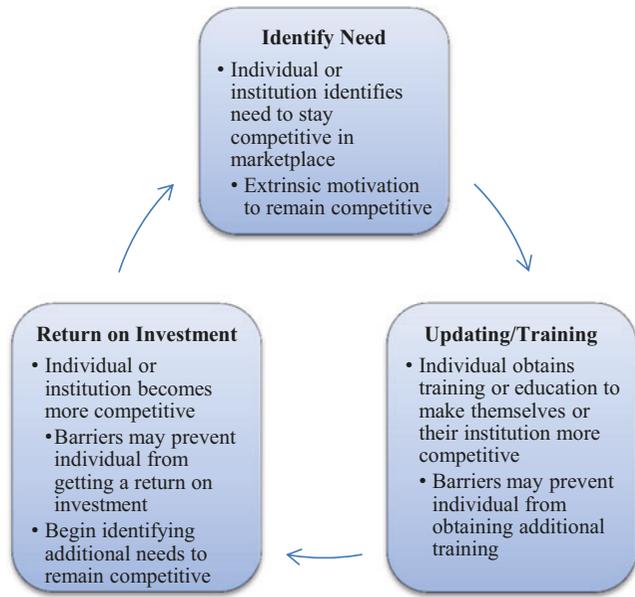
learning cannot stop after formal education has ended. The best predictor of education and training later in life is previous education (Sterns and Doverspike 1989).

While lifelong learning is beneficial and has a role in multiple facets of an individual's life (e.g., personal growth and leisure activities), it is critical to maintaining the human capital needed to be successful in the workforce. Thus, individuals need to continue to engage in training and updating to maintain work performance and reduce the potential for *obsolescence*; obsolescence occurs when an individual's knowledge, skills, and abilities become out-of-date due to technological or structural changes (Lovász and Rigó 2013). Work performance decrements due to obsolescence can be corrected with appropriate training. For example, a recent study by Lovász and Rigó (2013) analyzed data from the Hungarian Wage and Employment Survey collected at multiple time points between 1986 and 2008. Due to a major economic transition between 1989 and 1994 in Hungary from a communist to a democratic government, this provides a unique opportunity to look at the effects of obsolescence between older and younger workers over time due to the sudden influx of new technology and management practices that rendered previous work experience and knowledge obsolete. The authors found a significant productivity gap between skilled older and younger workers in the years immediately following this transition; however, no such decrease in productivity occurred for unskilled older workers compared to younger workers after the transition. Thus, the authors point to the need for continued opportunities for training for skilled workers in order for them to maintain productivity, particularly in the face of industry change.

### Understanding Lifelong Learning: Theories, Strategies, and Outcomes

There is no shortage of theoretical models for conceptualizing lifelong learning throughout the existing literature; however, the challenge lies in

**Lifelong Learning and Work, Fig. 2** A conceptual illustration of the human capital model of lifelong learning



the ability to synthesize the commonalities among the current theories. A recent review by Regmi (2015) simplifies the literature by concluding that current models of lifelong learning are based on two foundational models: the human capital model and the humanistic model. The *human capital model* views lifelong learning as a tool with which an individual or institution (e.g., employer, government) can invest in education and training to maximize economic growth and remain competitive. This model, depicted in Fig. 2, posits that individual skills and knowledge are a commodity, and increases in this commodity will result in a greater economic return on investment; thus, in the context of work, employers view their employees as economic resources, whereby offering opportunities for training results in a return on their investment by increasing their institution’s competitiveness in the marketplace. Thus, both individuals and institutions are extrinsically motivated to engage in updating to keep their competitive edge.

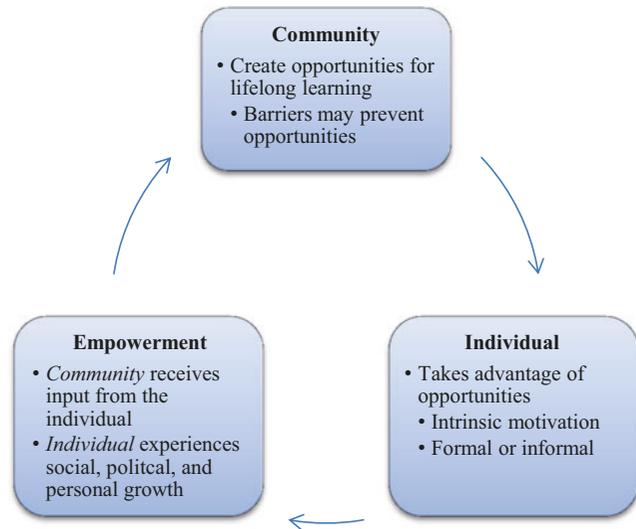
The first step in the human capital model is for the individual or the institution to identify a need for updating in order to remain competitive. Kanfer (2009) emphasizes the importance of the person-job fit and notes that a gap in an

individual’s knowledge, skills, and abilities and the requirements of their particular job lead to the necessity for continued training to prevent decrements in job performance. This places a burden on the institution to continually appraise and evaluate the performance of the individual to identify concerns regarding person-job fit in order to maximize job performance to remain competitive in the marketplace. Additionally, the human capital model has been criticized for placing a burden on the individual to continuously seek opportunities for training to stay competitive as well as for not recognizing the constraints preventing some individuals from seeking training (e.g., financial concerns, family commitments) Regmi (2015). Thus, it is important that both the institution and the individual share this responsibility, as the institution can make the individual aware of performance gaps and provide opportunities for training and updating before decrements in performance result in the need for a different job role or in negative self-perceptions by the individual.

The *humanistic model*, depicted in Fig. 3, views lifelong learning as not only an opportunity for economic development but also as a method of enhancing the welfare of individuals and communities by empowering them to: (a) own their right



**Lifelong Learning and Work, Fig. 3** A conceptual illustration of the humanistic model of lifelong learning



to a free and equitable education, (b) utilize education for personal and not just economic growth, and (c) be an active participant in social, political, and economic movements on a local and global scale. This model places the burden on society to create a culture of learning that facilitates the internalization of the importance of lifelong learning and the development of *social capital*, resources actualized via collaborations with others. This model also moves lifelong learning beyond the constraints of the workplace and recognizes its importance from a more holistic perspective in terms of individual growth within the context of societal level influences and processes.

Self-management and personal responsibility – “the protean career” – place responsibility on the individual (Sterns and Spokus 2013). It also recognizes the ability for the individual to engage in *self-directed learning*, learning initiated and managed by the learner, an informal learning strategy associated with higher levels of motivation, self-efficacy, locus of control, peer support, and better performance outcomes in a meta-analysis of 34 studies (Boyer et al. 2014). Furthermore, in contrast to the human capital model, the humanistic model promotes collaboration rather than competition between individuals and institutions (Regmi 2015).

### Barriers to Lifelong Learning

Barriers to lifelong learning can be categorized into two broad conceptual categories: individual level barriers and environmental level barriers. Individual level barriers include, but are not limited to: negative self-concepts, readiness to learn, stereotype threats, locus of control, self-efficacy, motivation, health concerns, life events, age-related declines (e.g., changes in cognition, audition, and vision), role changes (e.g., caregiving, family planning), and lack of financial resources (Boyer, et al. 2014; Knowles et al. 2005).

*Age-based stereotype threats* occur when an older adult, due to their membership in a group associated with negative stereotypes, is put in a situation whereby their behavior can result in a confirmation of an age-related negative stereotype (Lamont et al. 2015). For example, an older adult given a memory task may be concerned that their performance on the task may confirm a common stereotype that older adults have poor memories. This concern, or stereotype threat, can result in poorer performance on the task. Lamont and colleagues conducted a meta-analysis on 22 published and 10 unpublished studies and found that age-based stereotype threats negatively

impacted the performance of older adults overall, impacting performance on memory and cognitive tasks in particular. Further, there was no interaction with either the age or gender of the participants. Membership in two stereotyped categories, female and old, did not result in poorer performance.

Environmental level barriers include differential opportunities and challenges that may be outside of the control of the individual. These opportunities and challenges can be the result of laws, policies, or expectations by institutions (i.e., government agencies or employers) and communities. As depicted in Fig. 2, there are opportunities for institutional barriers to prevent individuals from either obtaining training (e.g., stereotypical beliefs held by those choosing employees for training programs) or from receiving the benefits of training (e.g., discriminatory promotion practices) in the human capital model of lifelong learning (Sterns and Doverspike 1989). Figure 3 illustrates the influence of barriers within the humanistic model of lifelong learning at the community level. While this model encourages individuals to seize their right to have access to free and equitable education, this is not always feasible when the community is unable to offer those opportunities due to differences in national funding for education, particularly for postsecondary education and informal learning opportunities.

While multiple laws have been put in place to protect workers from discrimination in the workplace (e.g., Age Discrimination in Employment Act, Americans with Disabilities Act, Equal Pay Act), experiences with workplace discrimination are still prevalent (Goldman et al. 2006). A thorough review of the literature on discrimination in the workplace by Goldman and colleagues (2006) discussed the consequences of discrimination on both the individual as well as the organization, a concept not often considered in the literature. The authors noted negative organizational consequences due to the costs associated with fighting legal cases, repairing a damaged reputation, and underutilizing and ineffectively managing a diverse workforce. A meta-analysis of 49 studies on sexual harassment by Chan and

colleagues (2008) found that higher levels of sexual harassment were related to lower levels of job satisfaction, job commitment, job performance, well-being, and health; furthermore, higher levels of sexual harassment were also related to higher levels of job and work withdrawal (e.g., avoiding tasks, resigning), work stress, general distress, and health symptomology. These findings were found to be stronger in workers under 40 years of age compared to those over 40 years old. Thus, it is evident that discriminatory workplace practices have negative outcomes for the individual (e.g., lower well-being) and the institution (e.g., lower worker productivity).

It is difficult to understand the impact of discrimination on workforce participation and outcomes by looking at forms of discrimination in isolation because, in reality, individuals have multiple identities that coexist to influence how they are treated by others. For example, a recent meta-analysis of 59 independent samples by Vanhove and Gordon (2014) analyzed the interaction of weight discrimination with sex, race, and age on employment outcomes (i.e., employment status, income). They found support for sex and age differences in weight-based employment discrimination, such that women experience higher rates of discrimination. Additionally, both young and older workers experienced significantly higher levels of discrimination than middle-aged workers. No difference was found between young and older adult workers. There were no significant differences based on race alone; however, white women experienced significantly higher levels of discrimination than white, black, or Hispanic men but not black or Hispanic women. Further, white men experienced significantly higher levels of discrimination than black and Hispanic men, but not black or Hispanic women. It should be noted that across race, women experienced higher levels of weight-based discrimination than their same-raced male peers. This study illustrates the difficulty in both studying and understanding how multiple identities (e.g., age, race, sex) can intersect to create opportunities for oppression or privilege in the workplace, which is important to

consider given the effects discrimination can have on the lifelong learning opportunities of the individual.

## Practical Implications

While an understanding of lifelong learning necessitates an understanding of the context of the learners, a discussion is not complete without mentioning *andragogy*, the art and science of facilitating adult learning (Knowles et al. 2005). This term turns the focus from the learner to the dyadic relationship between the learner and the “teacher.” Specifically, it gives a theoretical, philosophical, and pedagogical framework for determining what approaches to the instruction of older adults are currently supported in the literature. Zepke and Leach (2006) recommend the application of empirically supported pedagogical practice into informal learning opportunities. These practices include: (a) developing a supportive work environment conducive to learning, (b) creating institutionalized peer support and mentoring programs, (c) valuing and utilizing diverse workers, and (d) instructional flexibility and focus on the needs of the worker.

Applying the seven tenants of lifespan development to understand lifelong learning acknowledges the multiple and unique factors that influence learning over the lifecourse (Baltes 1987). The overarching message underlying the application of this theory is that learning can vary depending on the historical and cultural environments individuals develop in, nonnormative influences (e.g., brain trauma), as well as in terms of changes in educational, health, and employment opportunities. The classic text on adult learning with the most recent edition of Knowles and colleagues (2005) classic text on adult learning discussed the contribution of lifespan development theory to adult learning. The authors note that an individual’s motivation for learning, training, or updating is often prompted by life changes. They propose five points for individuals facilitating learning with adults to consider: (a) use developmental theories to help prepare for learning needs associated with particular points in the

lifecourse; (b) anticipating life changes allows instructors the ability to help prepare adults ahead of time; (c) recognize that life events can impact learning in either a positive or negative way; (d) take advantage of in-the-moment opportunities that open the door to learning; and (e) meet the learner where they are by planning meaningful learning opportunities.

As workers are increasingly vulnerable to discrimination based on their age, it is important to break down myths and stereotypes related to older workers as they are commonly used as a justification for discriminatory treatment toward older adults. For example, a recent meta-analysis of 418 studies by Ng and Feldman (2012) investigated six common stereotypes about older adults in the workplace: (a) less motivated, (b) less willing to participate in training and career development activities, (c) less willing to change, (d) less trusting, (e) less healthy, and (f) vulnerable to work-life imbalance. The authors did not look at a seventh stereotype that older workers are worse performers than younger workers, as a previous meta-analysis they conducted found no supporting evidence for that stereotype. Similarly, the authors found insufficient support when analyzing data throughout the literature for stereotypes of older workers as less motivated, less willing to change, less trusting, and more vulnerable to work-life imbalance. They also suggest the stereotypes that older workers are less healthy and less willing to participate in training and career development activities are over exaggerated due to weak correlations and effect sizes in their analyses. Further, the only evidence that supported older workers having poorer health was blood pressure and cholesterol levels; however, the authors noted it was unlikely that cardiovascular disease would present before retirement.

## Conclusion

As noted in Fig. 3, the humanistic model positions lifelong learning as a potential source of empowerment by encouraging individuals to take control and become active in social, political, and economic movements. This type of empowerment

can be achieved with the creation of a culture to support lifelong learning that values informal and formal methods of continued education, both within the work context and without. Within the work context, a culture of lifelong learning requires institutions to continuously provide opportunities for all of their employees, regardless of age, to receive additional training rather than simply waiting for a need or decrement in performance as an impetus for training and mentoring programs.

At a macrolevel, there is a need for policy and programs to support lifelong learning and reduce barriers to obtaining lifelong learning opportunities. Support for these programs can come from the government, national organizations, colleges and universities, community organizations, non-profits, public libraries, museums, and trade unions. Legislation to protect individuals by requiring institutions to adhere to practices that can promote lifelong learning differ worldwide (Manheimer 2008). A review by Cascio et al. (2015) notes that leave policies (e.g., maternity leave, paternity leave), subsidized childcare, and formal preschool increase female workforce participation. Increasing female workforce participation across the lifecourse with these types of policies can potentially alleviate the economic impact of taking unpaid and unprotected leave from the workforce. Furthermore, there is a need for nations to adopt laws to protect vulnerable groups from work-based discrimination based on their age, race, ethnicity, gender identification, sexual orientation, weight, and disability status. All of these issues can affect the willingness to engage in maintaining competence, skill updating, and the pursuit of additional education and training. Learning is a lifelong enterprise.

## Cross-References

► [Age-Related Changes in Abilities](#)

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## Lifestyle Factors on Depression, Effects of

Ada Lo  
The University of Queensland, St Lucia, QLD,  
Australia

### Synonyms

Alcohol; Cigarette; Depression; Depressive symptoms; Drinking; Exercise; Physical activity; Smoking

### Definition

The effects of lifestyle on mental health, especially depression, in older adults.

### Introduction

The global prevalence of depressive disorders in the elderly population at a particular point in time has been reported to be between 10% and 20%, and depression is the third highest burden of disease globally (World Health Organization 2008). Depression in older adults has been associated

with increased risk of cognitive decline, disability, and mortality. The World Health Organization estimates that depression will be the number one leading health concerns by 2030 (World Health Organization 2008), and depression among older adults is a significant and growing public health problem worldwide due to our rapidly aging population.

Late-life depression refers to clinical depression occurring for the first time in an older person aged 60 years or older. Contrary to popular belief, it is not part of normal aging. Depression in older adults often goes undiagnosed or under-reported due to the fear of being stigmatized or the belief that it is a normal response to living with chronic diseases or disabilities, which may delay appropriate treatment and ultimately result in poorer prognosis.

Treatment of depression in older adults is often inadequate due to a number of factors such as poor recognition of depressive symptoms, comorbidity of multiple illnesses, poor adherence to treatment, and adverse effects of polypharmacy. A growing body of evidence supports the notion that lifestyle factors can be potent in determining both physical and mental health and cognition. Lifestyle factors as discussed here include physical activity, dietary patterns and supplements, smoking, sleep, and alcohol consumption. Better understanding of modifiable lifestyle factors may, therefore, contribute to the development of more effective strategies to prevent or reduce depressive symptoms among older adults.

### Physical Activity

Physical activity has been regarded as a key modifiable factor for improving physical health, cognitive functioning, and emotional well-being. Physical inactivity has been found to increase the risks of developing depression, while being physically active has been shown to effectively reduce symptoms of depression and improve mood in younger adults (Kwan et al. 2012). Similar beneficial effects of physical activity on depression have also been reported in older adults (Kwan et al. 2012).

Over the past decade, physical activity as an intervention has shown promise in older adults in reducing the risks of depression as well as in treating depressive symptoms (Kwan et al. 2012); however, direct comparison between different studies is fraught with methodological issues due to heterogeneity in sample characteristics (e.g., age, comorbidity, severity of depression, recruitment setting), intervention protocols (e.g., type of exercises, intensity and duration, control group, and length of follow-up), and outcome measures.

In a systematic review of 11 randomized controlled trials with over 500 participants who were over 60 years of age, significant short-term improvement in depressive symptoms was found in most of the studies utilizing aerobic and resistance programs, regardless of the intensity, duration, or the actual form of exercises. However, medium- to long-term effects remain unclear (Blake et al. 2009). If the beneficial effects of exercise diminish with time, physical activity perhaps should be maintained indefinitely to keep depressive symptoms at bay among older adults as a prophylactic measure.

In a meta-analysis of seven randomized controlled trials, Bridle et al. (2012) found that moderate-intensity of mixed exercise including strength and endurance has a comparable effect as antidepressant medication and psychotherapy on depression severity for older people. At a clinical level, they calculated that 63% of exercise participants had a lower severity of depression than the average control participant and approximately 20% reduction in the severity of depressive symptoms. While this may be argued as a relatively small clinical effect, considering the issues of medication compliance and possible side effect of antidepressant medications, as well as issues with stigma and access to psychotherapy, individualized exercise program is a more attractive alternative without those problems but with the additional health benefits, such as reducing the risks of stroke, obesity, and heart disease. Despite emerging evidence, exercise is currently underused as a treatment for depression.

A number of underlying mechanisms have been proposed in order to explain the beneficial impact of physical activity in reducing the

incidence and severity of depression. First, physical activity may prevent the development of serious chronic conditions such as diabetes, osteoporosis, and heart disease, all of which have been shown to be associated with an increased risk of depression and lower health-related quality of life in old age (Craft 2012). Second, increased level of monoamines and endorphins and alterations to central norepinephrine activity after exercise may be responsible for the improved mood and better quality of life associated with physical activity (Craft 2012). Third, physical activity has been shown to decrease stress-induced cortisol responses (Craft 2012). Finally, greater physical activity may promote increased self-esteem and increased feelings of self-efficacy and, in turn, positive psychological outcomes (Craft 2012).

## Nutrition and Diet

There is growing evidence that improving the nutritional status in older adults may help improve or maintain emotional status and decrease depressive mood. Studies investigating the association between diet and depression focused primarily on a single nutrient in the past, and such approach is valuable in identifying food supplements that may offer prophylactic and therapeutic benefits for improving depressive mood. However, since meals are consumed as a combination of numerous nutrients that may interact with each other, research in recent years has started considering the effects of dietary patterns, not just individual nutrient, on health outcomes. Hence, the association of depression between supplements and dietary patterns must both be considered in order to understand the impact of nutrition and diet on mood. Due to their involvement in biosynthesis, metabolism, and neuronal membrane stability, the association between depressive symptoms between specific nutrients including omega-3 fatty acids, folate, and vitamin B12 has been examined.

Low levels of omega-3 in the body have been shown to be correlated to depression in older adults, and dietary omega-3 fatty acids have

been suggested to play an important role in the prevention of depression (Payne 2009). Omega-3 fatty acids are involved in brain biochemistry, physiology, and functioning and have vascular and anti-inflammatory properties that could explain their protective effect against depression (Payne 2009). Promising result of fish oils as a treatment for depressive symptoms in older people has been demonstrated in an eight-week randomized, double-blind controlled trial (Rondanelli et al. 2010). The researchers reported a statistical significant difference in depressive symptoms measured by the Geriatric Depression Scale (GDS) between the treatment group and placebo group after 2 months of 2.5 g of fish oil per day versus paraffin oil per day, which is consistent with the positive finding of omega-3 fatty acids in patients with mood disorders in a meta-analysis of ten double-blind, placebo-controlled studies (Lin and Su 2007).

The relationships between depression and vitamin B12 or folate remain controversial. Some studies found no significant association between folate or vitamin B12 status and depression (Eussen et al. 2002; Refsum et al. 2003), while two recent systematic reviews of observational studies concluded that folate and vitamin B12 deficiencies are associated with increased risk of depression (Gilbody et al. 2007; Almeida et al. 2015). Although it has been suggested that depression may lead to inadequate intake of food and consequently lead to vitamin deficiency, older Korean men with lower serum levels of folate and vitamin B12 were found to have an almost two-fold increased risk of developing clinically significant depression over the 2–3-year follow-up period, after controlling for a large number of covariates, including age, sex, education, minimal state examination (MMSE), smoking, alcohol, physical activity, vascular risk, serum creatinine levels, vitamin supplementation, and homocysteine (Kim et al. 2008). The underlying mechanisms have been posited to involve the effects of folate and vitamin B12 on neurotransmitter and myelin synthesis or through vascular pathways by influencing homocysteine metabolism (Payne et al. 2009). A Cochrane review based on three intervention trials concluded that folate

may be useful as an adjunctive treatment for depression, although it is still unclear as to whether supplementation will benefit both those with low and normal levels of folate (Taylor et al. 2004).

In a large cross-sectional study investigating the relationship between past dietary habit and current depressive symptoms among elderly people in Japan, it was found that individuals whose diet consisted of regular consumption of dairy products and well-balanced meals were less likely to report depressive symptoms. Also, avoidance of excess salt and fat in men has been found to be associated with reduced risks of developing depression in old age (Aihara et al. 2011). In a large longitudinal study in Chicago, Skarupski et al. (2013) reported that adherence to a Mediterranean-based diet, a diet comprised of vegetables, fruits, whole grains, fish, and legumes, was associated with a reduced number of newly occurring depressive symptoms at 7-year follow-up. In a population-based study of older adults in France, men who consumed mainly pasta in their diet reported higher level of depressive symptoms when compared to men who consumed mainly fish, whereas women whose diet consisted mainly of fruits and vegetables reported lower levels of depression compared to women who consumed snacks high in fat and sugar (Samieri et al. 2008). Given the cross-sectional analysis of this study, the findings suggest that people who consume more carbohydrates and sugars experience a higher level of depressive symptoms. Alternatively, they also suggest that individuals who are depressed may be more likely to crave for sugars and carbohydrates.

Overall, some evidence is emerging to suggest that certain dietary habits may be more beneficial to protect against depressive symptoms and the protective effects may be gender specific. Although the positive effects of certain dietary patterns and nutrients such as omega-3 on depressive symptoms appear promising, these findings are limited by publication bias (i.e., non-significant findings are rarely published), potential uncontrolled confounders, heterogeneity of sample characteristics, and small sample size in prospective intervention studies. The benefit of

taking dietary supplements and the dosage required are yet to be determined.

## Smoking

Smoking is a well-known risk factor for a number of physical illnesses, including coronary heart disease, type 2 diabetes, and stroke. Recent neuroimaging and neuropathological studies have found evidence of significant cerebrovascular disease in older people with depression, suggesting that cerebrovascular disease may be linked to late-life depression (Aizenstein et al. 2011). Although smoking has been extensively studied in numerous studies, few have reported the relationships between smoking and depression. In a retrospective study of community-dwelling women aged 70 years and over, Cassidy et al. reported a nearly three times increased risk of depression in women who smoked more than 20 cigarettes per day for at least a year in their lifetime (Cassidy et al. 2004). In a large population-based study in Hong Kong, smoking was shown to be positively associated with depressive symptoms in older people aged 65 or over (Lam et al. 2004). They found that current female and male smokers who smoked at least one cigarette per day for at least a year increased the risk of having depressive symptoms by 43% and 62%, respectively, when compared to never smokers. For former smokers, the risks of having depressive symptoms increased by about 20% than never smokers. Although the causal relationship of smoking and depression in older adults cannot be formally established based on the cross-sectional designs used to study them, the current evidence of its association is consistent.

Several theories have been proposed to explain the strong association between smoking and depression in general. These include the possibility that smoking and depression may share the same genetic vulnerability and psychosocial factors such as divorce, assault, and job losses that may trigger both the onset of depression and smoking (Mendelsohn 2012). According to the self-medication model of smoking, the central antidepressant properties of nicotine are especially reinforcing for those who experience

depression and promote smoking as a coping strategy to regulate emotions and relieve symptoms of depression (Mendelsohn 2012).

Given the strong association of smoking and depression, change in smoking habits or smoking cessation may play an important role in reducing depressive symptoms or the risks of developing depression in late life. Although the effect of smoking cessation on mental health in older adults specifically has never been examined, research findings in younger adults are contentious. Some research indicate that smoking cessation may result in increased depressive symptoms (Hughes 2007), whereas others report no significant associations (Mathew et al. 2013). Some recent studies have suggested that reducing cigarette consumption or smoking cessation is significantly linked to improved mental health outcomes or increased happiness (Cavazos-Rehg et al. 2014; Taylor et al. 2014; Shahab and West 2012). Discrepancies in these findings could be explained by differences in the design and delivery of the intervention program (e.g., gradual reduction vs. abstinence) as well as participant characteristic (e.g., depressive symptoms vs. depression diagnosis, classification of smoking status, psychosocial factors, and psychological resilience). A deeper understanding of how an individual's personality and coping strategies interact with their social environment in smoking cessation may lead to better psychological outcome in adulthood and reduce subsequent risks of late-life depression.

## Alcohol Consumption

Moderate levels of alcohol consumption in older people have been found to be protective against cardiovascular morbidity and mortality, and it has been associated with better cognitive health. A U-shaped or J-shaped relationship has been suggested between alcohol consumption and cognitive function or cardiovascular health, whereby light to moderate drinking is found to be more beneficial to cognition and cardiovascular health than abstinence or heavy drinking (Zacharias 2012).

Although the relationship between depression and alcohol consumption is not well established, comorbidity between hazardous alcohol use and various types of psychiatric conditions has been documented in the literature (Mäkelä et al. 2015; Gilman and Abraham 2001). Depressive symptoms among older adults have been associated with problem drinking (St John et al. 2009), and persistent depression has been shown to be associated with incident excessive alcohol use (van Gool et al. 2007).

Interestingly, older adults who reported moderate alcohol consumptions were found to have fewer depressive symptoms than those who abstained from alcohol or those who drank heavily, suggesting a similar U-shaped or J-shaped relationship observed in alcohol consumption and cognitive function or cardiovascular health (Kim et al. 2015; Lang et al. 2007). A light to moderate level of alcohol consumption may reflect the individual's social network and ability to engage in social interaction, which in turn reduces the risks of social isolation and modulates the level of depression (Lang et al. 2007). In contrast, heavy drinking may reflect maladaptive coping, while abstinence may reflect social isolation which may be a result of and contributor to depressive symptoms.

Using alcohol as a coping mechanism is more common among men than women, and it is not surprising that the effect of alcohol on emotional well-being is gender specific. For example, a large population-based study in the USA has found that frequent drinking and heavy or binge drinking were significantly positively associated with depressive symptoms in older men, but no association was found between drinking and depression in older women (Choi and DiNitto 2011). Likewise, Cassidy et al. (2004) found no significant associations between moderate alcohol consumption, defined as up to 40 g of alcohol (four standard drinks) per day for no more than three days per week, and mood in older Australian women in the community. It is possible that gender differences in relationship between alcohol consumption and depression may stem from the different attitudes men and women have toward alcohol, whereby men tend to use alcohol to numb

their emotional pain while women may cope with psychological distress through other means like religion and emotional release rather alcohol. In contrast, Aihara et al. (2011) has reported that occasional alcohol consumption during middle age was significantly associated with the lack of depressive symptoms in older Japanese women (OR = 10.46, 95% CI = 1.16–94.75), while no significant association was reported between alcohol consumption during middle age and depressive symptoms among older Japanese men. This interesting finding points to another layer of complexity in this area – cultural differences and social interpretation of alcohol use and its associated psychological impact.

Although acute alcohol exposure elevates serotonin levels in the brain and may relieve depressed mood in the short term, the accumulative toxic effects of long-term alcohol exposure interferes with neurotransmitters and tends to lead to worsening mood. Fortunately, the effects of alcohol on depression appear to be somewhat reversible with abstinence. In a large-scale multicenter study of older adult inpatients suffering from clinical depression, significant improvement on depressive symptoms on the Geriatric Depression Scale was reported on discharge when patients abstained from drinking alcohol during their inpatient stay and the improved mood was maintained at 3-month follow-up (Oslin et al. 2000).

In addition to similar methodological shortcomings found in other lifestyle studies, one of the major challenges is the classification of frequency and level of alcohol consumption, which varies significantly from studies to studies. Given the complex U-shaped relationships in alcohol consumption and depression, as well as potential cultural and gender differences, it is important for future research to be more collaborative and consider more standardized classifications and measures.

## Sleep

Sleep disturbances, including both insomnia and hypersomnia, have been estimated to be experienced by as many as 90% of patients with

depression (Tsuno et al. 2005). Recently, insomnia and hypersomnia have also been reported to co-occur during a depressive episode for some patients. Hypersomnia is less prevalent in the older population and most research to date has focused mainly on the impact of insomnia on depression.

A number of longitudinal studies across different age groups have demonstrated that insomnia is a risk factor for developing both new and recurrent episodes of major depression, suggesting that insomnia may mediate the development and severity of depression. In a recent meta-analysis, Baglioni et al. (2011) analyzed 21 longitudinal studies of varying age groups on the role of insomnia as a predictor of depression. Taking into consideration of heterogeneity of the study population, design, and measures, nondepressed people with insomnia was found to have a significant twofold risk to develop depression, compared to people with no sleep difficulties.

Insomnia has also been shown to increase the severity and duration of a depression episode and may be a predictor for poorer treatment outcome (Pigeon et al. 2008; Thase et al. 1996). In a case-control study, depressed older adults with sleep abnormalities were found to have poorer responses to cognitive behavior therapy than those without sleep disturbances (Thase et al. 1996). Similarly, in a multisite intervention study, Pigeon et al. (2008) reported that older adults with persistent insomnia were 1.8–3.5 times more likely to remain depressed at 6- and 12-month follow-up, compared with their counterparts. These findings suggested that strategies aiming to improve sleep quality through lifestyle modifications or sleep intervention may reduce incidence and prevalence of depression and potentially boost rates of recovery in older adults.

Although sleep disturbance is a symptom of depression, and that insomnia and depression share a bidirectional relationship, a high degree of residual insomnia has been reported in up to 55% of treatment responders following cognitive behavioral therapy or pharmacotherapy for depression alone (Nierenberg et al. 2010; Carney et al. 2007). A few small-sample intervention studies have looked at the effects of combined

psychotherapy and antidepressant medications on insomnia and depressive symptoms in adults. For example, in their pilot study, Manber et al. (2008) found a 50% remission rate for insomnia in the treatment group receiving combined escitalopram and cognitive behavioral therapy (CBT) compared with just 7.7% in the control group receiving escitalopram and insomnia psychoeducation. Moreover, the combined treatment group also had a greater rate of remission of depression than the control group (61.5% vs. 33.3%). In a recent randomized controlled study comparing therapist-guided CBT with self-help CBT, therapist-guided CBT demonstrated significantly greater decline in the severity of insomnia and depression than the self-help group, both immediately posttreatment and at 3-month follow-up (Ashworth et al. 2015). Although these studies show promising results, further studies are required to provide more evidence for the efficacy of psychotherapy and antidepressant medications in the treatment of comorbid insomnia and depression in the older population.

## Summary

Depression is one of the most prevalent mental health conditions and can affect people of all ages. The causes of depression are multifactorial, and lifestyle modification may offer a unique opportunity for safe and low-cost interventions to prevent the risks of developing depression and augment the current treatment regime of depression. Identifying and implementing effective strategies focusing on early prevention of late-life depression and management of depression in older adults are therefore an increasing public health priority for many countries facing the same issue of a growing aging population, both from the individual and societal point of view. Understanding how lifestyle choices impact on depression in older adults is essential in facilitating the establishment of effective therapeutic lifestyle change programs and guidelines for older adults. While the beneficial effect of physical activity on depressive mood in older adults is

well documented, less clear are the potential protective effects of smoking cessation, dietary change, improvement in sleep quality, and reduced alcohol consumption have on the emergence of depressed mood. Further research in this area with greater collaborative effort to standardize measures and classification, taking into consideration the effect of gender, culture, and ethnicity would be advantageous in moving forward.

## Cross-References

- ▶ [Comorbidity](#)
- ▶ [Complementary and Alternative Medicine](#)
- ▶ [Depression in Later Life](#)

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## Loneliness and Social Embeddedness in Old Age

Louise C. Hawkey  
Academic Research Centers, NORC at the  
University of Chicago, Chicago, IL, USA

### Synonyms

Social connectedness; Social isolation

### Definition

Loneliness is an unpleasant and distressing experience that accompanies a perceived deficiency in social relationship quantity or quality. Loneliness is not synonymous with objective social isolation. People can be alone without feeling lonely, and, conversely, people can feel lonely even when with many others. The subjective nature of loneliness has given rise to an alternate term for loneliness, namely, “perceived social isolation.” There is no obvious term for the opposite of loneliness, but “social embeddedness,” “belongingness,” and “connectedness” are common surrogates.

### Prevalence

Loneliness is a prevalent experience across the lifespan. Available studies conducted in developed countries indicate that as many as 40% of adults over 65 years of age report being lonely at least sometimes. Approximately 5–15% of adults of this age report feeling lonely frequently, but that figure increases to about 50% of adults 80 years and older. Chronic feelings of loneliness are experienced by 15–30% of the general population.

### Loneliness Theories

Loneliness has been approached from many perspectives (Peplau and Perlman 1982), but three approaches currently dominate its scientific study. The social needs approach, introduced by Robert S. Weiss in the 1970s, holds that social relationships serve specific functions and that the absence of a reliable attachment figure, poor social integration, few opportunities for nurturance, and other provisions of social relationships contribute to feelings of loneliness. The primary distinction made by Weiss was between social and emotional loneliness, where social loneliness reflects a lack of an engaging broader social network and emotional loneliness reflects the lack of an intimate or close emotional attachment figure.

The cognitive approach, described by Letitia Peplau and Daniel Perlman in the 1980s, holds that loneliness results when subjective evaluations of social relationships are perceived as deficient in meeting personal standards for the number or quality of social relationships. Social comparisons influence the standards for evaluation and the importance and magnitude of perceived discrepancies. From this approach, loneliness intensity can be reduced by, for example, developing new, more satisfying social relationships, altering one’s relationship standards, and developing skills to improve relationship quality in order to reduce the discrepancy between actual and ideal social relationships.

A third approach, described by John Cacioppo and Louise Hawkey in the early 2000s, holds that

loneliness is a biological signal that helps to ensure that people seek out and maintain social connections (Cacioppo and Patrick 2008). In evolutionary time, the pain of loneliness may have deterred selfish actions that would have disconnected one from the group and promoted the social connections needed to increase the likelihood of survival. In contemporary society, evidence suggests that loneliness can have maladaptive effects on cognition and behavior. The threat of isolation, actual or perceived, is sufficient to elicit implicit hypervigilance for social threat (e.g., rejection) and defensive behaviors that include greater anxiety and hostility. Implicit hypervigilance becomes manifest in attentional biases favoring negative social information and self-fulfilling confirmation biases in which negative expectations and distrust adversely affect behavior toward others (e.g., aggression). Negative behavior toward others tends to elicit negative behavior from others, thereby confirming the lonely person's negative expectations and reinforcing feelings of disconnection and loneliness. Behavioral confirmation processes help to explain why lonely individuals tend to believe that they have little control over their social contentment. This "loneliness regulatory loop" (Cacioppo and Hawkey 2009) describes how loneliness can be perpetuated and exacerbated over time. In most cases, however, loneliness functions well in motivating efforts to establish or reestablish social connections, efforts that typically cause feelings of loneliness to dissipate.

From an evolutionary perspective, it is reasonable to expect that loneliness has a heritable component. Indeed, roughly half of the variance in loneliness in the adult population has been attributed to additive genetic components (Peplau and Perlman 1982). The heritable component has been posited to include variability in sensitivity to social isolation that might result in individuals feeling more or less lonely in similar circumstances, whereas the nongenetic component includes a range of individual differences, including social cognitions, emotions, and behaviors that perpetuate loneliness.

## Measurement

Large-scale surveys often rely on a single direct question to inquire about people's feelings of loneliness. A typical question is "How often do you feel lonely?" with response options ranging from never to often/always. Such questions have been criticized, however, because societal stigma attached to admitting loneliness may bias reports downward, particularly for some groups. Men, for instance, are less likely to admit loneliness than women (Borys and Perlman 1985). For a similar reason, face-to-face interviews tend to elicit lower intensity and prevalence rates than the more anonymous methods of mailed-back questionnaires or phone interviews (Bowling 2005).

Indirect measures of loneliness avoid the inclusion of terms likely "lonely" and "loneliness" and instead ask questions pertaining to experiences associated with feeling lonely. The most widely used instruments to measure loneliness indirectly are the UCLA Loneliness Scale (Russell 1996), used predominantly in the United States, and the De Jong Gierveld Loneliness Scale (De Jong Gierveld and Kamphuis 1985), used predominantly in Europe. Both were initially developed in the early 1980s and have subsequently been validated in many populations (e.g., scores are highly correlated with self-reported feelings of loneliness). Sample items from the full 20-item UCLA Loneliness Scale include "How often do you feel isolated from others?," "How often do you feel that there are people you can talk to?," and "How often do you feel part of a group of friends?" The four response options are never, rarely, sometimes, and always. Sample items from the full 11-item De Jong Gierveld Loneliness Scale include the statements "I experience a general sense of emptiness" and "I miss having people around." The response options are "yes!," "yes," "more or less," "no," and "no!;" a reduced response scale uses only "yes," "more or less," and "no." Short-form versions of each scale have been developed (i.e., a 3-item UCLA Loneliness Scale and a 6-item De Jong Gierveld Loneliness Scale) for use in large-scale survey research. For both the UCLA and the De Jong Gierveld Loneliness scales, responses are reversed for positively

worded items before summing or averaging across all items to produce a total loneliness score. The result is a continuum of loneliness frequency or intensity. Scores on these scales are typically skewed; most people experience relatively infrequent and low intensity feelings of loneliness, but some people experience frequent and/or intense loneliness.

Loneliness intensity exhibits a U- or J-shaped function across the adult lifespan (Pinquart and Sörensen 2003). Levels are relatively high in young adulthood, diminish through middle adulthood, and increase as old age is approached, but do not surpass young adult levels of intensity until oldest old age (about 80 years and older). Overall, loneliness exhibits fairly high temporal stability, with correlations of loneliness scores ranging from 0.6 to 0.9 for periods of days to weeks and from 0.5 to 0.8 for periods of up to 5 years.

### Loneliness Dimensions

Although the UCLA Loneliness Scale was developed as a unidimensional construct and is used as a unidimensional scale, factor analyses of this scale have nevertheless revealed several dimensions. Russell (Russell 1996) confirmed a global bipolar loneliness factor but the direction of item wording (i.e., positively and negatively worded items) resulted in a two-dimensional structure. Large-scale studies incorporating exploratory and confirmatory factor analyses in young and older adults have also confirmed a global loneliness factor but have also revealed a conceptually differentiated three-dimensional structure (Hawkley et al. 2005). These dimensions have been labeled Intimate, Relational, and Collective Connectedness and are highly correlated. Intimate Connectedness reflects a deep sense of connectedness and self-worth and, relative to the other dimensions, is uniquely correlated (i.e., independently of its correlation with the other two Connectedness dimensions) with being married. Relational Connectedness reflects feelings of closeness and support in social relationships and is uniquely correlated with regular contact with close friends. Collective Connectedness reflects

feelings of group identification and a sense of belonging and is uniquely correlated with membership in a voluntary group. These results provide evidence of construct validity, but the dimensions are only partially represented by their constituent items, and subscales representing these dimensions have not been applied in research contexts.

The De Jong Gierveld Loneliness Scale can be and is used as a unidimensional scale, but was developed under the assumption that loneliness is a multidimensional construct with a social and an emotional loneliness component as articulated by Weiss (see Loneliness Theories above). During the development of this scale, items were chosen to capture the absence of an intimate relationship or close emotional attachment (emotional loneliness) and the absence of a broader group of contacts or a fulfilling social network (social loneliness). Subscale scores can be calculated for social loneliness and emotional loneliness, and research has found that these dimensions of loneliness have unique antecedents and consequences (De Jong Gierveld et al. 2006).

### Risk Factors

Variability in loneliness between individuals and within individuals over time has been associated with a variety of personality, demographic, and situational factors. *Personal characteristics* that are associated with greater loneliness include poor social skills, shyness, social anxiety, introversion, pessimism, and low self-esteem. Cross-sectional studies have shown that risk factors for loneliness severity in older age encompass several domains (Pinquart and Sörensen 2003; De Jong Gierveld et al. 2006). In the demographic domain, *age* is a weak predictor of loneliness severity and tends to be inversely correlated with loneliness until oldest old age. Longitudinal studies have the advantage of not confounding age and cohort, and results are generally consistent with cross-sectional data. When examined as the prevalence of self-reported loneliness frequency, occasional loneliness shows a U-shaped distribution, but frequent loneliness shows a relatively linear increase from

adolescence to oldest age (Yang and Victor 2011). For both loneliness frequency outcomes, however, prevalence is lowest among adults aged 30–60 years as is found when examining loneliness severity.

Studies of older (and younger) adults have found that *gender* is inconsistently associated with loneliness; some studies find men are lonelier than women, some find women are lonelier than men, and some find no difference. Question wording contributes to the gender inconsistency; as noted above, men tend to underreport when asked direct rather than indirect questions about loneliness, possibly because the stigma of loneliness is greater among men than women. *Socio-economic status* has been associated with loneliness in older adults; better education and higher income predict lower levels of loneliness. Some evidence suggests that in the United States, education and income explain higher levels of loneliness in ethnic minorities. These findings suggest that income and education represent protective resources. For instance, financial means may improve access to social opportunities and activities, and education may improve problem-solving strategies and coping skills. *Health* is consistently associated with loneliness in older adults; poorer self-rated health and more functional limitations, for instance, predict higher levels of loneliness. *Stressful events* (e.g., traumatic events in early or later life) and *perceived stress* have also been associated with greater loneliness in older age.

Individual differences in social roles and behaviors are, not surprisingly, consistently associated with loneliness. For instance, people who are *married or in a cohabiting partnership* have lower levels of loneliness than the unmarried, particularly relative to widowed or divorced individuals. Contact with children alleviates loneliness to a greater degree in formerly married than currently married older adults, and siblings and friends are particularly important in alleviating loneliness among those without a partner or children. Both of these effects suggest that specific relationship types can compensate, at least partially, for the absence of an intimate attachment figure.

The *size of individuals' social networks* is inversely associated with loneliness, as is the *composition of the network*. People with strong and weak ties in their network are less lonely than those with strong ties only, and those with purely kin networks are lonelier than those with more heterogeneous networks. Loneliness is also inversely associated with the *frequency of interactions* with close others, *frequency of attendance at religious services*, and *membership in voluntary groups and associations*. *Relationship quality* surpasses quantitative aspects of people's social behavior in the magnitude of the association with loneliness, such that closeness is inversely associated with loneliness even after adjusting for social network size and frequency of contact. Even among married individuals, marital quality matters for loneliness; people in better-quality marriages have lower levels of loneliness than people in lower-quality marriages.

Cross-sectional studies are limited, however, in that they are unable to address the causal role of risk factors in the onset and perpetuation of loneliness. Longitudinal and prospective studies are superior for causal inference, and of the few such studies, almost all have been conducted in European countries. The findings show that loneliness increases as older people experience various types of losses, including loss of a spouse, especially through widowhood; death or other loss of relatives or friends; changes in living arrangements that entail the loss of cohabitants in the household; loss of independence through institutionalization; deterioration of health; impairment of mobility, vision, and hearing; shrinking social networks; and reduced social activity.

### Health Correlates, Consequences, and Mechanisms

Transient feelings of loneliness (e.g., brief periods of perceived social exclusion or rejection) are unpleasant, but associated feelings of sadness and anxiety are typically short-lived and resolved upon recovery of a sense of social embeddedness. More intense and enduring feelings of loneliness contribute to persistent psychosocial problems

and to the gradual development and exacerbation of physiological changes that are associated with disease and death (Hawkey and Cacioppo 2010). Among psychosocial problems, loneliness is associated with greater depressive symptomatology, and increases in loneliness have been shown to predict increases in depressive symptoms over follow-up periods of a year or more. In addition, cognitive functioning is worse in lonelier older adults, and loneliness predicts more rapid cognitive decline and dementia (Cacioppo and Hawkey 2009).

Loneliness has been associated with poorer health behaviors known to affect physical, emotional, and cognitive functioning. Lonelier older adults, and chronically lonely individuals in particular, are less physically active, discontinue physical activity at a faster rate during aging, are more likely to abuse alcohol, and have a greater risk of obesity than their socially embedded peers. Sleep is also influenced by feelings of loneliness. Lonelier older adults suffer from less satisfaction with their sleep quality and greater daytime fatigue than their less lonely counterparts, even though sleep duration is comparable.

Lonelier adults report poorer health and are more likely than their less lonely counterparts to be admitted to a nursing home. Objective indices of poor health that have been associated with chronic loneliness include coronary heart disease incidence, higher rates of age-related increases in blood pressure, and functional limitations. A meta-analytic review found that risk for mortality is significantly greater among adults with impoverished social relationships (Holt-Lunstad et al. 2010). Individual studies have shown that the mortality difference tends to be most marked when contrasting chronically lonely with nonlonely or situationally lonely older adults. Although some health behaviors differ between lonely and nonlonely adults, health behaviors have not to date explained loneliness-related differences in mortality. However, some studies have found that medical status (i.e., more chronic health conditions) accounts for higher rates of mortality in lonelier older adults.

The causal mechanisms for the association between loneliness and health are unclear at present, although physiological mechanisms suggest several possibilities. Indicators of altered physiological functioning in lonelier older adults include impaired blood pressure control, dysregulation of the hypothalamic-pituitary-adrenocortical (HPA) axis, and differential expression of pro- and anti-inflammatory genes. Blood pressure is the end point of two physiological processes: regulation of blood volume (i.e., cardiac output) and resistance to blood flow (i.e., peripheral arterial resistance). In young adults, loneliness is associated with greater peripheral resistance but no significant difference in blood pressure, possibly due to local chemical compensatory processes. To the extent that heightened peripheral resistance persists over time, however, blood pressure would be expected to increase more rapidly in lonelier adults. Evidence consistent with this scenario shows that in middle and older age, blood pressure positively correlates with loneliness and increases more rapidly over time (Hawkey and Cacioppo 2010). An accelerated increase in blood pressure suggests that lonelier older adults are at greater risk for hypertension and associated cardiovascular diseases.

Loneliness has been associated with larger diurnal increases in cortisol upon awakening, possibly signifying the enhanced mobilization of energy resources in anticipation of greater daily stresses and challenges (Hawkey and Cacioppo 2010). Cortisol has anti-inflammatory properties, but only to the extent that the HPA axis is responsive to the cortisol signal. Genome-wide studies (Hawkey and Cacioppo 2010) have found evidence that genes with anti-inflammatory functions are under-expressed in lonely relative to nonlonely individuals, suggesting a deficit in the receptor mechanism that detects the cortisol signal. At the same time, proinflammatory genes are over-expressed in lonely relative to nonlonely individuals, suggesting a possible mechanism for increased rates of morbidity, particularly because the chronic health conditions of older age are known to have an inflammatory component.

## Interventions

A meta-analysis (Masi et al. 2011) reviewed the efficacy of a variety of intervention strategies that have been attempted to ameliorate loneliness. Among the 50 eligible interventions published between 1970 and 2009, only 20 used the gold standard randomized control group design. Analyses of these studies showed that the interventions had a beneficial but small effect on average and that effectiveness was moderated by the type of intervention that had been implemented. Interventions that targeted maladaptive cognitions (e.g., cognitive behavioral therapy with a social focus) had the largest effect, larger than providing social support, teaching social skills, or increasing opportunities for social contact. In studies of older age groups, however, the dominant type of intervention implemented was social support provision; only one randomized control group study implemented social cognitive training.

## Conclusion: The Future of Loneliness Research

The future of loneliness research is increasingly focused on the one hand and broader in scope on the other hand. Among the focused domains of research, the limited efficacy of extant loneliness interventions indicates that considerably more research is needed to effectively prevent and ameliorate loneliness in older adults. This is an active area of study, in part because of mounting concern about the growing population of older adults. Focused research is also indicated and underway to better understand the mechanisms through which loneliness influences health and well-being. This research may be furthered through the development of an animal model of loneliness (Capitanio et al. 2014), which would permit a greater degree of experimentation in a species with a more rapid developmental trajectory.

In the broader scheme, population-based surveys are increasingly incorporating a loneliness measure, and studies are beginning to examine whether

countries, or regions of countries, differ in mean levels of loneliness. Within Europe, older adults in Eastern European countries (e.g., Bulgaria, Russia, and Hungary) have significantly higher levels of mean loneliness than those in Western European countries (e.g., Germany, Sweden, and the United Kingdom) (Hawkley et al. 2005). Moreover, within Western Europe, older adults are lonelier in southern and central European countries (e.g., Spain, Greece, and Italy) than they are in northern countries (e.g., Switzerland, the Netherlands, and Denmark) (Fokkema et al. 2012). An analysis of World Values Survey data from 17 countries (Stack 1998) found that across the adult age range, people in Italy and Japan report more frequent intense loneliness than those in the United States and Canada, for instance. Explanations for national differences in loneliness are theorized to include differences in cultural norms; societal wealth, inequities, and welfare; health; and social engagement. Research in this area will foster an understanding of contextual factors that may serve as effective intervention targets to prevent or reduce loneliness and improve quality of life.

Finally, as panel data accumulate in population-based surveys, it will be possible to trace loneliness trajectories across the lifespan and whether these trajectories differ among cohorts. This information will be useful in distinguishing among subgroups whose loneliness onset is early versus later in life and who do or do not recover from loneliness once it is triggered. These subgroups may benefit from different types of interventions. The relevance of loneliness for physical and mental health, and well-being for the individual, and for the financial cost to society of caring for a growing number of lonely older adults highlights the importance of understanding how to alleviate loneliness.

## Cross-References

- ▶ [English Longitudinal Study of Aging \(ELSA\)](#)
- ▶ [Health and Retirement Study, A Longitudinal Data Resource for Psychologists](#)
- ▶ [Social Cognition and Aging](#)
- ▶ [Social Group Interventions for Older Adults](#)

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## Longitudinal Aging Study Amsterdam

Marja Aartsen<sup>1</sup> and Martijn Huisman<sup>1,2,3,4</sup>

<sup>1</sup>NOVA Norwegian Social Research, Oslo and Akershus University College, Oslo, Norway

<sup>2</sup>EMGO Institute for Health and Care Research, VU University Medical Center, Amsterdam, The Netherlands

<sup>3</sup>Department of Epidemiology and Biostatistics, VU University Medical Center, Amsterdam, The Netherlands

<sup>4</sup>Department of Psychiatry, VU University Medical Center, Amsterdam, The Netherlands

## Synonyms

Cohort sequential study; Older adults; Survey; The Netherlands

## Definition

This entry describes the general outline of the Longitudinal Aging Study Amsterdam (LASA) and highlights some recent outcomes. LASA is the first ongoing longitudinal study in the Netherlands specifically designed to study determinants of the autonomy and well-being of older persons. In LASA, four domains of functioning are distinguished: cognitive, social, emotional, and physical. The study focuses on predictors of change in these domains, on trajectories of functioning, on the interrelationship between the four domains of functioning, and on the consequences of change in functioning for the use of formal and informal care and well-being.

## Introduction

One of the biggest triumphs of mankind is the increased longevity of human beings. The life expectancy doubled since 1850, while fertility rates decreased. Consequently the population of the Netherlands is aging, just like that of many

other developed countries. A worrisome outcome, however, is a misbalanced dependency ratio. It is predicted that for every person who is not working, only two will be working in 2030 (Statistics Netherlands 2013). This undeniably puts the sustainability of pensions systems, social security systems, and health care provision under pressure. In the late 1980s of the last century, policy makers in the Netherlands became increasingly aware that maintaining independent functioning, a high quality of life, and participation in society were one of the major strategies to combat these threats. In order to develop policies for older people who are in need of support and care, scientific insight into the aging process was needed. In 1991 the Longitudinal Aging Study Amsterdam was initiated to fulfill this need.

### Aim of LASA

In line with Havighurst's notion that "one of the major aims of gerontology is to provide society and individuals with advice on the making of societal and individual choices . . ." (Havighurst 1961), LASA is essentially a scientific study aiming to collect scientific insights on the multidimensional nature of the aging process, but with a very practical purpose. While LASA is feasible for thorough and in-depth mono-disciplinary research, it stands out among many longitudinal studies on aging for its potential to conduct multidisciplinary research, which facilitates cross-fertilization between scientific disciplines, the combination of methods, and the integration of divergent perspectives. Interdisciplinary research enables a holistic approach and is an important means to a life course perspective on aging.

LASA was funded in 1991, originally as a 10-year prospective longitudinal study. Participants aged between 55 and 85 years old were invited to participate in LASA for three measurement cycles. Additional funding in the following years allowed for continuation of the study until today, with a follow-up measure being conducted about every 3 years. Moreover, the sample was enriched with additional cohorts of

respondents aged 55–65 years old in 2002 and 2012. Recently, a cohort of Turkish and Moroccan older people (LASA Wave 3 M,  $n \approx 478$ ; at the time of writing, data collection is still to be finalized) was recruited for the study. Currently, the eighth measurement cycle is in preparation and will be conducted in 2015/2016.

At the outset of LASA, the following central research questions were formulated:

1. Which changes over time take place in the physical, cognitive, emotional, and social components of functioning in older persons?
2. Which predictors of change can be recognized in these components of functioning?
3. How are changes in the four components of functioning interrelated?
4. What are the consequences of changes in functioning in terms of contributions to society, the necessity of adjustment, and the need of care?

These questions are based on the assumptions that aging is a process, involving multiple aspects of cognitive, social, emotional, and physical functioning important to maintain individual autonomy and self-evaluations of functioning. The consequences of improvements and declines in functioning and the resulting (in)dependence can be expressed in terms of autonomy and well-being, contributions to society, and the need for health and social services (Deeg and Westendorp-de Serière 1994).

### The LASA Sample and Data Collections

The LASA participants were initially recruited for the "Living arrangements and Social Networks of older adults (LSN)" study (Knipscheer et al. 1995). LSN utilized a nationally representative sample ( $N = 3,805$ ) stratified according to year of birth and sex and consisted of people born between 1908 and 1937. The LSN sample was randomly taken from the registers of 11 municipalities in 1991 in the West (Amsterdam and surroundings), North East (Zwolle and surroundings), and South (Oss and surroundings) of the Netherlands (Fig. 1). These areas are culturally distinct



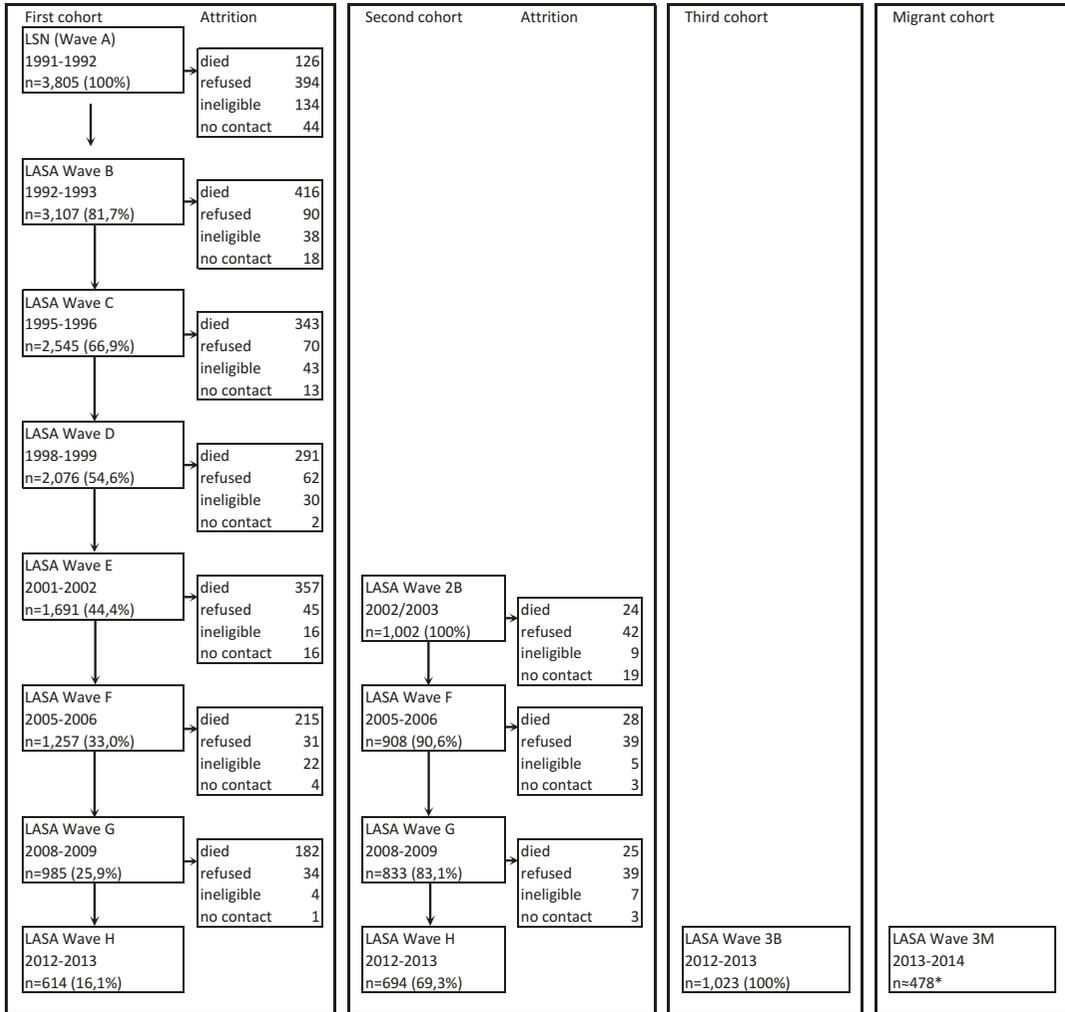
**Longitudinal Aging Study Amsterdam, Fig. 1** Map of the Netherlands, with black dots representing the 11 municipalities from which the initial LASA samples are drawn

and consist of one medium to large size city and two or more rural municipalities that border on the city. The initial response rate was 60% and the cooperation rate 62%. The response rate is calculated according to guidelines of the American Association for Public Opinion Research (2015) and reflects the number of complete and partial interviews with persons divided by the total number of eligible persons in the sample, plus a fraction of those persons who were in the sample but of whom eligibility could not be determined. The cooperation rate is defined as the proportion of completed interviews in the number of contacted eligible persons. On average, 11 months after the LSN interview, the participants were approached to participate in the first LASA cycle, with a response rate of 85% and a cooperation rate of 89%.

The first LASA data collection (Wave B) took place in 1992/1993 ( $N = 3,107$ ), and there were follow-up measures in 1995/1996 (Wave C), 1998/1999 (Wave D), 2002/2003 (Wave E), 2005/2006 (Wave F), 2008/2009 (Wave G), and 2012/2013 (Wave H). The mean cooperation rate for the follow-up observations since LASA

baseline was 95%. Additional cohorts of respondents aged 55–65 were added to the LASA sample in 2002/2003 and 2012/2013 to study age-period-cohort effects. The first additional cohort (years of birth 1938–1947;  $N = 1,002$ ) was recruited 10 years after the first LASA cycle (Wave 2B), and roughly the same measurement instruments were applied so that cohort differences in physical, cognitive, emotional, and social components of functioning can be studied. In the subsequent waves, respondents from this second cohort were combined with those from the original one (Fig. 2). A third cohort of 1,023 respondents was added in 2012/2013 (Wave 3B) and consists of respondents born between 1948 and 1957. These respondents will be added to respondents from previous cohorts in subsequent measurement waves. Attrition between Wave A and Wave H for the first cohort is mainly due to death ( $n = 1,930$ , 62%), followed by refusal ( $n = 726$ , 9%), ineligibility ( $n = 287$ , 9%), and no contact ( $n = 98$ , 3%). Attrition between Wave 3B and Wave H for the second cohort is due to refusal ( $n = 120$ , 12%), death ( $n = 77$ , 8%), no contact ( $n = 25$ , 3%), and refusal ( $n = 21$ , 2%) (for more information on the cohort profile, see (Huisman et al. 2011)).

Data are collected in the homes of the participants in three different data collection modes. In the main face-to-face interview, various sociological, psychological, and demographic variables are assessed. At the end of the interview, respondents are invited for a medical interview, and if consent is provided, the interview takes place within a few weeks after the main interview. In this medical interview, several medical and cognitive tests are conducted, among which measures of physical performance, such as a walking test, tandem stand test, a test of upper extremity performance, and a chair-stand test, and cognitive performance, such as memory, problem solving, and processing speed. Occasionally blood samples are taken. After the main face-to-face interview, respondents are also asked to fill in a written questionnaire with additional questions on aspects such as quality of life, norms, values, sleeping habits, and questions about the partner.



\* at the time of writing of this chapter, data collection is still to be finalized

**Longitudinal Aging Study Amsterdam, Fig. 2** Survival and participation in the LASA study

The face-to-face and the medical interviews take about 90–110 min each. If participants are too frail to sustain a full regular interview or refuse to do so, they are invited for a telephone interview. Telephone interviews take considerably less time (about 15 min) than regular interviews. If a telephone interview with the LASA participant is not possible, a proxy of the participant, for example, a family member or caregiver, is asked for a telephone interview. Participants who are interviewed by telephone are not asked to participate in the medical interview,

nor are they asked to complete the self-administered questionnaire in that particular measurement wave.

Next to the regular LASA-cycles, more than 25 side studies have been completed with additional data collections among a selection of LASA participants, all with high response rates.

For example, approximately 300 LASA participants have filled in a questionnaire on depressive symptoms every 5th month during 6 years, to capture the potential fluctuating course of depression. Other side studies with additional data

collections focused on the structure and function of the social network and loneliness; adaptation to widowhood; precursors and consequences of (recurrent) falling; religiousness and mood; lifestyle factors such as physical activity, sports, and diet; and end of life.

## Data Quality

Of crucial importance for all longitudinal surveys are a high-quality data infrastructure, reliable data, a fixed set of validated measurement instruments, and a low nonresponse rate. Several strategies are applied in LASA to optimize the circumstances for a high data quality. With respect to the collection of data, special attention is paid to the registration of the interviews and the selection and training of the interviewers of LASA. The interviews are computer assisted (CAPI on notebooks) to facilitate the interview and reduce data entry errors. Interviews are tape recorded for later inspection. Interviewers who live in or near the municipalities in the study are recruited, since they can understand or speak the dialect spoken in the region. Furthermore, interviewers are thoroughly trained to be sensitive to the needs and wishes of respondents, especially with regard to monitoring signs of fatigue and responsiveness and changes in mood. Responding adequately to such signs is crucial for minimizing respondent burden (Robins et al. 1981), which in turn is crucial for participation in the study. To increase control over the data collection and to enhance data quality, the staff has organized the data collection and data storage since 1991 under their own management. Issues of reliability and validity are further addressed by using a large set of validated measurement scales. Equivalent interviews are applied during the seven measurement cycles so that observed within-person change can be related to changes in the intended construct. A specific concern for longitudinal studies on aging is that attrition is considerable. Therefore, men and the oldest participants were oversampled at the start of the study to ensure that there would be reasonable numbers of very old men, even after long periods of follow-up.

The quality of the data, the data collections, and the studies conducted with LASA data are further enhanced by means of regular meetings with an external and independent advisory board, consisting of high-profile international experts in the scientific disciplines and on subtopics that LASA set out to study. This advisory board assists LASA in fulfilling its purposes by providing advice on the research agenda, the quality of data collection and data infrastructure, and the quality of its research by examining indicators of output, including scientific publications, research grants, (inter)national collaborative networks, and knowledge valorization. The long-term viability of the data has been judged to be of good quality, based on an assessment of Data Archiving and Networked Systems (DANS), which resulted in a DANS Data Seal of Approval in 2013.

## Measurements

Detailed information of the measurements used in the LASA can be found on the LASA website ([www.lasa-vu.nl](http://www.lasa-vu.nl)) and elsewhere (Huisman et al. 2011). In short, the following domains are assessed: physical, emotional, cognitive, and social functioning and the use of health care services. Measures of physical functioning include self-reported chronic diseases, functional limitations, indicators of physical performance based on performance tests (e.g., walking speed, chair stand, balance test, cardigan test), lung functioning, grip strength, anthropometry, pain and perception (hearing, vision), and lifestyle (diet, physical exercises, alcohol use, and smoking). Emotional functioning is assessed by means of diagnostic tests (DIS (Samelson et al. 2008), CIDI (Wittchen 1994)) and screening instruments including level of depressive symptoms (CES-D (Radloff 1977)), symptoms of anxiety (HADS-A (Zigmond and Snaith 1993)), evaluation of life, sleep problems, and aspects of personality, such as mastery (Pearlin Mastery Scale (Pearlin and Schooler 1978)), self-esteem (Rosenberg Self Esteem Scale (Rosenberg 1965)), and neuroticism (Dutch Personality Questionnaire (Luteijn et al. 1975)). Cognitive functioning is evaluated

by means of general cognitive functioning (MMSE (Folstein et al. 1975)), information processing speed (letter-letter coding task (Savage 1984)), episodic memory (15-words task (Saan and Deelman 1986)), memory complaints, and problem solving (Raven's colored progressive matrices (Raven 1995)). Measures of social functioning include among others social network (Van Tilburg 1998) (e.g., size, composition, social support obtained from and given to network members), intergenerational relationships, loneliness (De Jong Gierveld loneliness scale (De Jong Gierveld and Kamphuis 1985)) aspects of participation in productive and cultural activities, and in more recent waves the use of Internet. Demographic information comprises among others year of birth, gender, level of education, work history, age of retirement, level of urbanization, and housing history. In more recent waves, detailed information is collected about the use of curative and long-term care and characteristics of the partner.

## Output and Highlights

Since the beginning of LASA 56 PhD dissertations, 16 reports to the ministry and more than 750 scientific papers have been published, the majority in peer-reviewed scientific international journals (<http://www.lasa-vu.nl/publications/publications.htm>). LASA staff members have regular meetings with representatives of the Ministry of Health, Welfare and Sports. The purpose of these meetings – usually about four times a year – is to develop research questions to address current policy concerns. The large number of respondents, the long follow-up information on a broad range of indicators, the multidisciplinary approach, and the cohort-sequential design allows LASA to answer many policy-relevant and fundamental questions on aging. Below, some recent publications are highlighted that are of particular interest to geropsychologists to illustrate LASA's many potentials.

Cognitive functioning has been assessed on all waves of LASA with a variety of neuropsychological tests on fluid intelligence (Horn and Cattell

1967) such as memory, learning, information processing speed, and problem solving. In contrast with crystallized intelligence, these functions show increasing inter- and intraindividual differences in functioning over time. Thirteen-year changes in processing speed, memory, nonverbal reasoning, and general cognitive functioning found support for the processing speed hypothesis (Salthouse 1996), indicating that age-related reduction in information processing speed accounts for impairments in other cognitive functions (Robitaille et al. 2013).

Although processing speed plays a central role in many age-related cognitive differences, multidisciplinary studies of LASA found that other domains of functioning and factors earlier in life also relates to age-related decreases in cognitive functioning. For example, mental health predicts both decline of general cognitive functioning and information processing speed, independent of relevant covariates (Van den Kommer et al. 2013). Emotional support, operationalized as talking with someone about personal thoughts and feelings, is related to better cognitive functioning (Ellwardt et al. 2013) and a complex network that consists of relations with a variety of contacts, such as family members, neighbors, and friends, and helps delay the onset of cognitive decline (Ellwardt et al. 2015). This fits to the idea that a stronger engagement of older adults in social activities and greater embeddedness in networks buffer cognitive decline and lower risks of dementia. Korten and colleagues examined whether childhood adversity might cause biological or psychological vulnerability, which is associated with both depressive symptoms and cognitive decline in later life. Their study showed that persons who experienced adverse childhood events had a faster 10-year decline in processing speed but only when depressive symptoms were experienced. Persons with more recent negative life events showed slower processing speed at baseline but no faster decline (Korten et al. 2014).

Studies on depressive symptoms are another central theme in LASA. One study recently investigated the relation between depression and physical health, in particular the risk of stroke. The authors argue that the mixed findings on the risk

of depression on incident stroke may be explained by differences in vascular disease and neuroticism, as only in persons with low levels of neuroticism depression is predictive for future stroke (Marijnissen et al. 2014). Studies on associations between depressive symptoms and a variety of demographics, social network, and personality characteristics found that a high need for affiliation is associated with depression in women but not in men. Lack of a partner in the household and having a small network predicted onset of depression in men but not in women. In respondents with high affiliation need and low social support, depression rates were higher, with men being more often depressed than women (Sonnenberg et al. 2013).

Recently, LASA has entered a new field of study in older adults, that is, the study of attention deficit hyperactivity disorder (ADHD) in older adults. Despite the abundance of studies on ADHD in younger adults and children, there is virtually no knowledge of the prevalence and correlates of ADHD in older adults. Studies by the LASA team found a prevalence of 2.8% in the general population of older adults, which demonstrates that ADHD does not fade or disappear in adulthood and that it is a topic very much worthy of further study (Michielsen et al. 2012). The association between ADHD and depression, and the potential mediating role of personality characteristics was further examined in a series of studies. It was revealed that associations between ADHD and depressive symptoms exist, which is partly due to the accumulation of adverse life events (Semeijn et al. 2015) and differences in mastery and self-esteem (Michielsen et al. 2013)

The study on aging is an enduring and challenging puzzle on the interrelations between changes at the cell level, the individual level, the group level, and even the societal level (Bengtson and Allen 1993) and the cumulative advantages and disadvantages (Dannefer 2003) of events and behaviors during the life course. Thanks to the addition of new cohorts of people aged 55–65 years 10 and 20 years after the beginning of LASA it will be possible to study also consequences of changes in the societal context of LASA. One study on the social-emotional domain in

LASA lends support to the notion that the societal level may exert important influence on individuals. This study revealed that divorcees in 2002 are less socially lonely than in 1992, with a smaller and nonsignificant further decrease in loneliness in 2012 (Van Tilburg et al. 2014).

The recent addition of a cohort of older Turkish and Moroccan immigrants will further add to our understanding of the sociocultural context of aging, as well as of the generalizability of results of studies on physical, mental, cognitive, and social functioning of older adults. LASA possesses a gold mine of data that has enabled – and continues to do so – the investigation of the consequences of improvements and declines in functioning and the related and consequent levels of autonomy and well-being, contributions to society, and the need for health and social services.

## Funding

LASA has been financially supported by the Ministry of Health, Welfare and Sports. The ministry has funded the regular measurement cycles since 1992, as well as the inclusion of the new cohort of respondents in 2002. The ministry's funding covers costs of interviewers, data management, data collection management and fieldwork coordination, secretarial support, and overall management, with some additional funding for research to investigate specific topics of interest to the ministry. In 2011, additional funding was obtained from the Netherlands Organisation for Scientific Research (NWO), which allowed LASA to include again a new cohort of respondents aged 55–64 years in 2012 and a cohort with respondents from Turkish and Moroccan migrant groups for the first time. Researchers and PhD students working with LASA data are usually hired on the basis of additionally acquired research grants.

## Cross-References

- ▶ [Activity Theory, Disengagement Theory, and Successful Aging](#)
- ▶ [Age-Related Changes in Abilities](#)

- ▶ Cognition
- ▶ Crystallized Intelligence
- ▶ Loneliness and Social Embeddedness in Old Age
- ▶ Marriage and Divorce in Later Life

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## Marriage and Divorce in Later Life

Tianyuan Li

Department of Psychological Studies and Centre for Psychosocial Health, Hong Kong Institute of Education, Tai Po, New Territories, Hong Kong, China

### Synonyms

Intimate relationship; Later adulthood; Legal separation; Marital relationship; Older adults; Spouse

### Definition

Marriage is defined as the legally recognized union of two people as partners of each other in an intimate relationship, while divorce is defined as the legal dissolution of a marriage. Marriage is one of the important relationships in human adulthood. Spouses in long-term marriages have accompanied each other for decades and have a strong influence on each other's lives. This entry considers changes in marital quality across adulthood, the characteristics and special challenges for marriage in later life, and the influence of divorce on the lives of older adults.

## Change of Marital Quality Across Adulthood

Marriage is a process. A first step to understand marriage in later life is to understand its history. Many studies have investigated how marital quality changes across adulthood. The family life cycle theory (Duvall 1957) divides the whole course of marriage into eight stages mainly based on the age of the eldest children in the family. The eight stages are beginning families, families with infants, families with preschool children, families with school-age children, families with teenagers, launching families (i.e., families that start to have grown-up children leaving the household), empty nest families, and families after retirement. Research has shown that marital quality varies across different stages in the family life cycle, largely following a U-shaped curve (Rollins and Cannon 1974). Marital quality is the highest in the first stage followed by a deep drop after the first child's birth, and starts to bounce back in later life when the children are leaving the household.

Critics on the family life cycle theory argue that the theory relies too much on childrearing, which is only one of the tasks for a marriage. The theory also cannot be applied to a growing population of couples who choose not to have children in modern societies. Thus, later studies have examined changes in marital quality over the duration of marriage instead of focusing on the

family life cycle. These too find a similar U-shaped pattern (Glenn 1990). Marital quality drops from the beginning to middle adulthood and levels out in later adulthood. Parents and nonparents show a comparable decline in marital quality in the early years of marriage (Kurdek 1993), suggesting that the change of marital quality is not solely due to the presence of children.

However, the increase in marital quality in later life is mostly identified in cross-sectional studies and is challenged by longitudinal findings. For example, Van Laningham and colleagues (2001) found that marital quality continued to decline in later life over a 17-year period, suggesting that the previously identified bouncing back of marital quality in later life may just be an artifact due to natural attrition and cohort effects. When seven different cohorts of couples were examined separately, they all reported a steady deterioration in marital quality over the 17-year period (VanLaningham et al. 2001).

More recent studies shed new light on this debate about the developmental trajectory of marital quality. This emerged when researchers started to explore categorical differences in how marital quality changes across adulthood among different types of couples. Using 20-year longitudinal data, Kamp Dush and colleagues (2008) found that couples can be divided into three categories based on their overall marital satisfaction. For couples who were high in overall level of satisfaction, their satisfaction level remained largely stable across the 20-year period. For those with a medium or low level of satisfaction, the developmental trajectory of their marital satisfaction did demonstrate a U-shaped curve with increasing marital quality in later life. A similar but reversed pattern was identified for marital conflict. Couples with relatively high or medium levels of marital conflicts demonstrated a longitudinal steady decline in marital conflict in later life (Kamp Dush and Taylor 2012). Moreover, initial life happiness, shared decision-making, and greater involvement of husband in housework were important factors that determined couples' membership in these three latent groups.

Thus, the current conclusion is that couples may differ qualitatively from each other in their initial level of marital quality and the trajectory of marital

quality changes. Nonetheless, most couples experience relatively stable or slightly enhanced marital quality in later life compared with middle adulthood. Some possible reasons for the sustained, if not improved, marital quality in later life are introduced in the next section, together with the special challenges faced by older couples.

### **Characteristics and Special Challenges for Marriage in Later Life**

According to the socioemotional selectivity theory (Carstensen 2006), older adults face a limited future, so they do not need to suffer for now to prepare for the future. Instead, older adults tend to focus on, and enjoy, the present. Thus, emotional meaningful goals and maximizing enjoyable affective experiences in the present are prioritized by older adults. As one of the key close social relationships, marital relationship represents a major source of emotional meaningfulness. Research suggests that older adults experience a more positive pattern of marital interactions in general.

For example, Lang and Carstensen (2002) have found that a limited future time perspective was related to higher emphasis on emotion-regulatory goals, which was in turn related to better social satisfaction and less interpersonal stress. In another study, researchers have asked younger and older adults to report their interpersonal experience on a daily basis, including how much interpersonal tension they encounter daily and how much stress these tensions bring (Birditt et al. 2005). Results indicated that older adults reported a similar amount of daily interpersonal tension as did younger adults. However, older adults felt less stressed and were less likely to experience arguments as the result of interpersonal tension. This suggests that older adults' better social satisfaction is not due to fewer problems in their relationships but due to more efficient management of interpersonal problems.

In dealing with relationship-related problems, older adults tend to adopt a mixture of active and passive strategies (Blanchard-Fields 2007). On the one hand, they use primary control strategies (e.g., discussion) to actively solve problems just as

younger adults do; on the other, older adults engage in more secondary control strategies (e.g., emotional regulation) compared with younger adults. These emotion-regulatory strategies do not tackle the interpersonal problems directly but help people to maintain more positive affect facing these problems. Such passive strategies can be an effective compromise for older adults when the problem is very difficult, if not impossible, to solve in a limited time frame. With greater flexibility in strategy choice and more adoption of passive strategies, older adults appear to be more effective in dealing with interpersonal problems and keeping a relatively positive emotional state at the same time.

Older adults' emphasis on emotional meaningful goals and effectiveness in handling interpersonal problems lay the foundation for more positive marital interactions in later life. Several studies have compared older and middle-aged couples' behaviors and physiological responses while discussing marriage disagreements. Compared with their middle-aged counterparts, older couples felt less negative affect during the discussion and gave more positive evaluations for their partner after the discussion (Smith et al. 2009a). Their cardiovascular system was also less aroused during the conflict discussion (Smith et al. 2009b). This is not due to decreased sensitivity of the older adults' physiological system as older couples were found to be more physiologically responsive than middle-aged couples while discussing a collaborative topic. Rather, reduced physiological arousal during conflict discussion may reflect older couples' greater acceptance of existing marital problems and better management of affect in the presence of conflicts. When couples' dialogue of the conflict discussion were analyzed, older couples were found to use more pronouns that were inclusive of the couple (e.g., *we*), and this was related to better emotional experiences and reduced physiological responding during the discussion (Seider et al. 2009).

To conclude, dyadic interaction between older couples appears to be more positive and constructive than that between middle-aged couples, which can be one of the reasons that explains the sustained or enhanced marital satisfaction in later life.

Nonetheless, marriage in later life also faces some specific challenges. For example, older couples need to adjust to one or two spouses' retirement together. In general, retirement does not bring substantial changes in marital satisfaction. Couples may experience an initial drop in marital satisfaction after retirement but will usually recover after a few years. However, detailed dynamics in couples' interactions do change after retirement (Trudel et al. 2008). Older couples with two spouses both working or both retired report higher satisfaction than those with one spouse retired and the other one still being employed. The mismatch of couples' working status may cause the husband and wife to have different priorities in life and this, in turn, creates tensions and marital conflicts in regard to time management, division of labor, and so on. When both spouses in a couple retire, they tend to spend more time together and engage in more housework or other tasks that used to be the responsibility of their partner. Thus, there is less gender differentiation in marriage after retirement (Szinovacz 2000). Another factor identified as influencing marital satisfaction after retirement is the shift in power balance between the couple. If one spouse becomes less influential in marital decision-making after retirement, their marital satisfaction will be impaired (Szinovacz and Davey 2005). Moreover, as marital relationship usually becomes the major interpersonal relationship in people's lives after retirement, a well-functioning marriage can actually provide the necessary social support and help that individuals need to better adjust to retirement (Wang et al. 2011).

Besides adjustment to retirement, many older couples also face the deterioration of one's own or the partner's health. Older age is inevitably related to higher risks of different types of chronic diseases and other health-related problems. Spouse usually becomes the primary caregiver of their partner. The addition of caregiving demand places a significant stressor for marriages in later life, and marital quality may suffer as a consequence. In fact, one's marital satisfaction is affected more by the spouse's health than one's own health (Yorgason et al. 2008). It is the caregiver who takes up most of the challenges brought by

chronic illnesses. Research has shown that caregiving demand is related to a heightened risk for the caregivers' own physical health. In a 4-year longitudinal study, the mortality rate of older adults who reported to be stressful caregivers was 63% higher than that of those who were not caregivers (Schulz and Beach 1999).

Nonetheless, older couples tend to cope with the caregiving situation better than their younger counterparts. Older couples' marital satisfaction was less affected by spouse's general health decline compared with younger couples (Yorgason et al. 2008). One possible reason for such age differences may be that younger couples have more life tasks to deal with in addition to the health problem, such as working and childrearing. The cumulative stress can be more detrimental to their marital relationship. Meanwhile, older couples may be more accepting of the illness and use more emotion-regulatory strategies to cope with the adversity. For example, compared with younger couples, older couples with one spouse diagnosed with Parkinson's disease demonstrated more mutuality in their interactions and reported finding more meaning in the coping process (Carter et al. 2010). Many older couples also report sharing the responsibility to manage the illness and trying to focus on the positive side of life despite the illness (Yorgason et al. 2010).

More importantly, other than being susceptible to the detrimental influence of health deterioration, marital quality can be an important resource that helps older couples stay healthy and survive under the stress of chronic diseases. For example, more negative marital experience was related to faster longitudinal subjective health decline, especially for older couples (Umberson et al. 2006). High marital quality also helps to attenuate the association between disability and loneliness for older adults (Warner and Kelley-Moore 2012). Thus, older adults' better marital interactions can also support them to handle chronic health problems more effectively.

To conclude, because of older adults' focus on emotional meaningful goals and close relationships, older couples demonstrate a generally positive pattern of marital interaction. While being threatened by some specific difficulties in later

life, such as transition to retirement and decline of physical health, a well-functioning marriage helps older couples to survive these challenges. However, not all marriages last over a lifetime, even for long-term marriages. The next section introduces the rising trend of divorce in later life and how it influences the divorced older adults' lives.

## **Divorce in Later Life and the Influences**

Duration of marriage is negatively related to the probability of divorce (Arland and Rodgers 1987; Brown and Lin 2012). Most divorces happen in the early years of marriage. Divorce is less likely in later life partly because older couples have more positive dyadic interactions as reviewed above. On top of that, older adults usually face greater barriers to leave their marriage. The spouses may be more interdependent socially, financially, and emotionally after being in a long-term marriage. Older adults may also face a more limited pool of available alternatives for a potential future relationship. According to the Investment Model of Commitment (Rusbult et al. 1998), greater barriers to leave and limited alternatives both lead to higher commitment to the current relationship and lower possibility of marital dissolution.

Despite these protecting factors of older adults' marriage, recent statistics show that there is a rapid increase in divorce for individuals aged 50 years and above (i.e., "gray divorce"). Based on nationwide samples of the United States, Brown and Lin (2012) reported that the divorce rate for people aged 50 years and above has doubled from 1990 to 2010. The "gray divorces" constitute about one quarter of all the divorces in 2010. The unprecedented population aging is one of the reasons for the increased number of divorces in later life. As the proportion of older adults in the population increases, older adults are also taking up a growing share of the divorce population. Moreover, improved education and better working opportunities for women grant more independence and freedom for wives to end a marriage and stay financially viable after the divorce. Most societies also become more tolerant of divorce. Marriage is considered less as a lifelong institution but more as

one of the relationship statuses. As a result, a larger number of older couples are in remarriages rather than first marriages. All these changes in recent years make divorce a more plausible choice for older adults (Brown and Lin 2012).

Compared with younger couples, marital happiness is found to be a stronger predictor of older couples' divorce (White and Booth 1991). Given the greater barriers and limited alternatives for divorce, older adults rely more on marital happiness to decide whether to end their marriage. This is consistent with the argument of socioemotional selectivity theory that older adults prioritize the emotional meaningfulness of a relationship. A recent qualitative study investigated older couples' divorce based on in-depth interviews (Canham et al. 2014). The reasons of divorce in later life are quite complex. Some older adults thought their marriage was a mistake from the beginning, while others enjoyed the beginning years of the marriage but the relationship stopped working because of change in oneself or their partner. Like younger couples, destructive communication, physical or emotional abuse, and unfair division of household labor led to the deterioration of the marriage, but many older adults reported delaying divorce because of concern for the children. Financial concerns and fear of being alone were also factors that prevented some people from divorcing earlier.

No matter why older couples choose to divorce, it has a substantial impact on their lives. Research has shown that divorced individuals have more health problems and higher mortality rates compared with those in an intact marriage (Dupre et al. 2009). Longer marriage duration is found to be the strongest factor that predicts lower mortality rate for both men and women. Married individuals' survival rate after major surgeries is also higher than those who have divorced (Idler et al. 2012). As divorce is becoming more acceptable in recent decades, studies have examined whether the detrimental impact of divorce on health is ameliorated in recent years. However, results suggest that differences in self-rated health between married and divorced individuals increased from 1972 to 2003 (Liu and Umberson 2008). Whether divorce is socially acceptable or

not, the immediate support offered by a spouse seems to have indispensable effects on health maintenance.

The picture is slightly different when it comes to enduring unhappy marriages. As noted earlier, some divorces in later life are due to long-term unhappiness but have been delayed for various reasons. Staying in a long-term unhappy marriage was found to be even more harmful to health than a divorce (Hawkins and Booth 2005). Contrary to their younger counterparts, individuals who divorce in later life did not experience elevated depressive symptoms after the divorce (Pudrovskaya and Carr 2008), which may be partly due to the feeling of relief and freedom after stepping out of the troublesome marriage.

Another area that is influenced by divorce in later life is the social network of the divorced partners, especially the relationship with their children. While quality of parent-child relationship before the divorce is a significant predictor of the relationship quality after the divorce, different studies consistently find that divorce in later life has a greater influence on fathers' relationships with their adult children than mothers' (Kalmijn 2007; Shapiro 2003). Divorced fathers are less likely to live with an adult child, have reduced contact with their adult children, and receive less support from their adult children. All the impacts are lessened or even reversed for mother-child relationship. In other words, men's social network is more vulnerable after later-life divorce than women's.

## Conclusion

This entry considered marriage changes in later life and the general interaction pattern between older couples. Marital quality is sustained in later life. Because of a heightened focus on the emotional meaningfulness in life and more flexible use of effective strategies to deal with interpersonal problems, older couples demonstrate relatively positive dyadic interactions compared with their younger counterparts.

Supportive marital relationship also helps older adults to deal with various challenges in later life, including adjustment to retirement and

taking care of chronic health problems. On the other hand, as the result of population aging and increasing social acceptance of divorce, a growing number of couples choose to divorce in later life. While the detrimental effect of divorce on well-being seems to be alleviated after a long-term unhappy marriage, divorce in later life still impairs older adults' relationship with their adult children, especially for men.

The current entry does not cover remarriage, cohabitation, and bereavement in later life, which are also important issues in regard to older adults' intimate relationship. Moreover, as the legislation of same-sex marriages has been introduced in more and more jurisdictions, whether and how the above findings about older couples, especially those regarding gender differences, can be generalized to homosexual couples needs further investigation. Last but not least, empirical research that specifically focuses on older adults' marriage and divorce, especially longitudinal investigations, is still lacking. While the aging population is growing rapidly across the world, more future research is needed to further understand marriage and divorce in later life, and how they contribute or undermine older adults' well-being.

## Cross-References

- ▶ [Age-Related Positivity Effect and its Implications for Social and Health Gerontology](#)
- ▶ [Late Life Transitions](#)
- ▶ [Motivational Theory of Lifespan Development](#)
- ▶ [Social Connectedness and Health](#)
- ▶ [Social Support and Aging, Theories of](#)
- ▶ [Socioemotional Selectivity Theory](#)
- ▶ [Stress and Coping in Caregivers, Theories of](#)

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## Medication-Related Issues in Later Life

Cik Yin Lee<sup>1,2</sup>, Christine Beanland<sup>1</sup>,  
Rohan A. Elliott<sup>3,4</sup>, Shinduk Lee<sup>5</sup> and  
Nicole E. Pardo<sup>6</sup>

<sup>1</sup>Royal District Nursing Service (RDNS) Institute, Melbourne, VIC, Australia

<sup>2</sup>Centre for Medicine Use and Safety, Monash University, Melbourne, VIC, Australia

<sup>3</sup>Monash University Centre for Medicine Use and Safety, Melbourne, VIC, Australia

<sup>4</sup>Austin Health Pharmacy Department, Melbourne, VIC, Australia

<sup>5</sup>Texas A&M Health Science Center, School of Public Health, College Station, TX, USA

<sup>6</sup>Remind Technologies Inc., Houston, TX, USA

## Synonyms

Medication-related problems, medication management problems, medication use problems,

medication-related risk factors, medication safety, adverse medication events, older people, older adults, elderly, seniors

## Definition

‘Medication-related issues in later life’ refers to the safety aspects associated with medication use by older persons. This can be related to individual, medication, health professional and healthcare system factors, with examples of strategies provided to assist older persons in managing their medications safely and effectively.

## Introduction

The prevalence of most chronic diseases, such as heart disease, diabetes, and dementia, increases with age. As a result of population aging, the global burden of chronic diseases (see “Definition”) is projected to increase from 47% in 2002 to 60% by the year 2020 (Epping-Jordan et al. 2004). Medications, including prescription, over-the-counter, and complementary preparations, are commonly used for preventing, treating, and managing symptoms and disease states in older people (Simonson and Feinberg 2005; Elliott and Booth 2014).

The availability and use of medications as first-line therapy for many health conditions has led to a significant increase in the number of medications used by older people over recent decades. Seventy five percent of the older people admitted to Australian hospitals use five or more medications, known as polypharmacy, and more than 20% use 10 or more medications, known as hyperpolypharmacy (Elliott and Booth 2014; Hubbard et al. 2015). Similar patterns of medication use have been reported in other developed countries (Feldman et al. 2009; Ellenbecker et al. 2004, 2008). High treatment intensity, having multiple prescribers, and suboptimal integration of care have led to increasing complexity of medication regimens and increased risk of medication-related problems (Elliott and Booth 2014). Medication use is higher in people residing in aged care facilities, who take an average seven

**Medication-Related Issues in Later Life, Table 1** Medication-related problems commonly occurring in older Australians<sup>a</sup>

Type of medicine-related problems	Prevalence in Australia (%)
Problems associated with prescribing	
Unnecessary and inappropriate prescribing	25–40
Underdosing	21
Overdosing	45–81
Drug interactions	7–67
Under-prescribing	25
Suboptimal monitoring	33
Medicine nonadherence	18–47
Problems associated with poor medication management	
Having poor knowledge about medications	20
Inappropriate storage and repackaging of medications	4–14
Stockpiling and hoarding of medications	20–42
Sharing of medications	13–20
Poor ability to self-administer medications	Up to 34
Adverse drug reactions	19

<sup>a</sup>Reference: Elliott (2006)

to ten medications compared with an average of five medications in community-dwelling older people (Elliott and Booth 2014; Lee et al. 2010). This chapter aims to provide insights into a range of medication-related issues in older people.

## Medication-Related Problems in Older People

Medication-related problems are defined as an event or circumstance involving a person’s drug treatment that actually or potentially interferes with the achievement of an optimal outcome (Table 1) (Simonson and Feinberg 2005).

Review of individuals’ medication regimens by clinical pharmacists reported that older people who use multiple medications experience, on average, one to three medication-related problems (Elliott and Booth 2014). Medication-related problems contribute to adverse clinical and social

outcomes including falls, cognitive impairment, dehydration, incontinence, and depression. In turn, these outcomes increase older peoples' risk of functional impairment, nursing home placement, hospitalization, and reduced quality of life (Simonson and Feinberg 2005).

Up to 30% of unplanned hospital admissions in older people and 18% of deaths in hospital are due to medication-related problems (Elliott and Booth 2014; Scott and Jayathissa 2010; Easton et al. 2009). Fifty percent of the medication-related problems and up to 75% of adverse drug event-related hospital admissions in older people are potentially preventable. This constitutes a large and potentially avoidable cost to the healthcare system (Simonson and Feinberg 2005; Elliott and Booth 2014; Elliott 2006; Scott and Jayathissa 2010).

In the United States, it has been reported that approximately 20% of older people discharged from hospital to their own homes experience an adverse event and more than 66% of these are medication-related (Lindeman 2010). Almost 20% of hospitalized older people are readmitted within 30 days, 76% of which are considered to be potentially avoidable (Lindeman 2010). Medication nonadherence in the United States is shown to contribute to 33–69% of medication-related hospital admissions and 23% of nursing home admissions (Lindeman 2010, 2011). It is estimated that if medication adherence was improved, this could lead to a saving of approximately US\$290 billion annually (Lindeman 2010, 2011).

### Risk Factors for Medication-Related Problems

Older people are at greater risk of experiencing medication-related problems because they have a higher rate of comorbidities, tend to consume multiple medications, and are more sensitive to the effects of medication due to age-related physiological changes in body composition and functioning (Simonson and Feinberg 2005; Scott and Jayathissa 2010). Over 50% of the older people living in the community have at least one risk factor for medication-related problems, and in

**Medication-Related Issues in Later Life, Table 2** Risk factors for medication-related problems<sup>a</sup>

<b>Medication-related factors</b>
Using $\geq 5$ medications <sup>b</sup>
Using $\geq 12$ medication doses a day <sup>b</sup>
Using medication(s) with a low therapeutic index or requiring therapeutic drug monitoring <sup>b,c</sup>
Using psychotropic medication(s)
Using complex medication regimens
Being recently commenced on a new medication
Having $\geq 4$ changes to medication regimen during the previous 12 months <sup>b</sup>
Experiencing symptoms suggestive of an adverse drug reaction
<b>Patient-related factors</b>
Having $\geq 3$ concurrent medical conditions <sup>b</sup>
Having a history of nonadherence with medication use <sup>b</sup>
Having poor medication knowledge
Attending multiple doctors or pharmacies to obtain medications
Being discharged from a hospital in the previous 4 weeks
Having a change in health status
Having cognitive impairment
Living alone
Having literacy and/or dexterity problems
High out-of-pocket cost of medication
Attitudes about disease and symptoms
Attitudes about treatment
<b>Healthcare system-related factors</b>
Lack of integrated care
Lack of system for monitoring and improving medication-related problems

<sup>a</sup>References: Elliott and Booth (2014), Lee et al. (2010, 2011), Elliott (2006), Scott and Jayathissa (2010), Easton et al. (2009), and Barenholtz Levy (2003)

<sup>b</sup>Risk factors consistently associated with increased risk of medication-related problems or adverse outcomes in older people

<sup>c</sup>Examples of medications with a low therapeutic index or requiring drug therapeutic monitoring – carbamazepine, digoxin, lithium, phenytoin, phenobarbital, procainamide, quinidine, theophylline, and warfarin

institutionalized care, this increases to more than 70% of residents (Lee et al. 2010, 2011). While there is a range of factors which can predispose older people to greater risk of medication-related problems (Table 2), six factors are consistently associated with increased risk of medication-related problems in older people (shown with superscript “a” in Table 2). When assessing older

**Medication-Related Issues in Later Life, Table 3** Commonly used medications associated with increased risk of adverse medication events in older people<sup>a</sup>

*Examples of medications associated with increased risk of adverse drug reactions (also sometimes referred to as potentially inappropriate medications)*

Anticholinergic antidepressants, muscle relaxants, and antispasmodics (e.g., amitriptyline, doxepin, oxybutynin)

Amiodarone

Long-acting benzodiazepines (e.g., diazepam, nitrazepam)

Long-acting oral hypoglycemics (e.g., chlorpropamide, glyburide)

Dextropropoxyphene and propoxyphene

Digoxin (>125 micrograms per day)

Dipyridamole

Methyl dopa

Nonsteroidal anti-inflammatory drugs (NSAIDs [e.g., diclofenac, naproxen])

Psychotropic medications ( $\geq 2$  used concurrently)

*Examples of medications associated with medication-related hospitalizations in older people*

Antithrombotic and anticoagulant agents (e.g., aspirin, warfarin)

Anti-inflammatory drugs (corticosteroids, NSAIDs)

Antineoplastic or cytotoxic drugs

Disease-modifying antirheumatic agents (e.g., azathioprine, cyclosporin)

Cardiovascular medications (e.g., antihypertensives, digoxin, diuretics)

Central nervous system drugs (e.g., anticholinergics, anticonvulsants, antidepressants, antiparkinsonian agents, benzodiazepines, hypnotics, psychotropic agents, sedatives)

Insulin

Opioid analgesics

Oral hypoglycemic agents

<sup>a</sup>References: Simonson and Feinberg (2005), Elliott and Booth (2014), Lee et al. (2010, 2011), Elliott (2006), Scott and Jayathissa (2010), and Easton et al. (2009)

people's risk of experiencing medication-related problems, these six factors should be considered.

Certain medications are associated with increased risk of adverse drug reactions or medication-related hospitalizations in older people (Table 3) (Simonson and Feinberg 2005; Elliott and Booth 2014; Lee et al. 2010, 2011; Elliott 2006; Scott and Jayathissa 2010; Easton et al. 2009; Goeman et al. 2015). One example is

psychotropic medications, including antidepressants, antipsychotics, benzodiazepines, and cholinesterase inhibitors (Goeman et al. 2015). These medications should be used with caution in older people due to greater risk of neurological side effects. A recent study reported 61% of older people with cognitive impairment, living in the community, were using at least one psychotropic medication (Goeman et al. 2015). Use of psychotropic medications has been linked to poor health outcomes in older people (Goeman et al. 2015). Although these medications are recommended for limited short-term use for specific issues such as short-term alleviation of behavioral and psychological symptoms of dementia, older people are more likely to be prescribed psychotropic medications for extended periods, and there is a need for greater focus on measures to limit inappropriate usage (Goeman et al. 2015).

Poor adherence to medications is a significant problem in older people (Elliott and Booth 2014). This occurs when a person does not follow the agreed directions for using their medication(s) (Simonson and Feinberg 2005). The rate of adherence for a person is measured as the percentage of the prescribed doses of the medication actually taken by the person over a specified period (Osterberg and Blaschke 2005). There is no agreed standard that defines an acceptable rate of adherence as it varies by disease. Some studies considered rates of greater than 80% to be acceptable, whereas others consider rates of greater than 95% to be mandatory for adequate adherence, especially among people with serious conditions such as infection with the human immunodeficiency virus (HIV) (Osterberg and Blaschke 2005). In older people, the prevalence of poor adherence ranges from 44% to 95% and may be unintentional or deliberate (Elliott 2006). There are many reasons for poor adherence in older people (Simonson and Feinberg 2005; Elliott 2006; Lindeman 2010). Poor memory or recall about consumption of medications can lead to problems such as missed doses or double-dosing (Simonson and Feinberg 2005; Elliott and Booth 2014; Elliott et al. 2015; While et al. 2013). Nonadherence may be due to persons' attitudes or behaviors, real or perceived side effects or risks

of adverse events, cost of medication(s), difficulty with swallowing, and tolerating or administering medication(s) correctly (Simonson and Feinberg 2005; Elliott 2006). When assessing a person's adherence to medication use, identifying the main barrier(s) to medication adherence and understanding the person's needs can help reduce the risk of nonadherence and medication errors and establish an effective medication regimen for the person.

### **Medication Management in Older People and Associated Issues**

The processes of obtaining and managing multiple prescriptions and receiving, storing, and administering multiple medications can be complex and challenging for some older people (Elliott and Booth 2014; Ellenbecker et al. 2004). Up to one-third of older people living in the community have difficulty managing their medications (Elliott and Booth 2014). The interaction between health professionals has an important impact on medication management. This process often involves multiple healthcare personnel, including general practitioners (GPs), specialist medical practitioners, other prescribers, pharmacists, nurses, professional or non-professional caregivers, and other members of the healthcare team such as case managers and insurance companies. Healthcare system issues, including poor communication, inadequate teamwork, or insufficient sharing of information between healthcare team, can contribute to poor medication management processes and increased risk of medication-related problems. For example, poor interdisciplinary care can lead to polypharmacy and complex medication regimens, resulting in potentially inappropriate prescription and thereby raising the risk of harmful drug interactions (Easton et al. 2009; Elliott et al. 2015). Transitions of care, including discharge from hospital to the community or residential care, lack of integrated, shared health records, poor understanding of different health professional's roles in medication support, and the complex and onerous process of navigating access to services such as medication reviews, all

contribute to increased risk of error or misadventure (Ellenbecker et al. 2004; Easton et al. 2009). Substitution of different brands of medications by prescribers or pharmacists, without sufficient counseling, can cause confusion that may lead to omissions or overdosing of prescribed medications (Elliott and Booth 2014; Ellenbecker et al. 2004).

Those who are unable to independently manage their medications because of functional or cognitive decline may require support from their family members or other informal caregivers (Elliott et al. 2015; While et al. 2013). If these are not able to assist, medication management support can be provided via community healthcare workers, such as community nursing home care services. Community healthcare workers, depending on their level of training, qualification, and competence, can provide support, ranging from prompting the person to take their medications to administering the medications to the person (Elliott et al. 2015; While et al. 2013).

### **Assessment of Medication Management**

A comprehensive assessment can be undertaken by a health professional to determine the risk of medication-related problems and type of medication support required by the older person (Elliott et al. 2015; Lee et al. 2015). The assessment should take a holistic approach and consider all domains related to medication management, including capacity to self-manage medications, the stability of the person's medical condition, the number and type of medications used, the complexity of the medication regimen, cultural beliefs, knowledge and understanding of their medications, social and economic status, participation of family or other caregivers in medication support, and medication affordability (Elliott et al. 2015; Lee et al. 2015). All of these factors will inform care planning and provision of care that facilitates the older person's participation in managing their medications safely and effectively. Understanding the person's health goals, capabilities, and support needs is central to safe and effective medicine care, and clear and regular communication between all members of the medication management

team supporting the person is required (Elliott et al. 2015; Lee et al. 2015).

**Instruments to Assist Health Professionals with Guidance on Medication Management**

Several instruments have been developed to assist health professionals with planning medication management for people. These include person-centered assessment tools that can help a health professional to determine a person’s ability to self-administer their medications, likelihood of their adherence to their medication regimen, their risk of experiencing medication-related problems, and complexity and appropriateness of their medication regimen (Table 4). These instruments may be useful for identifying barriers to self-management and assist health professionals to identify older people in need of education, regimen modification such as simplification of medication regimen, and other medication management assistances or medication management aids.

**Strategies to Support Safe and Effective Medication Management for Older People**

Ensuring safe use of medications and optimal adherence are critical aspects of medication management for older people. There is a range of interventions available to improve medication use and reduce medication-related problems, errors, and incidents in older people (Elliott and Booth 2014; Feldman et al. 2009; Ellenbecker et al. 2008; Easton et al. 2009; Lindeman 2010, 2011; Elliott et al. 2015, 2016; Towers and Tyler 2014). They may be used alone or in combination. These interventions are summarized below.

**Medication Management Aids**

There is an increasing range of medication management aids available to assist older people in managing their medications. Tools such as medication alarms, calendars, medication prompting cards, and software applications for smartphones and mobile devices may help the person

**Medication-Related Issues in Later Life, Table 4** Medication management-related assessment instruments and tools

Type of medication management-related assessments	Examples of tools
Assessment of ability or capacity in medication self-management	<p><i>Drug Regimen Unassisted Grading Scale (DRUGS)<sup>a</sup></i> A performance-based measure to assess a person’s ability to identify, access, select, and take their medications. The tool takes about 15 min to administer</p> <p><i>Medication Management Ability Assessment (MMAA)<sup>b</sup></i> A performance-based assessment tool similar to DRUGS, but utilizes a standardized simulated medication regimen instead of the person’s own medications</p>
Assessment of adherence to medication-taking	<p><i>Morisky Medication Adherence Scale<sup>c</sup></i> A four-item self-reported questionnaire that assesses a person’s adherence to medications</p>
Assessment of risk for medication-related problems	<p><i>Medication Risk Questionnaire (MRQ)<sup>d</sup></i> A 10-item self-administered questionnaire to assess a person’s risk of experiencing a medication-related problem</p> <p><i>Drug Burden Index (DBI)<sup>e</sup></i> A measure that calculates a person’s total exposure to anticholinergic and sedative medications (a measure of risk of physical and cognitive functional decline)</p>
Assessment of complexity of medication regimen	<p><i>Medication Regimen Complexity Index (MRCI)<sup>f</sup></i> A 65-item tool that quantifies the complexity of prescribed medication regimen</p>

(continued)

**Medication-Related Issues in Later Life, Table 4**  
(continued)

Type of medication management-related assessments	Examples of tools
Assessment of appropriateness of medications prescribed	<i>Beers Criteria</i> <sup>g</sup> A list of medications that are potentially inappropriate for use in older people
	<i>Screening Tool of Older Person's Prescriptions (STOPP)</i> <sup>h</sup> A screening tool that is used to assess the appropriateness of medications prescribed for older people

Original sources of the tools:

<sup>a</sup>Edelberg, H. K., et al. (1999). Medication management capacity in highly functioning community living older adults detection of early deficits. *Journal of the American Geriatrics Society*, 47(5), 592–596

<sup>b</sup>Patterson, T. L., et al. (2002). Medication management ability assessment results from a performance-based measure in older outpatients with schizophrenia. *Journal of Clinical Psychopharmacology*, 22(1), 11–19

<sup>c</sup>Morisky, D. E., et al. (1986). Concurrent and predictive validity of a self-reported measure of medication adherence. *Medical Care*, 24, 67–74

<sup>d</sup>Barenholtz Levy, H. (2003). Self-administered medication-risk questionnaire in an elderly population. *The Annals of Pharmacotherapy*, 37, 982–987

<sup>e</sup>Hilmer, S. N., et al. (2007). A drug burden index to define the functional burden of medications in older people. *Archives of Internal Medicine*, 167, 781–787

<sup>f</sup>George, J., et al. (2004). Development and validation of the medication regimen complexity index. *The Annals of Pharmacotherapy*, 38(9), 1369–1376

<sup>g</sup>American Geriatrics Society (2015). Updated Beers Criteria for potentially inappropriate medication use in older adults. *Journal of the American Geriatrics Society*, 63(11), 2227–2246

<sup>h</sup>O'Mahony D, et al. (2015) STOPP/START criteria for potentially inappropriate prescribing in older people: version 2. *Age Ageing*, 44(2):213-218

remember to take their medications (Lindeman 2011; Elliott et al. 2015). Most studies investigating the effectiveness of these types of strategy have involved relatively young population on few medications. There is little high-quality evidence about the effectiveness of these strategies for older people who use multiple medications.

The most common medication management aids used by older people in developed countries are dose administration aids (DAAs). These are devices or systems that organize multiple medication doses into secondary storage sorted by date and time. Some types of DAA can be packed by those administering the medications. Others are provided through pharmacies. Some older people, especially those with complex medication regimens or who are prone to double-dosing as a result of difficulty remembering whether they have taken their medications, may benefit from using a DAA (Elliott et al. 2015). DAAs can also help family members or other caregivers to assist in medication support (Feldman et al. 2009; Elliott et al. 2015). Automated (or smart) DAAs can be linked to remote devices such as mobile phones to automatically record the person's medication-taking or send an alert when medications are not taken (Lindeman 2011; Elliott et al. 2015). This information may assist health professionals and caregivers in remote monitoring of a person's medication-taking and help to inform clinical decision-making.

DAAs do have limitations. They are only suitable for oral medications that retain their efficacy when repacked into a DAA. They are not suitable for medications with frequent changes to timing or dose or for medications used occasionally. Use of a DAA may increase the cost of medication management, and some older people may have physical or cognitive difficulty managing a DAA. Introducing DAAs too early, that is, prior to other strategies such as providing education, a medication list, a calendar, or reminder application, can lead to disempowerment and de-skilling of the person. Therefore, these devices need to be used judiciously (Elliott et al. 2015).

### Interdisciplinary Care in Medication Management

Medication reconciliation involves obtaining a best-possible medication history using multiple information sources. The medication history is then compared to the person's current medication orders to identify and resolve any discrepancies.

Medication reconciliation has been shown to reduce medication errors such as inadvertent omission of therapy, prescribing a ceased medication, or duplication of therapy (Feldman et al. 2009; Scott and Jayathissa 2010; Easton et al. 2009; Lindeman 2011).

During the process of transitioning to or from hospital, residential care, or community care, the risk of experiencing medication discrepancies and errors is increased. This is often due to poor communication and information sharing between the interdisciplinary team during the clinical hand-over process. There is evidence that 52–88% of documents used in transition of care processes contain an error (Ellenbecker et al. 2004; Easton et al. 2009). Medication reconciliation should be performed as part of medication review and whenever there is a transition of care between healthcare settings or healthcare providers to reduce the risk of errors (Feldman et al. 2009; Scott and Jayathissa 2010; Easton et al. 2009; Lindeman 2011).

Medication review involves a structured evaluation of a person's medications by a health professional, usually a pharmacist, in collaboration with the person's medical practitioner(s). The primary goals are to optimize the impact of medications and minimize the number of medication-related problems (Easton et al. 2009). This approach is used either alone or in combination with strategies such as person-centered education. There is evidence supporting the use of such approach to improve medication use in older people (Feldman et al. 2009; Easton et al. 2009). It is the most common strategy globally recognized and used to improve medication use and reduce the risk of adverse drug events (Feldman et al. 2009; Easton et al. 2009).

There is evidence for the effectiveness of medication reviews in identifying and resolving medication-related problems (Elliott and Booth 2014) and reducing the risk of unplanned hospital admissions in older people at high risk of experiencing adverse medication events (Roughead et al. 2011). A study reported that in a cohort of older people using warfarin who were at risk of hospitalization due to bleeding, those

who had received a medication review had a 79% reduced likelihood of hospitalization between 2 and 6 months post-review compared to their unexposed counterparts (Roughead et al. 2011). There is also evidence that medication reviews and collaboration with other members of the healthcare team, especially pharmacists, prevent adverse events associated with poor medication management (Ellenbecker et al. 2008). This evidence suggests that older people, especially those assessed at risk of experiencing medication-related problems, should have their medications reviewed regularly, at least every 6 months (Roughead et al. 2011).

### **Person-Centered Education Interventions**

Structured education focusing on person-centered medication management can help to improve awareness, knowledge, and adherence to medications and empower older people and caregivers to be more independent with managing their medications (Epping-Jordan et al. 2004; Ellenbecker et al. 2008). Effective education programs include information about encouraging older people and caregivers to keep an up-to-date list of their medications and share it with their family members and health professionals. They should also assist people to identify and access support services in their community such as medication review and medication management aids. To enhance the effectiveness of education programs, the content and delivery must be tailored to the person's needs, including their preferred language, level of literacy, and learning style. Repeating education may be necessary (Ellenbecker et al. 2008).

### **Electronic Health Interventions and Assistive Technology**

Over recent years there has been an increased focus on the development of innovative electronic health interventions and assistive technology products to support medication management (Feldman et al. 2009; Easton et al. 2009; Lindeman 2010, 2011; Towers and Tyler 2014; Elliott et al. 2016). Some examples include electronic prescribing and electronic transmission of medication orders (Elliott et al. 2016). This can

streamline communication between doctors, nurses, and pharmacists and allow health professionals to have real-time access to the person's medication information. Assistive technologies include use of videoconferencing to enable remote monitoring, prompting, and supervision of a person's medication-taking at home; use of smartphone or wearable devices that enable automated monitoring, recording, tracking, and reporting of a person's disease progression; and use of automated dispensing devices that assist the person to self-administer their medications (Lindeman 2010, 2011; Towers and Tyler 2014). Another example includes technology that uses an integrated care management platform to connect the person and their healthcare providers in real time and to improve medication adherence of the person (REMIND TECH™). The platform is designed to track key aspects of care management, medication adherence, and clinical assessments of the person while utilizing data points and interactive tools such as adherence score per medication, side-effect reporting, and a provider-person-caregiver messaging board, allowing healthcare providers and caregivers to be alerted if the person is not adherent to their medication regimen (REMIND TECH™).

Despite some evidence suggesting that using electronic health interventions or assistive technologies has the potential to improve medication safety and medication management (Towers and Tyler 2014; Elliott et al. 2016), to date there has been limited research evaluating their effectiveness, especially in older people. Further studies are required to explore their utility and provide more robust evidence regarding effectiveness and safety in older people.

### **The Chronic Care Model Framework Approach**

A multidisciplinary group including the older person, their caregivers and/or family members, prescribers, community pharmacists, and healthcare providers are all part of the medication support team. In supporting older people to manage their medications safely and effectively, a multifaceted approach is required. The approach should consider a range of interventions that focus on

integrating collaborative and person-centered care, as illustrated by the framework of the Chronic Care Model (Epping-Jordan et al. 2004). This model recommends that interventions used to improve chronic disease care for older people require several essential elements to achieve the best-possible outcomes. These elements are self-management support, delivery system design, decision support, and clinical information systems (Epping-Jordan et al. 2004). This approach encourages older people and their caregivers to actively work in partnerships and participate in medication self-management and decision-making. Building a medication support team around the older person and their informal caregivers, for example, by advocating for the person to attend one general practice and have one pharmacy, preferably in communication with one another, creates a network that can be valuable if or when cognitive and functional capabilities decline (While et al. 2013). Furthermore, encouraging older people to keep a list of their medications and have their medications reviewed regularly can help keep older people safe and independent and defer the need to resort to high-intensity and high-cost interventions such as community nursing home care services.

### **Conclusions**

Medication management in older people is complex. Older people are at a greater risk of experiencing medication-related problems compared to younger adults. Pragmatic screening can identify older people at greatest risk of adverse events and can assist in identifying those who may benefit from assessment and intervention. Knowing the type of medication-related issues and risk factors that affect older people may help to inform assessment, care planning, and development of strategies to minimize the risk of experiencing medication-related problems, errors, or incidents and thereby reduce the incidence of adverse medication events. Multifaceted approaches that integrate different strategies such as interdisciplinary care, person-centered education and support, and,

where appropriate, medication management aids or assistive technologies are likely to be most effective in maintaining safety, effectiveness, independence, and well-being.

## Cross-References

### ► Complementary and Alternative Medicine

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## Melbourne Longitudinal Studies on Health Ageing (MELSHA)

Colette J. Browning<sup>1,2,3</sup> and Hal Kendig<sup>4</sup>

<sup>1</sup>Royal District Nursing Service, St Kilda, VIC, Australia

<sup>2</sup>International Primary Health Care Research Institute, Shenzhen, China

<sup>3</sup>Monash University, Melbourne, VIC, Australia

<sup>4</sup>Australian National University, Canberra, ACT, Australia

### Synonyms

Cohort; Panel studies

### Definition

This entry describes an Australian longitudinal cohort study, the Melbourne Studies on Healthy Ageing (MELSHA) program, which has followed a relatively healthy cohort of older people aged 65 years and older across the latter part of their life span from 1994 to the present.

### Background

The Melbourne Longitudinal Studies on Healthy Ageing (MELSHA) Program is an ongoing population-based longitudinal cohort study of 1000 people aged 65 years and over living in noninstitutional settings in Melbourne, Australia.

MELSHA was conceived in the 1990s as a way of establishing an evidence base to inform health promotion programs for older people, a relatively novel idea at a time when most research on aging in Australia focused on the “burden of aging” and the fear that population aging would result in a highly dependent cohort who would drain the health budget. While maximizing health and quality of life was seen as a way of reducing dependency and hence health costs, we have argued that good health in old age is a basic human right

(Kendig and Browning 2010). In contrast to paradigms of aging as a process of inevitable decline, we aimed to identify individual actions and public health measures that could be taken to maintain and in some instances recover good health and well-being through later life.

MELSHA has contributed to healthy aging policy in Australia through various federal and state forums and has contributed to the debate about the importance of including older people in health promotion programs (Browning and Kendig 2004; Kendig et al. 1998a). Collaborations with MELSHA and other Australian longitudinal studies through the Dynamic Analyses to Optimize Ageing (DYNOPTA) project where MELSHA is one of the contributing studies (Anstey et al. 2010) have contributed to national analyses of topics including depression, aging policy, medical conditions, and driving (Burns et al. 2013; Anstey et al. 2011; Bielak et al. 2012; Ross et al. 2009, 2011).

The baseline survey for the MELSHA program began in 1994 at a time when concepts such as healthy and active aging were rarely seen on policy agendas for older people. Our focus in 1994 was to identify avenues for changing individual actions and social environments that influence the health and well-being of older people. The Victorian Health Promotion Foundation (1994–1997) and the Australian National Health and Medical Research Council (1998–2000, 2003–2005, 2008–2010) funded the research. The following investigators have contributed to MELSHA: Hal Kendig, Colette Browning, Maria Fiatarone Singh, Leon Flicker, Robert Helme, Birgitta Lundgren Lindquist, Meg Morris, Daniel O’Connor, Susan Quine, Jane Sims, Shane Thomas, Carolyn Unsworth, Karen Teshuva and Yvonne Wells. We continue to monitor the sample through death checks and informant follow-up where possible. The cohort profile was described in Browning and Kendig (2010).

### Participants and Procedures

The study is situated in Melbourne, the second largest city in Australia. The baseline survey

sampled older people using a sampling frame based on the Victorian Electoral Roll. The clustered sample consisted of 1865 potentially eligible participants across 40 inner Melbourne postcodes. The sample yielded 1422 eligible participants. People aged 65 years and over residing in private dwellings were included in the sample. Those living in non-private accommodation, including residential aged care, those who could not speak English, and those with health conditions that impacted on communication were excluded. The final baseline sample was 1000 participants yielding a 70% response rate.

The demographic and health characteristics of the participants at baseline are described in Kendig et al. (1996). Fifty three percent of the participants were women, 58% were married, and 82% rated their health as good, very good, or excellent. The sample was somewhat healthier than the population from which it was drawn.

The baseline survey (1994) included face-to-face interviews with participants in their own home, a self-completion questionnaire, and brief physical tests. This protocol was repeated in 2004, 2008, and 2010. Participants answered questions focusing on the following domains: health-related actions, perceptions and health histories; functional health and prevalence of health conditions; quality of life; social support and interaction; and service use and transport and neighborhood. In 1996, 1998, 2000, and 2002, participants completed a computer-assisted telephone interview (CATI) using a shortened form of the original face-to-face interview schedule. In the intervening years, a short mail-out questionnaire was used to collect some key outcome variables and to help track the participants. Loss to sample has been relatively low as we have been able to track the participants through informants and death checks and identify specific outcomes that have precluded survey completion at each data collection such as death, entry to residential aged care, and severe health conditions such as cognitive impairment. For the first 10 years of the study, loss to follow-up was less than 10% at each biennial wave.

## Findings from MELSHA

Early cross-sectional analyses focused on particular domains such as social disadvantage, caregiving, driving, falls, urinary incontinence, oral health, functional impairment, and social and physical activity, while later time-based analyses focused on predicting particular outcomes such as entry to residential aged care, aging well and the relationships between illness and depression, and widowhood and well-being.

### Physical Activity

MELSHA included a number of measures of physical activity as well as questions about the perceived adequacy of physical activity levels, encouragers of and barriers to physical activity, and the importance of physical activity to health. Browning and colleagues (2009) found that most participants had engaged in light activity in the last 2 weeks and around 45% had engaged in energetic activity that made them puff or pant (Browning et al. 2009). Almost all participants believed that physical activity was important to health and about two thirds judged their current levels of physical activity to be about right. Perceived adequacy of physical activity and positive beliefs about being able to influence health were associated with physical activity behavior. Spouse and family members were common encouragers of physical activity. In addition Kendig et al. (1998b) showed a relationship between former occupation and current income and physical activity behavior (Kendig et al. 1998b). These social class effects underline the importance of the continuing disadvantage that can accrue across the life span and impact on health later in life.

### Falls and Functional Health

Falls and functional capacity have been another focus for MELSHA. An early analysis sought to understand the factors that differentiate between frequent and occasional fallers (Morris et al. 2004). Twenty percent of MELSHA baseline participants fell once in the last year and 9% fell

more than once. Women, those with back pain and those with multiple medical conditions, were more likely to be occasional fallers than non-fallers, while female gender predicted multiple falling. Multiple fallers were more likely to be afraid of falling than occasional fallers, but there is limited knowledge about the temporal relationship between fear of falling, falling, and psychosocial risk factors mainly because most of the studies are cross-sectional. Clemson and colleagues (2015) therefore examined the predictors of fear of falling and falls requiring medical attention across 11 years and found that having a serious fall does not predict fear of falling and fear of falling did not predict future falls (Clemson et al. 2015). Depression was a predictor of injurious falls, supporting the need for screening for depression in older people who fall. This study was the first to show that reduced social activities predicted fear of falling. It also has strengthened the knowledge base behind fall prevention programs that have proven efficacy through targeted physical activity programs and home improvements that reduce environmental risks.

Gender differences have also been a focus for MELSHA, and we have argued that it is important to understand the different experiences of aging for men and women, as well as examine potential differences in predictors of health outcomes in order to design programs and services that are targeted correctly. An analysis of gender effects on falls was conducted by Browning et al. (1998) who found that women were more likely than men to fall in the previous year, women were more afraid of falling, and women were more likely to fall in the home than men, while both men and women fell most outside their home (Browning et al. 1998). Predictors of falling for women were taking more than five prescription medications and for men poor eyesight. These findings highlight the need to take into account gender when designing fall prevention programs.

Foot and leg problems are potential markers of functional health in older people. Barr et al. (2005) found that 36% of the MELSHA baseline sample reported foot and leg problems

(Barr et al. 2005). Foot and leg problems were associated with impaired timed “Up and Go” measures, difficulty walking and climbing stairs, and a history of falling independent of sociodemographic factors and medical conditions. The findings underscore the importance of self-care foot education and access to podiatry and related health services.

### Impacts of Medical Conditions

MELSHA has provided insights into the various medical conditions of older people and their impacts. Sims et al. (2011) found that 28% of MELSHA baseline participants reported urge incontinence and 21% reported stress incontinence (Sims et al. 2011). The impacts on well-being were different for urge and stress incontinence and for men and women. “Occasional” urge incontinence impacted negatively on depressive symptomology, negative affect, and IADL. Positive affect and self-rated health were impacted negatively if urge incontinence was experienced “often.” Stress incontinence impacted on depressive symptomology, positive affect, IADL dependence, and self-rated health. Women with any form of incontinence had higher negative affect scores than men. The findings reinforce the importance of continence control for self-esteem and for willingness to keep socially involved in community life.

Kendig et al. (2000) examined how activity limitations mediated the impact of illness and pain on psychological well-being (Kendig et al. 2000). They found that major illnesses and pain impacted on psychological well-being (lower positive affect, increased negative affect, and depressive symptoms) by limiting usual activities. This finding highlights the importance of health and independence in old age as a resource to continue with a “usual” life.

Oral health impacts on older people’s physical, emotional, and social functioning including good eating patterns and balanced nutrition. MELSHA was one of the first studies to examine oral health and use of oral health services in Australia in older people. Mariño et al. (2007) found that 34% of

MELSHA baseline participants had visited a dentist in the last year and that 40% had not visited a dentist for over 5 years (Mariño et al. 2007). Those who were younger and had higher income and levels of education were more likely to visit a dentist in the last year, again demonstrating the impact of social disadvantage on health and access to health care. Visiting a dentist in the last year was associated with higher social support and positive affect scores.

MELSHA data has been used to examine the relationship between chronic medical conditions, mortality, and depression over a 10-year period. Depression has been associated with various chronic illnesses including diabetes and cardiovascular disease in cross-sectional studies. Atlantis et al. (2010) found that older people with baseline depressive symptomology were twice as likely to develop diabetes as compared to those without depressive symptomology, and this relationship was independent of antidepressant use (Atlantis et al. 2010). In contrast, Atlantis et al. (2011) found that depressive symptomology or antidepressant use at baseline were not associated with cardiovascular disease or premature death (Atlantis et al. 2011). Analyses of longitudinal data can help untangle the cause and effect relationships between variables. Screening for and providing the appropriate treatment for depression early in old age may impact on the subsequent onset of diabetes.

Medication use and polypharmacy have significant impacts on the health and well-being of older adults. Thomson et al. (2010) investigated medication use and risk factors for side effects at baseline in MELSHA (Thomson et al. 2010). They found that 8.5% of participants on medications reported side effects, which was comparable to those found in older adults attending primary care settings in Australia. Risk factors for side effects included how recently the person visited a pharmacist, younger doctor age, and doctors' awareness of their medications.

### Life Transitions

Another focus of MELSHA has been on life transitions. Wells and Kendig (1997) investigated and

compared the consequences of spouse caregiving and widowhood using the baseline data from MELSHA (Wells and Kendig 1997). Interesting interaction effects were found. Former spouse caregivers adjusted better to widowhood in terms of depressive symptomology, but sleeping problems were worse in widowers who had previous spouse caregiving responsibilities. Widowhood was associated with more pervasive negative health and well-being outcomes, while spouse caregiving was associated with both negative and positive outcomes indicating that caregiving should not be just categorized as a stressor. In a later paper, Burns et al. (2015) examined the trajectories of mental health as measured by positive and negative affect and depressive symptomology in those who were widowed compared with those who were not (Burns et al. 2015). At initial partner loss, both men and women showed diminished positive affect, while women showed higher negative affect and depressive symptomology. In the years following partner loss, neither men nor women returned to the levels of positive affect pre-widowhood.

### Modeling Key Outcomes

Our longitudinal modeling has also allowed us to examine predictors of entry into residential aged care, predictors of aging well, driving status and trajectories and predictors, of hearing difficulties. Such analytic approaches allow a more fine-tuned understanding of opportunities for intervention both to promote healthy aging and prevent adverse events. They also suggest avenues for recovering capacities after experiencing health and social "shocks" such as acute illness.

Kendig et al. (2014) investigated the threats to aging well over a 12-year period using a model of health and well-being based on older peoples' views of aging well (Kendig et al. 2014). The model includes hierarchical goals for aging: staying alive, living in the community (as opposed to residential aged care), and continuing to live independently with good physical and psychological health. They found that the threats

to aging well were different between men and women. For men, the threats were low stress, perceived inadequate social activity, and smoking. For women, the threats were urinary incontinence, low physical activity, and being under weight. Examining aging well from a gender perspective provides the evidence for more targeted approaches for health promotion in older people. Kendig et al. (2010) examined predictors of entry to residential aged care and found different predictors for men and women (Kendig et al. 2010). For women being dependent in IADL, never being married and low weight were risk factors (indicating social and functional vulnerabilities) for entry, while for men the number of medical conditions and poor nutrition were risk factors.

The transition to limiting or ceasing driving has significant impacts for the older person in terms of independence and access to services, especially in Australia where car use is very high. Unsworth et al. (2007) investigated the predictors of the driving transition over a 6-year period and found that older drivers self-regulate their driving by driving in familiar areas and limiting driving to daytime (Unsworth et al. 2007). The predictors of modifying driving were older age, poor eyesight, and IADL dependence. Women were three times more likely to cease driving than men, adjusting for health and disability, and those on higher incomes were more likely to cease driving.

Heine et al. (2013) examined self-reported hearing difficulties over a 10-year period and the influence of health behaviors and social activity on these trajectories (Heine et al. 2013). As expected, hearing difficulties increased over time. Factors that predicted a more rapid increase in hearing difficulties included health behaviors such as smoking and poor nutrition and older age. Surprisingly, increased social activity predicted increasing hearing difficulties. This finding could be explained by a greater awareness of hearing difficulties in social situations leading to greater reporting of hearing difficulties. The importance of health-promoting actions in old age was once again demonstrated.

## Issues in Longitudinal Research

Over the long duration of the MELSHA study, a number of key issues have required adaptations from its planning in the early 1990s, through to analyses that are continuing. The cohort is now largely completed given that few of the original samples are surviving. This enables us to turn to analyses of the full course of later life, for example, trajectories of the final years of life and analyses of late-life issues such as cognitive impairment, dual sensory loss, and frailty.

A fundamental concern has been the shifting funding bases and related changes in the substantive foci and applications of the findings. The baseline survey, funded in 1994 as a cross-sectional effort by the Victorian Health Promotion Foundation, was extended to a second round in 1996 when the Foundation determined that the topic of depression along with behavioral change were priorities. Several subsequent rounds were funded by the Australia National Health and Medical Research Council as 3-year project grants, the first focused on behavioral change and the second on functional capacities and accumulated outcomes. The 2010 data collection and subsequent analyses have been funded by the Healthy and Productive Ageing project in the ARC Centre of Excellence in Population Ageing Research (CEPAR). Each of these project rounds has had a range of investigators and project staff, with continuity provided by ourselves as lead investigators.

Methodological challenges have been considerable. Measures considered to be state-of-the-art at baseline needed to be streamlined and in some cases augmented or replaced by better measures in later rounds while maintaining a core of essential variables. Exhaustive follow-up strategies were devised to minimize loss to follow-up, while analytical strategies employed “survival analysis” and related techniques that took account of missing respondents and variables in survey rounds.

Policy applications and research translation have been priorities for ourselves and our colleagues as well as the funding bodies. A preliminary report on the baseline survey

brought priority findings to the attention of policymakers and program planners at a relatively early date while academic articles went through the lengthy peer review process before publication. We have written for broad “public affairs” audiences, for example, through the Academy of Social Sciences in Australia (Kendig and Browning 2011), as well as ongoing press releases and submissions to various inquiries and hearings concerning health promotion and related policies of national and state governments. Overall, these efforts to influence policy have had modest impacts directly, as governments have largely continued to set younger people and specific diseases as their priorities for action. MELSHA findings have contributed evidence on aging well in interpretive chapters for a number of national and international books, including a textbook on ageing (O’Loughlin et al. 2016), and another for policy and public affairs audiences (Kendig and Browning 2016).

Arguably the greatest impact of MELSHA has been part of broader efforts influencing public and policy thinking to encompass positive and improvable dimensions of aging. After a review by the Australian Prime Minister’s influential PMSEIC Scientific Committee, a number of initiatives were launched including the “Ageing Well, Ageing Productively” research funding programs for the ARC and NHMRC (Kendig and Browning 2010).

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## Memory Training Methods and Benefits

Carla M. Strickland-Hughes and Robin L. West  
University of Florida, Gainesville, FL, USA

## Synonyms

Intervention; Memory Rehabilitation; Cognitive Training; Cognitive Rehabilitation; Maintenance of Training; Mnemonics Training; Training Impact; Transfer Effects

## Definition

Memory training programs are cognitive interventions that aim to enhance or maintain memory performance via methods such as strategy instruction or engagement; training benefits may be evidenced immediately following training or over time and include improvements for trainees, relative to controls, in performance on tasks targeted in training (e.g., episodic memory), beliefs, or untrained memory or cognitive tasks or other broad outcomes (e.g., indicators of well-being).

As a practical matter, one of the most important questions facing geropsychologists is this one: Are memory training programs effective in

optimizing the memory performance of older adults? The simple answer is yes: *memory training results in immediate improvement in the tasks that are trained* (Gross et al. 2012; Hertzog et al. 2009; West and Strickland-Hughes 2015). However, excitement about this definitive response is tempered by concerns regarding the practical impact of these programs. When older adults ask if memory training is effective, they are really asking about more than immediate improvement on the trained tasks. They want to know if the impact of training is lasting and how challenging it might be to improve “memory in general,” so that training will help them to succeed over time on most practical memory tasks. These more complicated questions about the impact of training are addressed in this overview, which focuses on behavioral memory interventions.

This article documents the extent to which memory training improves memory for healthy older individuals, with a focus on episodic memory and memory strategies. This review excludes physical and pharmaceutical interventions for memory gain as well as interventions designed to improve particular cognitive skills (e.g., reasoning). Issues of practical impact are considered, specifically the long-term maintenance of training gains and transfer of benefit to non-trained tasks. The paper also addresses nonability factors that may moderate gains from training (e.g., beliefs about ability, chronological age) and novel methods for intervention that show promise.

## Approaches to Training

A primary aim of cognitive interventions for the aged is memory improvement. This section reviews the types of memory training programs that are typically offered, starting with a general overview, and then describes three exemplar interventions that reflect the variance in focus, duration, and scope among training paradigms.

Memory training programs for older adults range from intensive practice of core processes to extensive interventions aimed at enhancing overall cognitive engagement, and they vary

from training single memory techniques to comprehensive, multifactorial programs, which employ varied activities, including relaxation, attentional exercises, or basic education on aging or memory (Charness 2007; Schubert et al. 2014; Zehnder et al. 2009).

Training gains are typically assessed with a comparison of performance at pretest with performance at posttest (following the intervention), but it is also critical to include a control group. Control groups may be inactive/waitlist groups or active groups (placebo or non-placebo). Comparison to inactive/waitlist groups (who complete only the memory assessments) controls for the effects of practice from repeated testing (Stine-Morrow and Basak 2011). Some investigators use active control groups that serve a placebo function. Such groups are matched to the intervention in terms of meeting frequency, duration of activity, and degree of social engagement, but participate in activities which should not change the outcomes of interest. That is, the placebo controls for the level or type of activity, social experience, expectations, motivation, and other aspects of participation. Other active control groups are non-placebo: such groups may be utilized to compare different versions of training programs, such as group classes versus self-help via a workbook (Bailey et al. 2010; Hastings and West 2009) or novel versus traditional approaches (Rebok 2010; Stine-Morrow et al. 2014). Random assignment of participants to training or control conditions, such as in randomized control trials, establishes comparable groups representing the population of interest. Whether waitlist or active, an appropriate control group must be included for the results of a cognitive intervention to be credible. Thus, intervention programs lacking an appropriate control group are not considered in the present review, and the three exemplar programs, described next, each utilized appropriate control groups.

### Everyday Memory Clinic (EMC)

The Everyday Memory Clinic (EMC) was a 5-week-long, multifactorial program which supplemented strategy training with activities and lessons on other topics, such as attention and

normal aging. In addition to training multiple strategies, EMC focused on improvement in memory beliefs. Three episodic memory tasks (name, list, and story recall) as well as related beliefs (locus of control, self-efficacy, and memory anxiety) were assessed at pretest, immediately after training, and 1 month following training.

EMC trainees (aged 50+ years) showed improved name and story recall performance and used strategies more effectively than the control group (West et al. 2008). In addition, active trainees (e.g., high attendance, homework completion, and strong in-class participation) had higher memory scores than inactive trainees, and trainees using a self-help workbook demonstrated greater pretest-to-posttest gains in recall and locus of control, relative to a non-active control group (see Stine-Morrow and Basak 2011).

### **Advanced Cognitive Training for Independent and Vital Elderly (ACTIVE)**

The ACTIVE study is the largest randomized clinical trial for memory intervention conducted with older adults. Participants (ages 65–94 at enrollment) were randomly assigned to one of three different training conditions (memory, reasoning, or speed of processing) or to an inactive control group. Memory trainees completed ten weekly sessions focused on multiple strategies designed to improve verbal episodic memory (e.g., mental association, visual imagery). Directly trained abilities, as well as a large number of cognitive tasks and other measures, were assessed repeatedly, up to 10 years following initial training (Rebok et al. 2013).

Overall, the ACTIVE trial enhanced verbal memory and locus of control for memory. At least one quarter of the memory trainees improved their performance by more than one standard error (see Stine-Morrow and Basak 2011). Verbatim recall of stories was also higher for trainees immediately following training, but not 1 year later (Sisco et al. 2013). One and two years after training, the memory trainees outperformed the other groups on a composite score for verbal episodic memory (Rebok et al. 2013).

Cohen-Mansfield and colleagues (2014) replicated the ACTIVE program using a smaller sample

of older adults with memory complaints (ages 65–87). More particularly, they compared ACTIVE memory training to a health promotion program and to a memory “book club.” All three programs were of equivalent duration and intensity. All groups improved pretest-to-posttest cognitive functioning on a comprehensive test battery that included tests of verbal and nonverbal episodic memory, but only the ACTIVE training group showed reduced memory complaints. Collectively, the large-scale ACTIVE trial and replication showed success in enhancing episodic memory and self-perceptions regarding ability and performance.

### **Theatric Arts Intervention**

A collection of studies by Noice, Noice, and colleagues (Noice and Noice 2011) evaluated the efficacy of a theatric arts intervention for memory and cognition. The authors proposed that acting is a unique leisure activity for promoting cognitive gains because it is multimodal (i.e., involving emotional, social, cognitive, and physiological processes) and fosters engagement through novel experiences. Participants received 80-min acting lessons twice a week for 4 weeks. Lessons were focused on acting techniques and not memorization. The exercises increased in challenge and demand over the 4 weeks.

Across several studies, with participants ranging from 60 to 95 years old, the episodic memory gains for theatric arts trainees exceeded that of non-active control groups and groups trained in other arts programs (i.e., art appreciation or singing). The program demonstrated effectiveness in community-dwelling older adults, residents of long-term care facilities, and low-income seniors (Noice and Noice 2011). Memory gains were even replicated when the intervention was administered by an activity director and an acting teacher outside of the research team (see West and Strickland-Hughes 2015).

Clearly, memory interventions are conducted using many different approaches and techniques, and the data presented thus far has indicated that some programs are quite effective. The next two sections address the overall evidence for training-related changes in memory test performance and beliefs about memory.

## Strategy Training: Impact on Memory

Episodic memory performance is a key focus of interventions because memory ability is perceived as highly important and is necessary for everyday activities, yet declines normatively with increasing age. Thus, the primary indication of success for a memory training intervention is memory gain. Importantly, a long-accepted body of work establishes that older adults can benefit from memory training programs, as indicated by pretest-to-posttest improvement in episodic memory performance, over and above any observed practice-related gains in a control group.

A meta-analysis by Gross and colleagues (2012) evaluated training gains in objective memory performance for cognitively intact older adults (60+ years old at time of training) across 35 studies in which memory trainees were compared to appropriate control groups. This report replicated an earlier meta-analysis in that training-related gains in memory were greater for trainees than controls, and training gains were not directly linked to any specific trained strategy. Whereas the earlier review suggested that programs that included pretraining, such as relaxation training or other non-mnemonic instruction, showed higher gains than those without pretraining, this report suggested that programs training multiple strategies may be more effective than those training only one strategy. In effect, both meta-analyses showed that trainees benefit from interventions that go beyond training a single strategy. There is also evidence that group training is more effective than individual training, possibly due to social effects or due to the fact that group training programs tend to be longer (Berry et al. 2010).

In contrast to these promising findings, a review of cognitive intervention programs for both healthy older adults and adults with mild cognitive impairment found improved verbal recall and paired associate memory for trainees compared to inactive control groups, but not when compared to active control groups (Zehnder et al. 2009). These results might suggest that some training-related memory gains may not be specific to the intervention type or content; however, the authors very broadly defined active

control groups (e.g., including exercise interventions). Thus, when comparing memory intervention results to active control group data, the authors may have been comparing multiple interventions expected to yield memory change.

To summarize, meta-analyses have systematically evaluated over 50 years of cognitive interventions for older adults' episodic memory performance. The primary findings of the reports on mnemonic training suggest that older individuals do benefit from memory training, particularly when compared to individuals from inactive control groups. The collective data suggest a relatively greater benefit for training programs which are more comprehensive (e.g., those including pretraining and those training multiple rather than single strategies) and those with group-based exercises. Further, the data show that many different types of strategy training are effective, and no differences have been reported when comparing particular strategies. This suggests that episodic memory may benefit from some qualities of interventions unrelated to the specific strategies trained (e.g., changes in attentional factors). The meta-analyses reviewed here focused primarily on strategy training. Notable evidence on other approaches suggests that adults may also benefit from computerized and video game interventions, higher levels of daily cognitive activity, and repeated practice with attentional or working memory skills (Rebok 2010; Schubert et al. 2014; West and Strickland-Hughes 2015).

## Strategy Training: Impact on Beliefs

In addition to actual gains in memory test scores, researchers in the memory intervention area have long been interested in whether training has an impact on beliefs about memory. Self-evaluative beliefs correlate positively with memory performance. This association strengthens with age and is affected by the way in which beliefs are assessed (Beaudoin and Desrichard 2011; Berry et al. 2010). Beliefs also predict performance over short-term goal and feedback manipulations and predict long-term change (West and Strickland-Hughes 2015). Thus, beliefs might influence the

maintenance of intervention effects (Hastings and West 2009). One complicating factor in reviewing the literature on beliefs and intervention is that the assessments of beliefs vary dramatically from study to study (Beaudoin and Desrichard 2011). Nevertheless, there are some reasonable conclusions that can be drawn.

Floyd and Scogin (1997) systemically reviewed the memory training literature on subjective measures, including a wide variety of assessments for beliefs. Their meta-analysis of 27 studies revealed a significant effect size for the impact of training on subjective beliefs, but the effect was smaller than the magnitude of gains for memory performance. Not surprisingly, the greatest changes in beliefs appeared to be related to studies focused on improving aging attitudes. More recent evidence from experimental studies suggests that self-evaluative beliefs might not only be influenced by memory training, but may also predict performance gains through moderation or mediation of intervention effects.

Specifically, the ACTIVE study assessed personal control or the belief that performance outcomes can be determined by one's own influence. Five years after the ACTIVE program, participants who trained in reasoning and speed of processing were considerably more likely to improve their sense of personal control than was the no-contact control group (see West and Strickland-Hughes 2015), even though the ACTIVE training program did not emphasize self-evaluative beliefs. Unfortunately, ACTIVE *memory* trainees did not demonstrate this training benefit. As mentioned earlier, however, ACTIVE memory trainees did show reduced subjective memory complaints in a replication study (Cohen-Mansfield et al. 2014).

The EMC project was designed to enhance memory self-efficacy or confidence in one's memory ability. It did so by fostering enactive mastery (e.g., easier exercises first) and reducing anxiety (e.g., emphasis on self-set goals rather than high performance for all), among other techniques (West et al. 2008). In contrast to the minimal changes in beliefs observed for ACTIVE memory trainees, EMC trainees reported increased personal control and enhanced memory self-efficacy

1 month following the intervention, while the control group experienced some declines in these beliefs. Self-taught trainees showed significant improvements in personal control, but not in self-efficacy (Hastings and West 2009).

Thus, modest evidence suggests that intervention may promote enhanced self-evaluative beliefs. More interestingly, in an inductive reasoning intervention, trainees with higher initial levels of memory self-efficacy allocated more time to training and benefited more from the intervention (see West and Strickland-Hughes 2015). Do self-evaluative beliefs lead to more effort or greater benefit from training? In the EMC study, the initial level of memory self-efficacy, along with education and self-reported health, predicted the degree of active effort by trainees, which in turn predicted training-related gains. Further, memory self-efficacy was a significant predictor of episodic memory performance at follow-up, and training-related change in memory self-efficacy was a mediator of memory gains from the intervention (West and Strickland-Hughes 2015). Considering this collective evidence, beliefs may be related in important ways to the benefits that come from memory intervention.

### Strategy Training: Impact over Time

Given what we know about gains in performance and subjective memory, training clearly holds great promise for episodic memory. This promise will be realized if and when it is established that post-training episodic memory gains are lasting. Unfortunately, the majority of intervention studies examine gains cross-sectionally, immediately after training, and do not assess training effects over time (Gross et al. 2012). Consequently, there are no available systematic meta-analyses on long-term maintenance of benefits from training interventions, and relatively little is known about this topic. When training gains are significant, maintenance can still vary (Rebok et al. 2013). Evidence from past research suggests that maintenance is possible over a period of 1–6 months. However, when looking at maintenance for periods longer than 6 months, regression to

baseline performance is commonly found (Berry et al. 2010), or maintenance is limited (Rebok 2010).

In promising studies of multifactorial memory training (focused on encoding strategies, attention, and relaxation), 6-month maintenance was reported, and over 3 years later, maintenance or improvement of performance was still evident for the multifactorial trainees (see Berry et al. 2010). The ACTIVE trial was the first to assess long-term outcomes with a large sample. ACTIVE trainees were assessed immediately 1, 2, 3, 5, and 10 years following training. A subset of trainees completed four booster sessions about a year after training. Participants from all training conditions (with and without booster sessions), but not inactive controls, demonstrated improved memory when comparing performance at pretest with performance 5 years following the study. For memory trainees, these results were not affected by booster session participation (Rebok et al. 2013). However, no training or booster effects were significant for memory trainees 10 years following the program (see West and Strickland-Hughes 2015).

Hertzog and colleagues (2009) propose that our view of cognitive interventions may need to change. Interventions probably do not function like vaccines, that is, providing immediate protection against decline and requiring periodic boosters. Instead, perhaps memory interventions should be viewed like physical activity interventions, wherein continuing exercise is necessary for maintenance of performance. If so, maintenance of specific training lessons may be less of an issue. The focus, instead, should be on ways to encourage and motivate older adults to continue working on their memory. While the evidence thus far is hopeful, additional longitudinal analyses are needed to better understand the long-term benefits of cognitive activity.

### **Strategy Training: Impact on Transfer and Generalization**

Researchers agree that it is desirable for intervention programs to have broad practical impact. This might include transfer of performance gains to

new, untrained memory tasks or extension of learned memory strategies to tasks not targeted in training. These outcomes would increase the value of training and possibly even stave off age-related attenuation in cognition (Hertzog et al. 2009; Rebok 2010). One could also look for broader generalization effects: if training improved social-emotional functioning, promoted neural activation, or encouraged a more engaged physical or mental lifestyle (Hertzog et al. 2009; Rebok 2010; Schubert et al. 2014), it would enhance the daily lives of trainees. Although everyone agrees that transfer and/or generalization represent a value added from memory interventions, there is considerable controversy about how to define transfer and about what kind of transfer should be expected in conjunction with a memory intervention (Fisher 2012; Schubert et al. 2014). If transfer is defined strictly as a change in performance on memory tasks that are not part of training, past research clearly shows that transfer rarely happens (Berry et al. 2010; Fisher 2012; Hertzog et al. 2009; Rebok 2010). Thus, clarifying the *how* and *when* of transfer is imperative, especially for those target skills that are most relevant for everyday experience. Alternatively, researchers could focus on the generalization of training effects to better strategy usage overall, neurogenesis, reduced depression, improved activities of daily living, or more mental or physical activity, and these results are more promising (Hertzog et al. 2009; Rebok 2010; Schubert et al. 2014; West and Strickland-Hughes 2015). Some of these topics are considered here.

#### **Strategy Usage**

Older adults are less likely than younger adults to spontaneously employ memory strategies, and they may overly rely on external aids or familiar mnemonics (Fisher 2012). Thus, strategy training is a common focus of intervention programs, and this approach has been quite successful overall (Rebok 2010; Stine-Morrow and Basak 2011). Increased strategy use is often assumed to explain training-related performance gains. Yet, this effect is often unexamined as strategy use can be difficult to assess directly.

More often, strategy use is assessed subjectively, via open-ended or multiple-choice self-report questionnaires after testing. Gross and Rebok (2011) compared the standardized pretest to posttest gain in use of strategies between training and control participants from twelve reports of cognitive interventions. They found that nearly all trainees exceeded control participants in strategy improvement and that this improvement was larger than the improvement in scores, *per se* (Gross and Rebok 2011). For example, strategy checklists completed in the EMC intervention showed that trainees and control participants both reported increased strategy usage over time. Although trainees often chose to use simpler versions of the complex techniques they were taught, trainees clearly shifted to using more effective strategies than the control group over time (West et al. 2008).

Evaluation of clustering techniques, using categorizable lists, is a more objective method of assessing strategy use because it does not require post hoc reporting of strategic behavior (Gross and Rebok 2011). Researchers can report items recalled in the order of the study list (serial clustering, suggesting use of association), items recalled contiguously from one category (semantic clustering or use of categorization), or other signs of item grouping. In the ACTIVE intervention, trainees showed immediate gains on several types of clustering and maintained these gains over 5 years (Gross and Rebok 2011).

### Self-Monitoring

A self-monitoring approach to memory training involves guiding trainees to evaluate their learning (i.e., test their memory), identify what needs additional study, and adapt attention and strategy usage accordingly. A focus on self-monitoring techniques in training could be quite valuable because it allows older adults to make use of techniques – such as self-testing and allocating additional study time to unlearned items – which are relatively easy for them to apply (see Charness 2007). Also, successful self-monitoring may guide adults to allocate more learning resources to difficult items or discontinue study of well-learned items, thus helping them to meet their learning goals (see Fisher 2012).

If self-monitoring can be successfully taught, it could easily be included in any kind of strategy training, and the technique can be generalized to other, more practical learning situations (see Charness 2007).

Results are currently mixed for interventions based on self-monitoring. In an early study, gains were significantly greater for trainees in a program focused on strategies plus self-monitoring as compared to a strategies-only group. In addition, the effectiveness of this training approach was promising when administered via self-help workbooks (Bailey et al. 2010). However, two similar intervention programs failed to demonstrate greater gains for the self-monitoring groups above-and-beyond the benefits from traditional strategy training (see Charness 2007). Further intervention-based research is warranted to explore the benefits from self-monitoring approaches to memory training, as well as their potential for generalization in real-world settings.

### Engagement

One alternative approach to training is to set up an environment for older adults that leads to broad engagement in cognitive activities (Charness 2007; Hertzog et al. 2009; Stine-Morrow et al. 2014). In essence, this approach builds generalization into the training regimen itself because individuals are practicing cognition and memory in the context of real-world activities. While these approaches may have great potential for improving memory, this potential has been realized in only some cases.

For example, the Experience Corps (Carlson et al. 2008) aimed to improve cognitive and health outcomes for older adults through intensive volunteer training and participation. Participants had approximately 32 h of volunteer training followed by a full year of literacy-related volunteer service in schools (e.g., reading to children). Later, Experience Corps volunteers, and not waitlist control participants, demonstrated improved working memory and executive functioning (see Rebok 2010). Although there were also social and physical gains, the improvements in episodic memory were marginal. The Senior Odyssey program, which encouraged complex problem solving in a

social, intellectual, and competitive context, seems to have led to gains in fluid reasoning and problem solving, but not in episodic memory, at least thus far (Stine-Morrow et al. 2014). More promising is evidence from the theateric arts intervention, described earlier, which showed clear episodic memory benefits, even though the overall focus was on acting rather than specific memory strategies (Noice and Noice 2011). Similarly, Park and colleagues (2014) found that involvement with everyday activities that have high cognitive demands (quilting and digital photography) led to episodic memory change that was not evident in more passive social activities or less demanding mental activities.

The evidence thus far suggests that an engagement-focused intervention may need to include particular kinds of cognitive activities in order to successfully enhance memory, but the exact nature of these cognitive activities remains to be clarified in future investigations.

### **Strategy Training: Individual Differences in Outcomes**

The final issue to address is who benefits from training. Individual differences are person-level factors, such as age or baseline cognitive capacity, which may explain variance in the gains made by trainees. The current review focuses on cognitively intact older adults, who may have experienced normative aging-related memory loss but are free from dementia. However, diagnosis of dementia and level or stage of cognitive impairment are likely individual differences which influence one's ability to benefit from cognitive training. Cognitively impaired individuals may be able to profit from training, if to a lesser extent (e.g., for simple but not complex tasks) than healthy older adults (Zehnder et al. 2009). Further, specific mnemonics (e.g., spaced retrieval) or intervention techniques might be relatively more effective for certain populations (Berry et al. 2010).

Aligned with the idea of muted training gains for cognitively impaired individuals, some research evidence suggests a *Matthew effect*

(i.e., the rich get richer) for training benefit (Stine-Morrow et al. 2014). In the ACTIVE trial, gains immediately following training were greater for trainees with higher levels of education and better self-reported health (Rebok et al. 2013). However, other training programs demonstrated greater improvement for those who had the most to gain (i.e., individuals with lower baseline cognitive performance). For example, Experience Corps volunteers with impaired executive functioning at pretest demonstrated the greatest gains in memory and executive functioning following the program (Carlson et al. 2008). For the theateric arts training program developed by Noice and Noice (2011), training benefits were demonstrated across diverse populations with no indication that levels of independence, education, or income were a factor controlling the degree of benefit from training.

If there is a *Matthew effect* in cognitive training, it may be explained by a relationship between age and level of plasticity, wherein greater plasticity enables adults to benefit more broadly from the cognitive and social engagement provided in a training program (Stine-Morrow et al. 2014). However, evidence for this is mixed. Meta-analyses of memory training programs for older adults have shown mixed results for the relationship between participant age and training-related gains (Gross et al. 2012). Data from the ACTIVE trial suggested that age is negatively related to memory performance over time, but this effect was independent of training (Rebok et al. 2013). Additionally, younger ACTIVE trainees used more memory strategies at baseline, but age did not predict training-related changes in strategy use (Gross and Rebok 2011).

As an alternative explanation for training responsiveness, individual differences in motivation or other psychological factors may be important (Rebok 2010). For example, training gains from working memory capacity training were greater for individuals who were more engaged and implicitly motivated to train, rather than externally motivated by payment. Further, gains were larger for adults with a growth mindset (i.e., believing gains are possible with effort) than for adults who believed their level of intelligence was

fixed (Jaeggi et al. 2014). Higher levels of openness to new experience and larger social network size were positively related to gains in divergent thinking from an engagement-focused intervention where trainees worked in groups to solve ill-defined problems (Stine-Morrow et al. 2014). However, these factors did not explain the level of training-related gain for a traditional reasoning training group, which served as an active non-placebo control group. Therefore, the influence of different individual difference factors may interact with the specific intervention approach.

Realistically, the *interaction* between cognitive factors (e.g., initial cognitive capacity, degree of plasticity, and years of education) and motivational influences likely predict training gains, rather than any one factor acting alone. For example, in the ACTIVE trial, trainees who were adherent to the training protocols (e.g., attended all sessions) had significantly better baseline memory performance than those who were non-adherent (Rebok et al. 2013). In turn, these adherent trainees benefitted from memory training, whereas the non-adherent ones did not. Similarly, EMC trainees who were relatively more educated and healthy and had higher levels of memory self-efficacy were more likely to be actively engaged in training and more compliant with homework (see Rebok 2010). In turn, more compliant trainees demonstrated more profound recall and self-evaluative beliefs change than less involved trainees (see Berry et al. 2010).

Further explaining individual differences in training benefit, the relationship between baseline ability and training outcomes may be quadratic, rather than linear, whereby persons with either relatively higher or lower initial cognitive performance gain more from interventions than those functioning in the middle (Stine-Morrow et al. 2014). Thus, the impact of individual differences on training gain is not straightforward. Individual benefits from training are likely explained by complex interactions among those factors that affect performance and adherence to training regimens. Considering this evidence, it would be valuable to pursue additional research in this area, particularly studies focused on who is more likely to achieve long-term training benefits.

## Conclusions

Memory is an integral process involved in many everyday experiences. Adults of all ages value their memory ability and fear memory loss (West and Strickland-Hughes 2015). Intact memory capacity is a prerequisite for older individuals' ability to live independently and perform other important activities (Berry et al. 2010; Schubert et al. 2014; Stine-Morrow and Basak 2011). Yet, the evidence is clear that declines in episodic encoding and retrieval are pervasive in both cross-sectional and longitudinal research (Berry et al. 2010). Because memory is valued by older adults, essential for independent living and at risk for decline, geropsychologists need to address the key memory concerns of older adults.

As evidenced by half a century of research, memory interventions are effective in enhancing the memory performance of healthy, older adults. Multiple meta-analyses confirm this benefit. Experimental paradigms for memory training programs vary greatly, and several different approaches have been successful. Programs which train multiple strategies seem to be more effective than those which train only one technique, and multifactorial programs may promote more lasting training benefits than traditional programs that train strategies only. Programs which encourage social interaction in group training or focus on beliefs or motivation may yield greater benefits.

Returning to older adult concerns about the practical impact of training, it is clear that training, strategy use, and memory practice can all lead to improvement. Thus, older individuals should be encouraged to practice those memory tasks that they want to improve and to learn more about strategic techniques that will enhance their skills. Whether achieved gains will be lasting likely depends upon the individuals' cognitive capacity and their continued motivated effort to work on everyday memory activities. As scholarship continues in this field, additional intervention-based research should further examine how to promote sustained gains from training, which conditions best lead to direct transfer and/or generalization, and how to maximize the gains of particular individuals during and after training.

## Cross-References

- ▶ [Attitudes and Self-Perceptions of Aging](#)
- ▶ [Interventions for Late-Life Cognitive Health](#)
- ▶ [Memory, Episodic](#)
- ▶ [Plasticity of Aging](#)
- ▶ [Process and Systems Views of Aging and Memory](#)
- ▶ [Social Group Interventions for Older Adults](#)
- ▶ [Subjective Memory](#)
- ▶ [Working Memory in Older Age](#)

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## Memory, Autobiographical

Alexandra Ernst<sup>1,2</sup>, Chris J.A. Moulin<sup>1,2</sup> and Olivier Rouaud<sup>1,2,3</sup>

<sup>1</sup>LEAD CNRS UMR 5022, Université de Bourgogne, Dijon, France

<sup>2</sup>University of Burgundy, Dijon, France

<sup>3</sup>CMRR Dijon, Dijon, France

### Synonyms

Autobiographical memory; Episodic future thinking; Healthy aging; Pathological aging

### Definition of Autobiographical Memory

*It is where I meet myself, that I remember myself, everything I have done, the moment and the place where I have done it, the emotional state I have had at this moment.*

Saint Augustine (354–403)  
*Les Confessions*, Book X, section VIII,  
14, pp. 990–991

Autobiographical memory corresponds to the ability to mentally go back into the past and remember personal events. Within the human memory system, two main components have been distinguished: an *episodic* component and a *semantic* component (Tulving 1985; Fig. 1). To understand the effect of aging on autobiographical

memory, one has to appreciate the separate contributions of these two components on autobiographical memory.

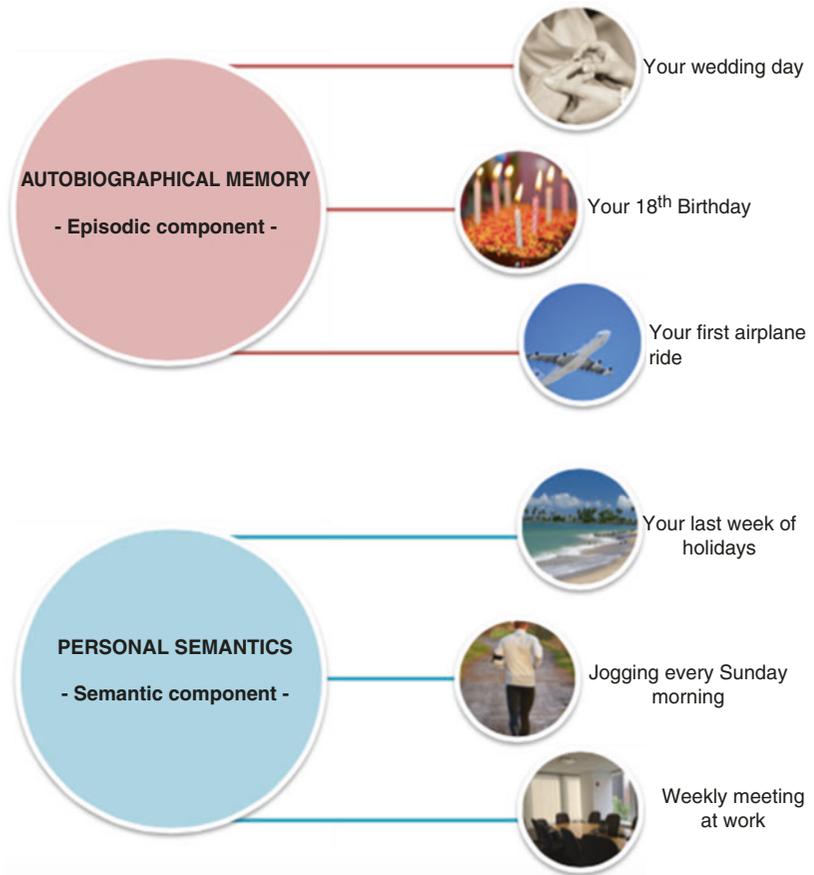
The episodic component corresponds to the ability to retrieve personal detailed events, within a specific spatiotemporal context, with a phenomenal experience of reliving the events as they are remembered. These specific episodes contain perceptual, affective, sensory, space, or time-related details. Conversely, the semantic component corresponds to factual information, such as the day of birth, the name of friends, or general and repeated personal events, such as “Friday nights after work at the Barbarians pub.” For these general and repeated events, a kind of “scaffolding” containing general information is retrieved, like where the events took place, with whom, etc. This relies on stored representations and knowledge not temporally bound to any one event. The differentiating feature of the episodic and semantic components is the level of consciousness associated with the retrieval of information. Specifically, the retrieval of personal episodic memories is associated with auto-noetic consciousness, the recollection of past experiences with the awareness of mentally reliving these events. The retrieval of personal semantics gives rise to noetic consciousness, which describes the retrieval of information without this sense of reliving.

From a theoretical standpoint, the Self-Memory System model (Conway 2005) offers a more nuanced view of autobiographical memory. This model also relies on the distinction between different memory subsystems hierarchically organized, going from life story themes (e.g., work theme, *while I worked in Bristol*) to episodic memories (e.g., *my visit to the Eiffel Tower*). A critical component of Conway’s model is the self, with a distinction between the conceptual self, that encompasses personal semantic representations and the working self, a dynamic system which regulates the encoding and retrieval of autobiographical memories which are relevant for current goals and activities. For the sake of clarity, and based on the theoretical framework used in most of the studies dealing with autobiographical memory and aging, this chapter will refer to Tulving’s

## Memory,

### Autobiographical,

**Fig. 1** Illustrations of autobiographical memories and personal semantics according to Tulving's model (1985)



memory model (Tulving 1985) and the distinction between episodic and semantic components.

### Functional Roles and Benefits of Autobiographical Memory

Approximately one third of a waking day is devoted to the generation of self-oriented thoughts, including the recollection of personal memories. This omnipresence is related to the functional roles and benefits that autobiographical memory takes on in everyday life. Three main functions have been attributed to autobiographical memory: (i) A *self*-function, where autobiographical memory participates in the construction of and the sense of continuity of the self and provides material to the emergence of self-concepts. In this context, autobiographical memory contributes to self-coherence but also to self-enhancement, that is, it provides a positive view of the self. (ii) A *social* function, whereby autobiographical

memories aid in the development of new relationships and the nurturing of existing ones. In particular, autobiographical memory enables people to keep memories about significant others, to exchange memories and facilitate social bonding, to elicit empathy or intimacy, or simply to inform people about us. (iii) A *directive* function, where the memories serve as a basis for guiding present and future behaviors, especially for specific past episodes.

As such, from a clinical standpoint, autobiographical memory is of particular importance in conditions where self-changes, self-preservation/enhancement, or self-regulation is required. Indeed a positive association between autobiographical memory performance and quality of life has been found. Conversely, in older adults, autobiographical memory decline could have a deleterious impact on personal identity and well-being (► [Aging and Quality of Life](#) by Chappell,

N. L., this volume; ► [Age, Self, and Identity: Structure, Stability, and Adaptive Function](#) by Lang, F. R., this volume; ► [Aging and Psychological Well-being](#) by Yeung, D., this volume). This underscores the importance of studying autobiographical memory in conditions where major life changes are expected, such as in normal and pathological aging.

### Assessing Autobiographical Memory

Various methodologies have been developed to assess autobiographical memory, with differences in terms of tasks, instructions, and scoring procedure. Typically, participants are asked to provide personal events and/or information from their past that happened in particular time frames. In older adults, two methods have been commonly used: the cue-word method (Crovitz and Schiffman 1974) and autobiographical questionnaires.

The cue-word method consists of recalling personal memories elicited by a frequently occurring and imageable word (e.g., car, flower, cat). Participants are asked to recall the first specific event that comes to their mind in relation with the cue-word and date it. Additional instructions are generally given if a nonspecific (i.e., non-episodic) event is provided or if the researcher or clinician is interested in memories from a certain time point. Depending on the focus of the study, varying scoring procedures and methods of analysis have been used: the temporal distribution of memories across lifespan, the ease at which they come to mind and are generated (autobiographical fluency) or their specificity and episodic richness (rated in general on 3-point or 5-point scales, ranging from the absence of memory, generic or repeated events to episodic events).

Several autobiographical questionnaires have been developed in the last decades. The most frequently used in the literature is the Autobiographical Memory Interview (AMI; Kopelman et al. 1989) which encompasses a semantic and an episodic section covering the lifespan. The semantic part tackles semantic facts such as the names of friends and postal addresses from different life periods. These are scored according to the precision of the information. The episodic part

typically consists of the retrieval of personal memories cued by theme such as “your first memory,” scored following their degree of episodocity on a 3-point scale.

To circumvent some methodological issues raised by these two techniques, such as the low sensitivity of the scoring procedure, or an unmatched scoring system for semantic and episodic components, the Autobiographical Interview (Levine et al. 2002) has been developed and widely used in recent studies conducted in healthy and pathological aging. In this, participants are asked to retrieve specific personal events from different lifetime periods and to provide freely as much details as possible about the event. Thus, episodic and semantic details are simultaneously collected, reproducing everyday autobiographical recall for which episodic and semantic components work in tandem. These details are then quantified and classified according to a standardized scoring procedure distinguishing different types of details (e.g., perceptual, emotional, semantic details) but with a matched procedure for episodic and semantic information. This procedure is particularly useful to measure episodic and semantic performance based on a single autobiographical memory and to explore how these two components could be differentially affected in clinical conditions.

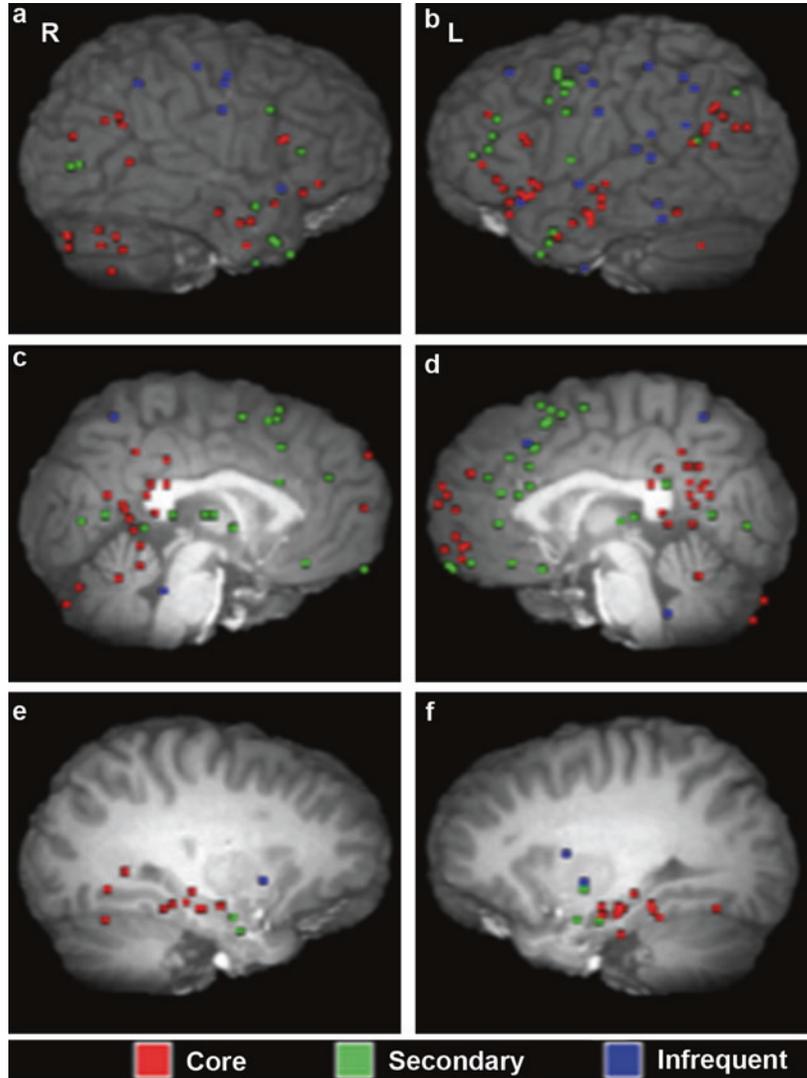
### Autobiographical Memory and the Brain

During the last decade, a large number of neuroimaging studies have been conducted in healthy participants to explore the functional underpinnings of autobiographical memory. The meta-analysis by Svoboda et al. (2006) proposes that the autobiographical memory network mainly engages left-lateralized and medial brain regions. The recollection of personal memory requires several steps and the involvement of a wide range of cognitive processes that give rise to a stream of cerebral activations within an extensive brain network.

Several brain regions have been identified as pertaining to the “core” and “secondary” autobiographical memory brain network (see Fig. 2). This brain network includes the lateral and medial prefrontal regions, the lateral and medial temporal

**Memory,****Autobiographical,**

**Fig. 2** Autobiographical memory brain network in healthy adults from the meta-analysis by Svoboda et al. (2006). Activations in the core and secondary autobiographical memory brain network are depicted, as well as infrequent brain activations. Brain activations across right (*left column*) and left (*right column*) hemispheres are illustrated (Reprinted from *Neuropsychologia*, 44, Eva Svoboda, Margaret C. McKinnon, Brian Levine, The functional neuroanatomy of autobiographical memory: A meta-analysis, 2189–2208, Copyright (2006), with permission from Elsevier)



regions, and also the posterior brain areas. In particular, the lateral prefrontal regions are involved in the strategic retrieval of memories, while the medial portion of the frontal lobe, together with the anterior cingulate gyrus, plays a central role in self-referential processes. Concerning the temporal lobe, the lateral region is mostly implicated in the semantic component of autobiographical memory. In addition, a key node of the autobiographical memory brain network is the medial temporal region, and especially the hippocampus, which is associated with the retrieval and binding of disparate details pertaining to a memory. Initial retrieval and

binding phases are followed by the creation of “mental film” of the memory that involves visual imagery processes, sustained by the posterior brain regions, including the retrosplenial cortex and the posterior cingulate gyrus.

Not surprisingly, considering this extensive brain network and the strong interconnections between the involved brain regions, autobiographical memory is particularly sensitive to structural brain changes and brain lesions. The high frequency of autobiographical memory impairment reported in the literature in various conditions has led to the view that damage in any of the key nodes of the autobiographical

memory network will compromise its functioning. This assumption brings us to the core of this chapter, that is, the discussion of the impact of normal and pathological aging on autobiographical memory.

## The Impact of Aging on Autobiographical Memory Functioning

In the next sections, an overview of the findings obtained at both behavioral and neuroimaging levels will be given, first in the field of healthy aging and then in pathological aging, especially in dementia.

### Healthy Aging

#### Behavioral Studies

Age-related changes have been described for decades in healthy older adults but with heterogeneous patterns of decline depending on the memory system (see for instance ► [Aging and Semantic Memory](#) by Laver, G., this volume; ► [Memory, Episodic](#) by Shing, Y. L., this volume; ► [Healthy aging](#) by Browning, C). It appears that episodic memory is particularly sensitive to the effect of age, while semantic memory is better preserved. However, this assumption has been mostly based on findings obtained with laboratory tasks, which possibly lack ecological validity and certainly do not represent the whole story with regards to autobiographical memory. An important characteristic of autobiographical memory that is not taken into account in classical laboratory tasks of memory function, such as recalling word lists or recognizing famous faces, is that autobiographical memories are the product of a combination of both personal episodic and semantic information. In this section, the impact of aging will be reviewed on both episodic and semantic components of autobiographical memory, by taking into account the influence of the methods used to address this question.

Overall, it has been posited that the decline of autobiographical memory becomes apparent after the age of 60 years and that older adults tend to produce fewer autobiographical memories than

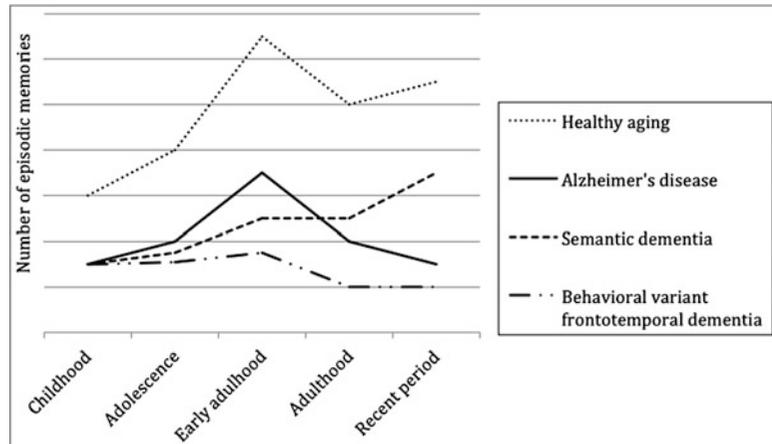
younger adults. Early studies conducted on this topic hypothesized that autobiographical memory decline in older adults follows Ribot's law. Ribot's law assumes that older memories are better preserved than more recent memories. This view has been quickly challenged by studies reporting a reverse pattern, with a similar recency effect being observed in older and younger adults (a greater number of recent memories relative to older ones). Two other phenomena related to the temporal distribution and organization of memory appear to be preserved in older adults: (i) childhood amnesia, which is the inability to retrieve episodic memories from events that occurred before the age of 3–4 years and (ii) the reminiscence bump, which corresponds to the life period between 10 and 30 years that is associated with an increase in frequency of memory recollection. Taken together, these findings suggest that aging does not affect the relative pattern of temporal distribution of autobiographical memories across lifespan (Fig. 3).

The cue-word method has been widely used to explore the effect of age on autobiographical memory performance. A robust finding is that older adults tend to produce fewer autobiographical memories in general than younger adults, especially episodic personal memories. Autobiographical memory questionnaires have provided insights into the impact of aging on the separate episodic and semantic components of autobiographical memory. Early studies revealed a deleterious effect of aging on both semantic and episodic components, while more recent investigations have highlighted a particular decrease of the episodic score that is possibly compensated by an increase of semantic information.

A line of research also aims to explore the cognitive processes involved in autobiographical memory decline in older adults. In this vein, an association between episodic memory performance in laboratory tasks and the specificity of autobiographical memories has been found. A relationship between executive function and the specificity of memories has also been described in the literature. However, recent studies using the Autobiographical Interview have also highlighted the influence of more general

### Memory, Autobiographical,

**Fig. 3** Hypothetical curves of autobiographical memory performance across lifespan (episodic component) in healthy aging, Alzheimer's disease, behavioral variant frontotemporal dementia, and semantic dementia



factors on autobiographical memory performance, especially the increased number of semantic content in memories. These general factors include narrative abilities and style or communicative goals (e.g., emphasis on the general meaning and significance of personal events in older adults rather than on its content). Thus, differences between autobiographical memory in older and younger adults may not be wholly cognitive, based on episodic memory impairment.

Research dealing with autobiographical memory in older adults has also explored a particular type of memories named “flashbulb memories.” The distinctive feature of flashbulb memories is that they concern a public event (e.g., the World Trade Center attack in 2001) but with the encoding of the personal context in which people first heard about the event (e.g., I was in the car with my father, going to my grandparents and we heard the news on the radio). A personal significance is thus attributed to this event, with a particular vividness of the event as it is remembered, like a highly detailed and emotionally arousing “snapshot.” As a consequence, flashbulb memories are proposed to be more episodic in nature than autobiographical memories. Mixed results have been obtained regarding the impact of aging on flashbulb memory, with some studies showing a deficit in older adults while other studies reporting that older adults can retrieve flashbulb memories with a similar accuracy to younger adults. In the literature, these findings have been linked to emotional processes related to

memories. In particular, it has been found that emotions could attenuate the deleterious impact of aging on memory specificity.

A specific feature in aging is also the shift from negative information in memory toward more favoring and positive information in older adults (see ► [Emotional Development in Old Age](#) by Kunzman, U., this volume; ► [Positive Emotion Processing, Theoretical Perspectives](#) by Isaacowitz, D., Livingstone, K., this volume). This “positivity effect” (► [Age-Related Positivity Effect and Its Implications for Social and Health Gerontology](#) by Reed, A. E., et al., this volume) is one of the most consistent findings in the literature on autobiographical memory in older adults. Specifically, older adults provide a higher proportion of positive memories than younger adults, a phenomenon that has been explained by older adults’ tendency to reappraise negative memories in a more positive way or to rate emotionally negative events as neutral or positive. According to socioemotional theory (► [Socioemotional Selectivity Theory](#) by Castensen, L., this volume), this positivity effect could stem from changes in the life goals of older adults, with a shift from information acquisition and accurate recollection to an emphasis on emotion regulation.

It has also been demonstrated that memories related to the self or personal concerns are better preserved in healthy older adults. These memories, named self-defining memories, are vivid memories that bring forth strong and intense emotions and are related to other memories that are

**Memory, Autobiographical, Table 1** Neural correlates of autobiographical memory impairment in healthy older adults, patients with Alzheimer's disease, behavioral variant frontotemporal, and semantic dementia

Brain regions	Healthy aging	Alzheimer's disease	Behavioral variant frontotemporal dementia	Semantic dementia
Prefrontal regions	++	++	++	++
Medial temporal regions	++	++	--	++
Lateral temporal regions	++	--	--	++
Posterior brain regions (precuneus, posterior cingulate, etc.)	++	++	--	--

++ Brain regions frequently involved in autobiographical memory changes, -- brain regions less frequently involved in autobiographical memory changes

connected to ongoing concern or unresolved conflict. This personal significance and the high frequency of rehearsal that characterized self-defining memories have been put forward to explain their relative preservation with aging.

In sum, age-related changes in autobiographical memory particularly affect the episodic specificity of retrieved personal events but relatively speaking spare the semantic content of such memories. Moreover, the temporal organization of memories across the lifespan appears comparable in younger and older adults. This raises the question of the potential functional cerebral changes that could be associated with these behavioral changes.

#### Neuroimaging Findings

The study of the neural mechanisms of autobiographical memory decline in older adults necessarily brings into question the neural changes typically associated with aging (► [Cognitive Neuroscience of Aging](#) by Gutchess, A., Paige, L., this volume; ► [Cognitive and Brain Plasticity in Old Age](#) by Li, S., Thurm, F., this volume). Healthy aging is defined here as the result of natural maturational processes in the brain. At the structural level, it is known that the volume of gray matter decreases with age, mostly in relation with lower synaptic densities in older adults. However, discrepancies have been observed in the distribution of these structural changes through the brain. The medial temporal lobe and the prefrontal cortex (especially the lateral portions) appear at the core of age-related changes, while the rest of the brain is relatively unaffected (Hedden and Gabrielli 2004). Structural changes also concern white matter tracts, whose integrity is mostly compromised in the

prefrontal regions, though a decline is observed in all brain regions. This is also accompanied by functional changes in the prefrontal and medial temporal regions, with the observation of both increased and decreased brain activity during the completion of cognitive tasks, in comparison with younger adults. In addition, reduced functional connectivity has been found in the default mode network (i.e., a set of brain regions that are activated in the context of no overt task assignment) in older adults. Most of the studies conducted in this field have interpreted this result as a decrease in the specificity of functional networks with age.

Studies focusing directly on the neural changes associated with autobiographical memory decline in older participants remain scarce. Using functional neuroimaging, it has been demonstrated that older adults mainly engage the same brain network as younger adults during the retrieval of autobiographical memories. However, some age-related subtleties have been observed (Table 1). In particular, relative to younger adults, fewer cerebral activations have been reported in brain regions sustaining the episodic richness of memories, whereas increased cerebral activations were shown in brain regions involved in semantic component. Particular functional changes have also been observed in the hippocampus and in prefrontal regions, which are the core structures of the autobiographical memory network. Neuroimaging studies show the recruitment of contralateral brain areas in healthy elderly participants in these core structures. It has been suggested that this bilateral recruitment is related to the reduced hemispheric asymmetry, or hemispheric specificity, associated with aging.

Overall, it appears that even in the absence of overt brain damage, the functional underpinnings of autobiographical memory are significantly modified in aging, and this is associated with changes at a behavioral level. Beyond the better understanding of cognitive age-related changes, this line of research also paves the way to research exploring autobiographical memory functioning in clinical conditions. The next section will thus mirror the current one, with the aim of giving a comparative view of the changes observed in the case of pathological aging.

## Pathological Aging

Pathological aging is associated with nonnormative factors that affect the brain and are independent from modifications typically associated with healthy aging. Pathological aging is commonly associated with dementia (► [Dementia and Neurocognitive Disorders](#) by Krishnan, K., Smith, G.), which is defined as a group of symptoms affecting cognitive functioning, especially memory, with a significant interference with daily life functioning. Most of the dementia conditions are progressive, and different disease courses are observed, depending notably on the brain regions that are damaged. In this chapter, a particular attention will be paid to Alzheimer's disease, behavioral variant frontotemporal dementia, and semantic dementia, which have been the most widely explored in the field of autobiographical memory. Behavioral and neuroimaging findings will be discussed in turn in light of the changes observed in normal aging.

### Behavioral Studies

Alzheimer's disease (► [Alzheimer's Disease, Advances in Clinical Diagnosis and Treatment](#) by Welsh-Bohmer, K.) is the most frequent type of dementia, and its deleterious impact on memory has contributed to the particular interest in autobiographical memory in this condition. Alzheimer's disease is characterized by a progressive loss of neurons (relative to healthy older adults), and in the early stages of the disease, this tends to affect disproportionately the medial

temporal lobe. Autobiographical memory impairment in Alzheimer's patients has been consistently reported across studies, even in the early stage of the disease. However, the heterogeneity of the disease course and severity between patients, as well as the varying methodologies used to examine autobiographical memory, have led to some discrepant results in the profile of alteration. Several studies using the method of cue words or autobiographical questionnaires have documented that autobiographical memory deficit in Alzheimer's disease follows Ribot's law, showing less accessibility of recent rather than older memories, whereas other studies revealed a flat gradient that is a similar degree of impairment for all lifetime periods. Research has demonstrated that Alzheimer's disease patients show a temporal distribution of memories, which is comparable to healthy older adults, with a preservation of the reminiscence bump, despite a general impairment in the ability to recall autobiographical memories (Fig. 3). The autobiographical memory impairment also extends to personal semantics, but a marked semantic deficit tends to be observed in the advanced stage of the disease, contrary to the episodic component, which is affected earlier on.

Turning to behavioral variant frontotemporal dementia (► [Frontotemporal Dementia \(FTD\)](#) by Hornberger, M.), this condition is characterized by a predominant deterioration of the medial prefrontal and the lateral temporal regions and is mainly associated with impairment in socio-emotional functions. While research in this field remains scarce, autobiographical memory impairment in the behavioral variant frontotemporal dementia has been consistently described as severe, affecting both episodic and semantic components. In this vein, a robust finding, independent of the testing method, is the flat gradient associated with autobiographical memory deficit in this condition (Fig. 3). This flat gradient corresponds to a consistent impairment irrespective of the lifetime period explored. This pattern of results has been observed for both episodic and semantic components, indicating a global autobiographical memory impairment. Recently, it has been suggested that autobiographical memory

dysfunction in behavioral variant frontotemporal dementia could be related to a more general self-reflective impairment, beyond the involvement of executive functions in memory retrieval difficulties, in association with frontal lobe degeneration (Irish et al. 2012).

Following frontal lobe damage, a particular phenomenon named “confabulation” has been observed in some patients. Confabulation corresponds to actions or verbal statements that are incoherent or implausible in light of patient’s personal history and situation. An important feature is that confabulation is unintentional and is generally observed in patients who are unaware of their memory impairment. For instance, a patient talks about an excellent dinner he had the day before in a restaurant in Paris while he is hospitalized for months in England. Confabulation has been associated with an executive deficit, especially retrieval strategy difficulties that compromise the research and verification of information in memory. As a consequence, automatic and associative processes take over to the more controlled processes and give rise to incongruous associations between information stored in memory. Confabulatory behavior has been observed in both patients with Alzheimer’s disease or behavioral variant frontotemporal dementia, especially in advanced stages of the disease.

Within the spectrum of frontotemporal dementia, semantic dementia (► [Semantic dementia](#) by Bott, N., Hantke, N., Samarina, V.) is a neurodegenerative disorder characterized by the progressive and amodal loss of semantic knowledge, in the context of a relative preservation of general cognitive abilities, including episodic memory. This condition is associated with a primary deterioration of the lateral temporal cortices, which extends from the anterior temporal fusiform gyrus, temporal pole, and anterior hippocampus to the amygdala. Few studies to date have explored autobiographical memory performance in patients with semantic dementia, and most of them have used questionnaires or the Autobiographical Interview. Autobiographical memory impairment in patients with semantic dementia shows a reverse temporal gradient, with better performance for recent than remote memories,

even if some studies also reported a flat temporal gradient in the more advanced stage of the disease (Fig. 3). This reverse temporal gradient observed for the episodic component likely reflects the occurrence of a semanticization process with the repeated rehearsal of episodic memories across time, which makes remote memories more vulnerable. In terms of cognitive mechanisms, it has been suggested that semantic dementia compromises the retrieval of the semantic scaffolding that contributes to the integration of episodic details into a coherent general context. While one would expect a particular impairment of the semantic component of autobiographical memory in semantic dementia, general personal knowledge is relatively preserved in most of the cases.

In a different line of research, but for which only few studies have been carried out, it seems that self-defining memories (i.e., memories strongly related to the self) are better preserved than the other types of personal memories in dementia, reproducing previous findings obtained in normal aging. However, some studies have also suggested that even self-defining memories are compromised in dementia, which could explain the weakened sense of self frequently reported in patients with dementia.

Taking a comparative view, it seems that patients with behavioral variant frontotemporal dementia show the most severe autobiographical memory impairment, followed by Alzheimer’s patients and finally patients with semantic dementia. Interestingly, the use of the Autobiographical Interview enables the distinction between different types of episodic details and provides a fine-grained view of the phenomenological properties of memories. This could be of particular interest to obtain a comprehensive picture of the pattern of memories’ deterioration in pathological aging and explore if some types of detail are more vulnerable than others, depending on the clinical condition. Although it appears that only one study has shed some light on this question (Irish et al. 2011), these findings are of importance to improve the understanding of the cognitive and neural mechanisms underlying autobiographical memory impairment in dementia. Irish et al. found that Alzheimer’s patients demonstrated lower

performance for episodic descriptions of happenings, actions, or people (event details), as well as emotional details. Patients with semantic dementia were particularly impaired for episodic details related to emotion/thoughts and spatiotemporal information. Finally, patients with behavioral variant frontotemporal dementia showed impairments on all categories of detail, including the aforementioned categories plus perceptual details. This last finding brings support to the idea that patients with the behavioral variant frontotemporal dementia are the most severely impaired on autobiographical memory tasks.

Overall, it appears that these three types of dementia compromise autobiographical memory functioning but with distinct clinical features that stem from different neural correlates that will be the focus of the next section.

#### Neuroimaging Studies

Alzheimer's disease, behavioral variant frontotemporal dementia, and semantic dementia are characterized by different patterns of brain atrophy and disease progression. Different key nodes of the autobiographical memory network are thus affected, leading to specific structural and functional correlates of autobiographical memory deficit in each condition (Table 1).

The neural signature of autobiographical memory impairment in Alzheimer's disease has been explored by means of different neuroimaging techniques. At the structural level, it appears that autobiographical memory performance mostly correlates with brain atrophy in the bilateral medial temporal regions, the bilateral prefrontal regions, and the posterior brain regions, such as the precuneus and the posterior cingulate cortex. Functional cerebral changes have also been reported in the same brain areas, with increased brain activations associated with autobiographical memory deficit in Alzheimer's patients.

In contrast, the autobiographical memory deficit in semantic dementia is mostly related to brain atrophy in the lateral temporal regions, even if some medial temporal structures such as the hippocampus play a particular role in the expression of the deficit. The volume of medial

and lateral prefrontal regions seems also to have an impact on autobiographical memory performance. The reduced volume observed in these brain regions has been associated with upregulated brain activity in patients with semantic dementia. In the case of behavioral variant frontotemporal dementia, the atrophy in the medial prefrontal regions has been identified as the main predictor of autobiographical memory impairment.

Taken together, these findings confirm that a specific neural signature is associated with each profile, with an apparent overlap between structural and functional correlates. However, it is important to note that this kind of investigations remain at a relatively early stage and further studies are necessary to tackle all the changes that could be associated with autobiographical memory decline in dementia.

### **Autobiographical Memory and Anticipating the Future**

Over the past years, there has been growing interest in the ability to mentally project oneself into the future. In the field of healthy and pathological aging, this particular interest is probably related to the central roles that future thinking plays in daily life, such as emotion regulation, problem solving, or goal achievement, but also its association with well-being.

Future thinking is strongly related to autobiographical memory, in that autobiographical memory does not only enable the report of past episodes but also provides the constituent parts for the construction of future personal events. According to the constructive episodic simulation hypothesis (Schacter et al. 2007), past and future events rely on similar information stored in episodic memory, which are flexibly recombined into a novel coherent event, and thus involve similar cognitive processes and cerebral underpinnings to retrieval of the past. However, converging lines of evidence have underlined the higher cognitive and cerebral functional demands for imagining the future compared to remembering the past. In this

context, one could hypothesize that the autobiographical memory deficit would be accompanied by future thinking impairment, with a more severe impairment for future thinking.

Regarding healthy older adults, a clear deficit in future thinking has been consistently reported across studies, with a lower number of episodic details provided by older adults relative to younger adults. In addition to the reduced episodic richness of future simulations, older adults tend to look less far into the future. Importantly, future thinking changes are greater than the change observed for autobiographical memory.

This disproportionate disturbance of future thinking abilities relative to autobiographical memory performance has been replicated in every clinical condition studied to date, including patients with Alzheimer's disease, behavioral variant frontotemporal dementia, or semantic dementia. In every case, the amount of episodic details provided by patients with dementia is significantly lower than in healthy older adults. In contrast with autobiographical memory, for which different profiles and degree of impairment emerge, episodic future thinking performance appears severely and similarly compromised in these three clinical conditions.

Since aging confronts people with major changes in life goals, with social connection and emotion regulation becoming a priority, or with changes associated with the occurrence of a chronic disease, the combined study of autobiographical memory and future thinking is critical to obtain a comprehensive picture of the changes experienced by older people and patients with dementia in their daily life.

## Conclusions and Future Directions

Normal and pathological aging have a clear deleterious impact on autobiographical memory functioning. Despite the different profiles of alteration discussed in this chapter, a consistent finding is that the episodic component of autobiographical memory is more sensitive to age-related changes than the semantic component. The cognitive

mechanisms involved in the expression of autobiographical memory impairment are variable. Depending on the etiology, episodic memory, executive functions, or semantic deficit has been suggested as being the main cognitive mechanism involved in autobiographical memory dysfunction. However, as noted in this chapter, the identification of distinct profiles of alteration could be challenged given the varying methodologies used across studies and also because of the progressive nature of dementia and the heterogeneity of disease course between patients.

The underlying brain regions are also differentially affected by normal and pathological aging. As mentioned at the beginning of the chapter, converging results obtained from different conditions support the idea that damage in any key nodes of the autobiographical memory brain network could interfere with autobiographical memory functioning, which makes autobiographical memory particularly sensitive to brain damage.

A recent line of research also aimed to extend the findings of autobiographical memory deficit to future thinking impairment in both normal and pathological aging. This new set of findings significantly contributes to the better understanding of age-related changes faced by older adults in their daily life. From a clinical standpoint, this body of research provides promising avenues to improve the care of people with dementia. In this context, a few studies attempted to improve autobiographical memory in patients suffering from dementia, but only mild improvement has been obtained to date. In contrast, no study has explored the possibility of improving future thinking performance, neither in healthy older adults nor in patients with dementia. Considering the central roles of autobiographical memory and future thinking in everyday life, a priority is further studies that have the potential to promote long-life health and quality of life in older people. In this vein, a topical research interest would be to examine more specifically memories that are particularly relevant to the self, which support personal identity and the sense of continuity across time (► [Self-Theories of the Aging Person](#) by Diehl, M. et al., this volume).

## Cross-References

- ▶ [Alzheimer's Disease, Advances in Clinical Diagnosis and Treatment](#)
- ▶ [Cognitive and Brain Plasticity in Old Age](#)
- ▶ [Cognitive Neuroscience of Aging](#)
- ▶ [Dementia and Neurocognitive Disorders](#)
- ▶ [Frontotemporal Dementia \(FTD\)](#)
- ▶ [Healthy Aging](#)
- ▶ [Positive Emotion Processing, Theoretical Perspectives](#)
- ▶ [Semantic Dementia](#)

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## Memory, Episodic

Yee Lee Shing

Center for Lifespan Psychology, Max Planck Institute for Human Development, Berlin, Germany

## Synonyms

Declarative memory; Explicit memory; Long-term memory

## Definition

Episodic memory refers to memory about events that are bound to particular times and places in the past. It is a type of long-term memory containing information from the past (ranging from minutes to decades ago) that can be recalled explicitly (hence also called explicit or declarative memory). A core part of our identity is rooted in the ability to mentally travel back in time and reexperience past events. For example, to remember what happened on your last birthday is episodic memory.

Episodic remembering is a conscious retrieval process, such that an individual attempts to reconstruct the past personal experience. It can be accompanied by specific contextual details of the episode, generally referred as recollection, or only based on the feeling of remembering without recovering specific details, generally referred as familiarity. While most of the time retrieval of past experience can be achieved reliably, the adaptive nature of the human memory system also renders itself prone to errors and distortions.

## Introduction

Most people associate aging with declines in episodic memory. Older adults more often complain

about experiencing memory difficulties, such as learning new information or recalling the name of a familiar face. Empirical evidence lends some support to this common conception. Cross-sectional studies, which involve a study sample consisting of individuals of different chronological age, suggest that individuals who are older show lower memory performance than those who are younger (Kausler 1994). Linear deterioration in episodic memory performance begins as early as in the 20s. Longitudinal and cohort-sequential studies in adulthood, which follow one or a few groups of individuals repeatedly across years, also show that episodic memory declines across time in old age. However, an important divergence in finding emerged such that episodic memory performance seems to remain relatively stable until about 60–65 years of age, after which accelerating decline is observed (Nyberget al. 2012). One source of discrepancy in estimating the onset of decline may be because cross-sectional estimates of age-related difference are potentially biased by cohort effects, with later generations showing higher educational attainment and better memory performance. In any case, it is fair to say that the decline in episodic memory is reliably observed in old age (particularly after age 60) and is steeper than semantic memory, namely declarative information about the world, culture, and one's own environment. This is the case even in individuals who are healthy and show no signs of dementing illness. A number of studies have examined cognitive decline in relation to proximity to death in older individuals (i.e., terminal decline). Accelerated decline in episodic memory has been identified as early as 8.4 years prior to death, with a rate twice that observed as a function of chronological age. At the same time, the structure, function, and neurochemistry of brain circuitries supporting episodic memory also undergo profound reorganization in old age (Buckner 2004). Due to the increased availability of brain-imaging technology, one of the current focuses in the aging research fields is to better understand the links

and dependencies between cognitive and neural changes during late life.

### **Differential Age-Related Differences in Memory Processes**

There are a number of important qualifications to the mean declining trend in episodic memory. The extent of episodic memory decline varies with the type of memory processes entailed. In the laboratory, episodic memory is typically studied by presenting the participants with some to-be-remembered information (e.g., encoding a list of scene pictures or word pairs). After a retention interval (ranging from minutes, days, to weeks), participants' memory on the information is tested or retrieved. One commonly used test format is recognition, in which studied and non-studied items are presented and participants' task is to say "old" to the studied items and "new" to the non-studied items. Another commonly used test format is cued recall or recall, in which participants have to search through their memory actively (or based on a retrieval cue) to remember the studied items, monitor the retrieved information, and judge whether it is the appropriate target given the current retrieval context.

Different aspects of memory performance are disproportionately affected by aging. In general, the extent of age differences in episodic memory depends on the amount of self-initiated processing required by the task. According to Craik (1983), older adults' memory performance is particularly impaired when retrieval depends on self-guided cues and active control processes. This is due to age-related depletion of attentional resources of the mind. On the other end of the continuum, with more task-appropriate cue from the environment, age-related deficits should be reduced (cf. Lindenberger and Mayr 2014). Empirical support for these propositions can be found in the literature. For example, older adults are less effective than younger adults in using memory strategies to aid remembrance. Age differences tend to

be smaller by increasing schematic support afforded by the study material. When memory tasks involve naturalistic information where participants can make use of prior knowledge, age-related differences can be reduced or eliminated. Examples for this include studying grocery items with price information at market value or word pairs comprising words semantically related to each other. The same phenomenon is found for retrieval from episodic memory. Processing demands at retrieval are greater in recall than recognition due to the additional needs to search and monitor the retrieval process. In line with this, age differences found in recall tasks are typically larger than with recognition tasks.

In addition to the central aspects of information, episodic memory heavily involves the encoding and retrieval of contextual information surrounding the episode, such as the modality in which information was presented or spatial location of items. It has been shown that memory for content shows smaller age-related decrease than memory for context (Spencer and Raz 1995). The magnitude of age differences in context memory depends on the relevance of the context to the targeted content. In a more general form of the content-context distinction, Chalfonte and Johnson (1996) proposed that older adults have difficulties binding pieces of information into complex memories. Later on, this was formulated as the associative deficit hypothesis, which postulates that older adults' problems in episodic memory are due to their difficulties in creating and retrieving intra- and inter-item associations. Empirical evidence has been gathered for this hypothesis, indicating a larger effect of age on memory for associative than for item information (Old and Naveh-Benjamin 2008). This was found in memory for source, context, temporal order, spatial location, and item pairings, in both verbal and nonverbal material, and particularly under intentional learning instructions. Additionally, age-related deficits in associative memory, particularly when measured with recognition, are due to higher false-alarm rate in wrongly endorsing rearranged information as original studied material (Shing et al. 2010).

One explanation for such a pattern of results is based on the dual process account of recognition memory (Yonelinas 2002). It is suggested that memory for past events can be based on retrieval accompanied by specific contextual details, that is, recollection, or on the feeling that an event is old without recovering specific details, i.e., familiarity. It is shown that recollection of particular contextual details is more strongly affected by senescent changes than familiarity-based processing (Light et al. 2000). Older adults are also more susceptible to familiarity-based memory illusions, such as ironic effects of repetition, in which repeated lures (unstudied information) during a recognition memory test are mistaken for word originally presented during encoding. Taken together, older adults show a stronger reliance on familiarity feeling during recognition, leading them to be more readily to falsely endorse information that appears familiar without engaging in careful verification through cognitive control.

### **False Memories in Aging**

In older adults, the reduction in memory for context, and the increased reliance on general familiarity, makes them particularly vulnerable for committing false memory (Schacter et al. 1997; Jacoby and Rhodes 2006). It has been shown that older adults, in addition to worse veridical memory, exhibit higher tendency to falsely remember things that in fact did not take place in the past. False memory is commonly studied using the Deese-Roediger-McDermott paradigm. Here, participants study a list of words in which some of them are related to a common theme (e.g., pillow, dream, and rest are related to sleep). Older adults show a more pronounced increase than younger adults in the erroneous endorsing or recall of critical lures (i.e., sleep) after studying the semantically related items in the encoding list. Furthermore, manipulations that reduce false memories in younger adults, such as providing more encoding opportunities or warning about the semantic lures, are only partially effective in older adults. For example, after several repeated

study-test trials in which the same lists were presented, only younger but not older adults showed a decrease in recalling non-presented semantic lures. This showed that older adults have difficulties in building up veridical representations of the actually studied items. At the same time, as both studied and non-studied semantic lures become more familiar across repetitions, older adults are less able to control their decision against the increasing strength of familiarity signals. Research also shows that older adults have difficulties in remembering the source of information, such as whether an event was suggested or perceived, who presented the information, or if the participant asked for, answered, or listened to certain information. Furthermore, older adults' subjective experience of memory (in the form of self-reported confidence judgment) is less well calibrated to their actual level of accuracy. In some cases older adults have been found to be falsely confident about the accuracy of their recognition memory (Shing et al. 2010). This renders older adults more susceptible to falsely endorsing misleading information (the misinformation effect) and scams in real life.

### **Interindividual Difference in Memory Aging**

Despite the general mean trend of memory decline, there are vast amounts of interindividual differences in both level and change of memory performance in late life. This suggests that while some individuals experience massive deterioration in memory functioning, other high-performing individuals display little or no performance decline in memory (Nyberg et al. 2012). These interindividual differences in change of memory increase as a function of advancing adult age.

Basic cognitive resources including perceptual speed, working memory, and inhibition are reported to be important predictors of interindividual differences in memory performance. This was commonly studied by correlational methods testing for mediation, such that the resource factors are

measured independently and their roles in accounting for cross-sectional age-related variance in memory performance are determined statistically. Skepticism is warranted against such approach as it is limited in its ability to explicate within-person longitudinal changes accurately (Lindenberger et al. 2011). To understand interindividual differences in level and change of memory functioning, researchers need to rely on longitudinal investigations of memory development within individuals.

Factors related to lifetime exposures such as educational attainment, socioeconomic status, and occupation have been considered as moderators of the age-memory relationship. This line of work is related to the notion of cognitive reserve, which postulates that cognitive processes are crucial for explaining the differences between someone who is functionally impaired and someone who is not, despite equal brain changes or pathology (Barulli and Stern 2013). These cognitive processes reflect differences in cognitive efficiency presumably shaped by life experiences. Empirically it is often estimated using proxy variables for lifetime exposures and cognitive activity, such as educational attainment. However, existing data suggests that education is associated with level of memory performance in old age, but not with interindividual differences in change, likely reflecting people's differences in cognitive functioning accumulating since early life. On the other hand, data from longitudinal observational studies suggests that having an enriched lifestyle that is intellectually stimulating and physically active predicts better maintenance of cognitive skills and is associated with a reduced risk of developing Alzheimer's disease in late life (Hertzog et al. 2009). Having an occupation of higher complexity in life is related to higher cognitive performance, but this relationship is attenuated after retirement, suggesting that forming as well as maintaining a stimulating lifestyle is important for preserving cognitive functioning in late life (Nyberg et al. 2012). Note that caution is warranted given that causal directionality of the association between enriched experience and cognitive functioning in human is thus far difficult to disentangle.

## Plasticity in Memory Aging

It is assumed that aging is not consisting of fixed trajectories but rather a range of possible functioning levels, which reflects person-specific constellations ranging from genetic profile to lifestyle preference. Given the observed memory decline in aging, this begs the question of to what extent (and in which condition) there is remaining memory plasticity in cognitively healthy older adults (Hertzog et al. 2009). Earlier memory training research focused on instructing older adults with memory strategy, as they are less able to spontaneously initiate adequate encoding strategies (Kausler 1994). Instruction and/or practice in a memory encoding technique, for example using imagery strategy, leads to robust performance improvements in healthy older adults. However, thus far the effects of strategy-based training seem to be relatively constrained to the memory task being trained and lack transfer to other cognitive domain or real-life application.

Reducing false memory in older adults can partly be achieved by training retrieval processes. After training in situations that entail facing high levels of interference and being provided by feedback, older adults can increase reliance on recollection and reduce misleading automatic influences of memory, such as the familiarity signal (Jacoby and Rhodes 2006). Such kinds of recollection training show transfer to other classes of memory tasks that are prone to proactive interference and require weighing of competing information.

Aerobic exercise as an intervention paradigm has better documented benefits in improving performance on cognitive tests, including episodic memory (Smith et al. 2010). It has been shown that aerobic exercise training in older adults increased the size of the anterior hippocampus, reversing the amount of loss by 1–2 years. The gain was also related to improvements in spatial memory. The neural mechanisms driving the positive effects of aerobic fitness on brain status and cognitive performance in humans are thus far not well understood. Evidence from animal studies suggests that these effects may be associated with neurogenesis in the hippocampus, and the

dentate gyrus in particular, due to changes in neurotransmitter and growth factor release (Kempermann 2008).

## Aging Brain and Memory

In recent years, many studies have used magnetic resonance imaging to examine the neural correlates of episodic memory decline in aging. Age-related differences and in some cases longitudinal decline in the structural and functional integrity of the neural network supporting episodic memory, particularly the prefrontal cortex and medial-temporal lobe, are frequently observed. Prefrontal brain regions are among the areas that undergo the strongest atrophy in old age (Raz 2005). Gray matter changes are especially pronounced in the hippocampus and less so in the surrounding cortex in the medial-temporal lobe. Hippocampal atrophy is particularly visible in those individuals with hypertension, underscoring the importance of vascular health in aging.

Studies assessing age-related differences in functional activation have mostly used the subsequent memory paradigm, in which encoding activity related to subsequently remembered events is contrasted against activity related to subsequently forgotten ones. In a meta-analysis by Maillet and Rajah (2014), age-related decreases in subsequent memory effect in the occipital and fusiform cortex are observed. But older adults tend to over recruit in a set of regions including bilateral middle/superior frontal gyri, anterior medial frontal gyrus, precuneus, and left inferior parietal lobe, which are regions often involved in unsuccessful encoding in younger adults. The implication of this finding is yet to be understood but it underscores a shift in the way older adults encode new information.

## Pathological Aging of Memory

Although memory decline is considered a part of normal aging, it can also be a leading indicator of brain pathology, such as dementia of the

Alzheimer's type. Alzheimer's disease is a progressive neurodegenerative disease characterized by loss of function and death of neurons in several brain areas. The medial-temporal cortex, particularly the entorhinal cortex, is vulnerable in the early stages of the disease, hallmarked by manifested deficits in episodic memory (Buckner 2004). It is the most common cause of dementia in pathological aging and symptoms advance to global compromise as the disease progresses, severely hampering life quality of patients and their caregivers. Considerable evidence suggests that individuals who will develop Alzheimer's disease exhibit cognitive deficits (including global cognitive ability, episodic memory, perceptual speed, and executive functioning) several years before a clinical diagnosis of dementia. Furthermore, pathology in the brain exists for at least a decade before clinical diagnosis of Alzheimer's disease is made (Gallagher and Koh 2011). From a clinical perspective, early identification of individuals at risk for developing Alzheimer's disease, combining genetic, biological, and cognitive markers, is imperative for maximizing effectiveness of interventions and is a research area currently under active investigation.

## Cross-References

- ▶ Individual Differences in Adult Cognition and Cognitive Development
- ▶ Memory Training Methods and Benefits
- ▶ Memory, Autobiographical
- ▶ Plasticity of Aging

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## Memory, Implicit

Susanne Mayr<sup>1,2</sup>, Jan Philipp Röer<sup>1</sup>, Axel Buchner<sup>1</sup> and Raoul Bell<sup>1</sup>

<sup>1</sup>Heinrich Heine University Düsseldorf, Düsseldorf, Germany

<sup>2</sup>University of Passau, Passau, Germany

### Synonyms

Remembering without awareness; Unconscious remembering

### Definition

Among memory researchers it is quite common to conceive of human memory as a collection of different memory systems. For instance, broad agreement exists that working memory must be distinguished from long-term memory (see the chapters in “► [Memory, Autobiographical](#),” “► [Memory, Episodic](#),” “► [Memory, Procedural](#),” and “► [Prospective Memory, New Perspectives for Geropsychological Research](#)”) and that these two memory systems are functionally distinct: They differ in terms of features such as the quantity of information they can hold and the time-span within which information is lost if it is not used.

In contrast, implicit memory is not meant to denote a memory system. Rather, it is merely a descriptive term that represents a particular way of measuring memory – although, as will be discussed further on, certain empirical findings have caused some researchers to suggest that implicit memory represents a memory system

that is separable and functionally distinct from other forms of memory. In order to understand why many people find the implicit way of measuring memory so interesting that even an entry in this handbook was devoted to this topic, it is useful to contrast implicit memory with its counterpart: explicit memory.

A typical explicit memory test is a recognition test in which it has to be judged whether an entity such as a person, an event, or an object has been part of a well-defined past episode. For instance, eyewitnesses may have to judge whether people whose photographed faces are shown as cues in a photo lineup have been present at the crime scene. Free recall is another popular explicit memory test. Here persons have to name entities such as persons, events, or objects from a past episode without any memory cues. The reference to a well-defined learning episode is the defining criterion for an explicit memory test.

Implicit memory measurements, in contrast, lack this reference to a previous learning episode. Instead, aftereffects of prior exposure to entities are measured indirectly. For instance, the perception of an object under difficult viewing conditions is typically somewhat faster and less error prone if that object has been experienced prior to the identification task than if it has not (Buchner and Wippich 2000). As another example, objects that have been repeatedly encountered are often preferred over novel objects merely because of prior exposure (Kunst-Wilson and Zajonc 1980).

For many people it is even more interesting that this improvement in performance or a change in preference can be observed independently of whether the object is recognized or not. This is because, in everyday language, the act of recognition comes with the connotation of being experienced as subjectively conscious. Thus, and in terms of the examples used in the previous paragraph, the performance improvement or the change in preference for previously experienced objects can be observed in the absence of conscious recognition.

It seems reasonable to suspect that the idea of improving a person’s performance or of changing a person’s preferences without the person being aware of it is so fascinating per se that it explains a

substantial part of why the topic of implicit memory is so attractive. For instance, the advertising industry knows that consumers tend to devalue arguments contained in advertisements because consumers (usually correctly) suspect that advertisements are strongly biased in favor of the advantages of the promoted product or brand. Obviously, this form of devaluation depends on the fact that a person is aware of the source of the argument (in this case, the advertisement). However, if a person's preferences could be changed without the person being aware of it, then there would be no basis for such a devaluation. This would obviously open up new ways in which advertisers could try to affect consumer decisions. Indeed, it has been shown that people prefer brands to which they were previously exposed even when they do not remember that they were exposed to those brands (Shapiro and Krishnan 2001).

However, there is more to implicit memory than the mere fascination with the cognitive unconscious. First, and perhaps most obvious, implicit memory tests have greatly expanded, and continue to expand, the available toolbox of memory measures, allowing to assess contents of memory that would not be measurable otherwise and to gain insights into memory processes that would not be possible otherwise. Second, dissociations between implicit and explicit memory measures have been interpreted to show that these measures reflect distinct and functionally dissociable forms of memory systems. As will become clear further on, this interpretation is quite problematic and should be avoided.

### **Expanded Toolbox of Memory Measures**

As Ebbinghaus (1885) has already argued, of all the previous experiences that leave traces in memory and affect current behavior, only a very limited part becomes consciously available and can be assessed with explicit memory measures such as recall and recognition. To overcome this limitation, Ebbinghaus invented the so-called savings method as a way to measure memory for previous experiences independent of whether these

experiences were consciously available or not. In this sense, the savings method can be regarded as the first implicit memory test. The savings method is best illustrated using one of Ebbinghaus' own extensive and heroic self-experiments. For instance, on day 1 of such an experiment, he memorized many long lists of nonsense syllables and noted how many learning trials he needed until he could reproduce each list perfectly. Using the same lists, he repeated the list learning on subsequent days. With every day, fewer relearning trials were needed until the criterion of perfect reproduction was reached. This reduction (or saving) in the number of relearning trials on subsequent days is a measure that represents memory for the nonsense syllables independent of whether those syllables were consciously accessible or not when relearning began on subsequent days.

Memory researchers have been very creative in inventing implicit memory tests as alternatives to the savings method. A whole class of such tests is based on the principle that information that has been processed recently can be accessed more easily than novel information, as a consequence of which the use of this information in a seemingly unrelated task is facilitated. For instance, in the word-stem completion task, participants' task is to complete word stems with the first word that comes to mind. Usually unbeknownst to the participants, some word stems can be completed with words that were encountered just prior to the word-stem completion task in an incidental learning situation in which words may have to be read on some pretext. Usually an attempt is made to conceal the relationship between the prior encounter and the subsequent test, for instance, by pretending that prior encounter and test belong to different experiments. Memory is measured in terms of the proportion of word stems completed with previously encountered words relative to a base-rate condition in which these words were not previously experienced. The same task has also been used with word fragments instead of word stems. Similarly, when category exemplars have to be generated or difficult knowledge questions have to be answered, previously encountered words have a higher probability of being named

as responses than words that have not been encountered previously (Buchner and Wippich 1998, 2000). In all of these measures, performance improves as a function of previous experiences. Therefore, implicit memory tests in which memory is expressed in performance measures (an increase in the number of word stems completed to words that correspond to previously encountered words, an increase of category exemplars named that correspond to previously encountered words, etc.) can be referred to as performance-based memory tests.

Such performance-oriented measures were used in a series of studies published in the 1960s and 1970s that are now considered game changing, but which have received significant attention in the scientific community only one to two decades after they had been published. In one of these studies, memory performance of amnesic patients and control persons was compared using memory measures such as recognition and word-stem completion scores (Warrington and Weiskrantz 1970). The difference between amnesic patients and control persons was large and statistically significant for the recognition measure, but was small and not significant for the word-stem completion measure. Thus, there was a difference in explicit but not in implicit memory between amnesic patients and control persons. Very similar results have also been obtained when younger and older participants were compared. A good example is a series of experiments conducted by Light and Singh (1987). They reported the rather typical result of large and statistically significant differences between younger and older participants with explicit memory measures such as recall and recognition, whereas only small and statistically nonsignificant differences were found using implicit memory measures. Thus, the finding of a memory deficit depends on the way in which memory is measured. With explicit memory measures that imply intentional retrieval processes, it appears that healthy young adults can retrieve more information than amnesic patients or older persons. In contrast, with implicit memory measures that presumably rely mostly on automatic memory processes, this retrieval advantage becomes smaller and sometimes appears

nonexistent. Such an interpretation fits with the assumption that younger adults are much more likely than older adults to store or to retrieve information about the context within which an object or event was experienced. Performance in explicit memory tests such as recognition or recall depends on the availability of context information (i.e., of knowledge about whether or not an object or event was presented in a certain prior episode). Thus, younger adults should outperform older adults in explicit, context-dependent memory tests. In contrast, implicit memory tests such as word-stem completion do not require any context information, thus allowing for equal performance of younger and older adults. Such a pattern of results has been obtained in a number of different studies. However, in general it appears that age-related differences in implicit memory tests are not zero; they are just smaller than age-related differences in explicit memory tests (Zacks et al. 2000).

The same pattern of results has also been obtained when a different class of implicit memory tests was used. These tests are referred to as illusion-based memory measures. A good example of an illusion-based implicit memory test is the fame judgment task that can be used to create the false fame illusion. In that task, participants first read names or see faces of people under some pretext in a study episode. At a later point in time, they are asked to judge whether persons whose names they read or faces they see are famous or not. The typical finding is that previously read names or seen faces are judged to belong to famous persons with a higher probability than new names or faces. This phenomenon was first reported by Neely and Payne (1983) but received little attention at the time. A few years later, Jacoby and colleagues (1989a, b) smartly named it the “false fame effect” and investigated it further. One rather interesting feature of the false fame illusion is that it is moderated by the temporal distance between the study episode and the fame judgment task. With only a few minutes between the study episode and the fame judgment task, participants can easily remember the context in which they had experienced a name or a face. As a consequence, they can correctly attribute the

familiarity of a previously experienced name or face to the study episode rather than to the to-be-judged fame of the person to which the name or face belongs. With a longer delay (e.g., 1 day) between the study episode and the fame judgment task, much of the information about the context in which the name or face was experienced is typically forgotten. That is, participants read a name or see a face, but they often cannot remember that they have seen that name or face the day before. However, previously experienced names or faces still appear more familiar than names or faces that were not experienced in the study episode. In the absence of context information, this increased familiarity is attributed to the current judgment dimension, that is, to the to-be-judged fame of the person, creating the false fame illusion.

Interestingly, when older participants perform a fame judgment task immediately after the study episode, they show basically the same pattern that younger adults show with a 1-day delay between study episode and fame judgment task (Dywan and Jacoby 1990). This is plausible if one assumes that older adults encode or remember less context information than younger adults. With less context information available even immediately after the study episode, older adults tend to attribute the increased familiarity of studied names or faces to the current judgment dimension, that is, to the to-be-judged fame of the person to which the name or face belongs. Note that this pattern of data obtained with an illusion-based implicit memory test nicely fits results obtained with performance-based implicit memory tests: Younger adults outperform older adults in explicit, context-dependent memory tests because younger adults encode or remember more context information than older adults. Implicit memory tests do not require any context information, thus allowing for equal performance of younger and older adults.

The difference between performance-based and illusion-based implicit memory tests is that measures derived from the former – more accurate or faster responses or both – reflect memory performance directly, whereas measures derived from illusion-based implicit memory tests reflect cases in which memory is used as a tool to solve other

judgment tasks. A great variety of such judgment tasks has been explored (Buchner and Brandt 2003). For instance, when spoken sentences are heard against a background of white noise, the noise appears less loud when presented together with a sentence that has been heard before than when presented together with a novel sentence. Presumably, the previously heard sentence is perceived more easily than a novel sentence, as a consequence of which the interference caused by the noise is judged to be lower which is then attributed to the noise being less loud. Similarly, previously experienced problems are judged to be easier than novel problems, presentation times are judged to be longer for previously experienced items than for novel items, previously seen objects are judged to be more aesthetically pleasing than novel objects even when these objects are presented subliminally, and previously heard responses to difficult questions or statements such as product claims are accepted as true with a higher probability than novel statements or responses. It appears a bit scary that the latter is the case even when product claims are unambiguously paired with the note saying that a particular claim is false: Repeated exposure to product claims labeled as false can increase people's judgment that these statements are actually true, and to make matters worse, this false-truth illusion is even more pronounced for older than for younger adults (Skurnik et al. 2005).

### **Explicit and Implicit Memory as Dissociable Forms of Memory Systems**

In the “[Definition](#)” section above, it was pointed out that the term implicit memory is merely descriptive and only represents a particular way of measuring memory. However, dissociations such as those described in the previous paragraph – large age-related differences in explicit memory measures, small to no differences in implicit memory measures – have stimulated researchers to think about explicit and implicit memory as two forms of functionally distinct memory systems (Ward et al. 2013a): an explicit memory system which is impaired as a function of aging and an implicit memory system which is

spared from this impairment. Presumably, this change in theoretical focus has been supported by the fact that similar dissociations were reported for a variety of other comparisons such as those between patients with Alzheimer's disease and healthy older adults, between schizophrenia patients and healthy control persons, or between healthy elderly people who received glucose for peripheral ingestion and those who did not receive glucose (Buchner and Wippich 2000). However, it is more than questionable whether an interpretation of these dissociations in terms of two underlying memory systems is justified.

The main reason for this is a very simple methodological problem. It turns out that the measures derived from implicit memory tests typically have a much lower reliability than the measures derived from explicit memory tests (Buchner and Wippich 2000; Ward et al. 2013b; Buchner and Brandt 2003; LeBel and Paunonen 2011; Meier and Perrig 2000). In any given experiment, the probability of detecting differences between conditions is a function of the reliability of the measure used. In other words, differences such as those between older and younger people are more likely to be detected with the typically more reliable explicit memory measures than with the typically less reliable implicit memory measures (for details, see Buchner and Wippich 2000). Thus, the dissociations between explicit and implicit memory measures reported in the literature may simply reflect the differences in the reliability of the tests that were used rather than differences in underlying memory systems. What is more, Ward et al. (2013a) have recently shown that a single-system memory model can fit typical dissociation data even better than a multiple-system memory model. Thus, it is neither necessary nor justified to conceive of explicit and implicit memory in terms of functionally distinct memory systems.

## Conclusions

Measures derived from implicit memory tests have greatly expanded the available toolbox of memory measures. Using these measures,

researchers can explore the characteristics of, and test theories about, human memory in ways that would not be possible otherwise. Illusion-based implicit memory measures may even be considered interesting and relevant per se: The fact that the supposed fame of a person or attractiveness of a brand increases in the absence of explicit memory for having encountered the name or brand is quite fascinating in its own right, with obvious real-world applications.

Another motivation for using implicit memory tests came from the assumption that explicit and implicit memories represent separate memory systems with different developmental trajectories. Specifically, a standard finding in aging research is that younger and older adults usually differ significantly in terms of measures derived from explicit memory tests, but hardly, if at all, in terms of measures derived from implicit memory tests. This dissociation has, in the past, been interpreted as reflecting an explicit memory system that suffers in old age, combined with an implicit memory system that is spared from age-related impairments. This interpretation is not justified. First, the dissociation is likely due to the fact that the reliability of measures derived from implicit memory tests is much lower than that derived from explicit memory tests. Second, it has been shown that a single-system memory model fits such dissociation data even better than a multiple-system model.

It is thus best to use the terms explicit memory and implicit memory in the way in which they have been originally conceived, that is, as descriptive terms for situations in which memory is tested either with reference to a particular study episode (explicit) or without such a reference (implicit).

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## Memory, Procedural

Céline N. Bürki

University Center for Medicine of Aging, Felix Platter–Hospital, Basel, Switzerland  
Department of Radiology, University of Basel Hospital, Basel, Switzerland

## Synonyms

Non-declarative memory; Procedural learning

## Definition

The procedural memory system encompasses the retrieval and the execution of integrated skills, habits, and other procedures such as walking, writing, or riding a bicycle. The procedures are retrieved and performed mostly below the level of conscious awareness and therefore without the need of attentional control. As such the procedural memory is a type of “implicit” memory. It is a memory of “how to do things” and is formed through procedural learning, i.e., repeating an activity over and over again until it is executed automatically. The procedural memory is differentiated from the declarative memory, from the memory of conscious knowledge of facts and events (Schacter and Tulving 1994; Squire and Zola 1996). Together with the declarative memory, the procedural memory forms the long-term memory system.

From a historical perspective, the difference between procedural and declarative memory systems has already been described in the nineteenth century (James 1890). A seminal contribution regarding the experimental evidence for dissociation between procedural and declarative memory is from Milner (1962). She examined a former epilepsy patient, known as patient H.M., who underwent a bilateral medial temporal lobe resection and then suffered from amnesia, i.e., from severe memory impairments. Milner showed that H.M. was nevertheless able to learn and retain a

visuomotor drawing skill, but without explicitly remembering having practiced the task before. Subsequently, there has been extensive research using amnesic patients with brain damages differing in location and degree. Findings showed that amnesic patients, i.e., patients with severely damaged declarative memory, were able to learn and retain a broad spectrum of skills. Thus, the procedural memory system has a distinct underlying neuronal structure from the declarative memory system (Squire 1992).

Today, the underlying neuronal structures of the procedural memory system are well investigated: mainly subcortical regions are involved in procedural memory tasks, in particular the cerebellum and the basal ganglia. The basal ganglia consist of functionally different components whereof the striatum is the most important one for the procedural memory system. Both the striatum and the cerebellum have many interconnections to cortical areas such as to the frontal, parietal, and superior temporal cortex and to the hippocampus (Packard and Knowlton 2002). The subcortical regions are associated with different phases of procedural learning: The cortico-cerebellar and the cortico-striatal system are involved in early phases of motor learning where movements need to be adjusted. The cortico-striatal system stays involved in later phases where the task is executed automatically and consolidation and long-term retention takes place (King et al. 2013).

### **Age-Related Changes in Procedural Memory Performance**

Age effects in procedural memory performance have been studied among individuals with specific skills, such as typists, musicians, or athletes. The main finding in age-related changes in procedural memory skills is the decreased speed of task execution in older adults. However, it is also found that older adults are able to compensate this deficiency using alternative strategies to execute the task. An example is documented in studies by Bosman (1993) and Salthouse (1984). According to their investigations, older typists were slower

than younger typists in tapping a single key. However, older typists were not slower in typing words compared to younger typists, suggesting that older typists were able to compensate for the age-related slowing by beginning to prepare the keystrokes farther in advance as compared to young typists. Furthermore, studies with musicians and athletes showed that age-related changes in procedural memory performance also reflect reduced levels of practice (Ericsson 2000). When older expert pianists maintained a high level of practice, their piano-related task performance was similar to the one of young expert pianists (Krampe and Ericsson 1996).

Studies relying on more experimental settings broadly confirm the results of decreased task execution speed in older adults. Laboratory tasks such as the pursuit rotor task or the serial reaction time task are considered most reliable measures of procedural memory learning. The rotor pursuit task involves learning a sequence of movements by following a moving object with a cursor. In the serial reaction time task, participants are asked to respond as quickly as possible to each stimulus of a series of stimuli which follow a random order or, unbeknown to them, a repeating order (Nissen and Bullemer 1987). Typically, participants become faster at responding to the repeated order than to the random order by practicing the tasks.

Findings from the serial reaction time task show that procedural memory learning and performance is mainly spared from age effects with the exception of the generally decreased speed of task execution. In a study comparing younger and older adults, although older adults showed slower reaction times and a slower learning rate, no age difference was found with regard to the total amount of serial reaction time task learning (Daselaar et al. 2003). The authors also observed similar brain network activations during the serial reaction time task in both age groups. Hence, age differences were found neither at behavioral level nor at brain level in procedural memory.

Further findings indicate that while the learning of simple procedural memory tasks is preserved with age, the learning of more complex procedural tasks is not (Howard and Howard 2012). A first important element triggering

age differences in procedural learning was the predictability of the stimulus. A sequence can either be probabilistic or deterministic; whereas the former describes learning about probabilities in series, the latter describes sequences where each trial is fully determined by the preceding trials. No age differences are reported in the latter, the deterministic serial reaction time task, while there were differences in the probabilistic task (Gaillard et al. 2009). The complexity of the sequence structure was another important factor that mediated age effects in procedural learning (Rieckmann and Bäckman 2009). Age differences increased when the information to be integrated increased from preceding trials, enabling predictions regarding the current trial. This evidence is supported by the finding that cortico-striatal networks subserving motor learning are affected by age although subcortical brain regions are known to show later and slower age-related decline than cortical regions. The fronto-striatal networks are associated with deficits in conditions of increasing task complexity (King et al. 2013).

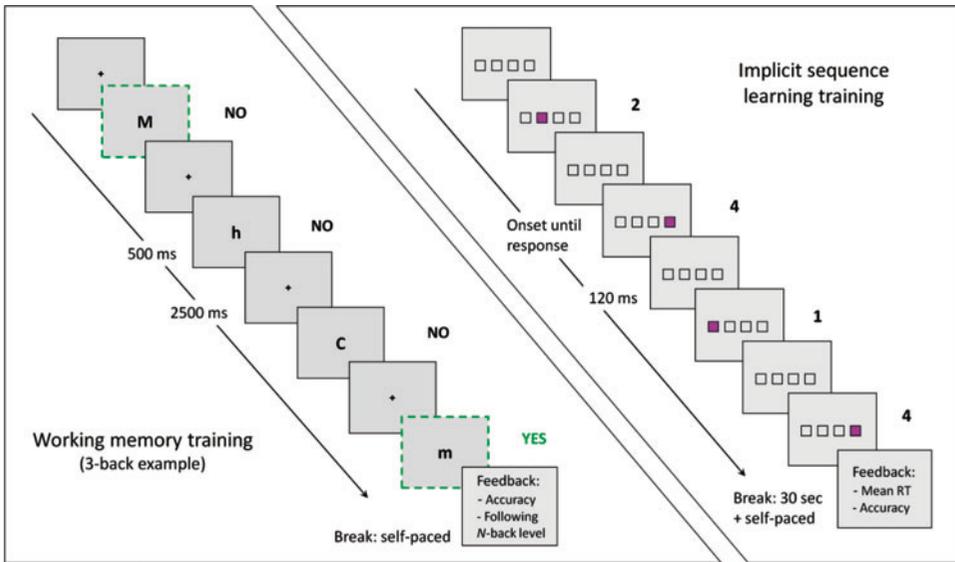
### Testing the Limits of Procedural Memory

The literature overviewed in the previous section suggests that no age-related differences in procedural memory occur when tasks are simple. This is also true for extensive procedural memory practice where the participants train over several days and finally perform at their limits. There is still an age-related decrease in speed, but age differences are not increased when participants attain their limits of task performance. This is remarkable, as in the case of working memory, age differences in task performance are substantially increased after several days of practice.

An illustrative example of an extensive practice where the limits of procedural memory and working memory were compared is the following study (Bürki 2012; Bürki et al. 2014). A deterministic lower-order serial reaction time task was implemented in a training procedure over ten training days and compared to the learning curves of a classic working memory training procedure. A sample of younger ( $n = 42$ ; aged

18–38 years) and older ( $n = 42$ ; aged 61–81 years) adults was trained. The goal was to practice a task requiring as little attentional resources as possible as compared to the working memory training. The procedural training group served as an active control group for the working memory training group. The serial reaction time task consisted of four light grey squares presented horizontally aligned in the center of the screen (see Fig. 1, right panel). One stimulus consisted of one pink and three grey squares, each square changing color from grey to pink in turn. The participants were asked to respond as fast and as accurately as possible by pressing the key matching the position of the pink square. The stimuli were presented in a determined second-order sequence where one trial is determined by the two preceding trials. A sequence of 16 trials was presented which was repeated six times without interruption in one block resulting in 96 trials per block. The starting point in the sequence in each block was defined randomly in order to avoid explicit learning of the sequence. Between each block, a rest of a minimum of 30 s was demanded in order to relax the hand. At the same time, the participant received a feedback containing the mean reaction time and the percentage of the correct responses from the preceding block. Fifteen blocks per training session were provided and each session lasted around 20–30 min. The participants trained during ten sessions distributed over 2–4 weeks. For the working memory training, an adaptive verbal  $N$ -back task training was used. The task consisted in judging whether the current letter matches the letter  $N$  positions back in a sequence of letters presented one by one (see Fig. 1, left panel). The level of difficulty ( $N$ -level) was varied by adapting the load in each block to the participant's performance reached in the preceding block. Similar to the procedural memory training, 15 blocks per training session were provided and ten training sessions distributed over 2–4 weeks were performed.

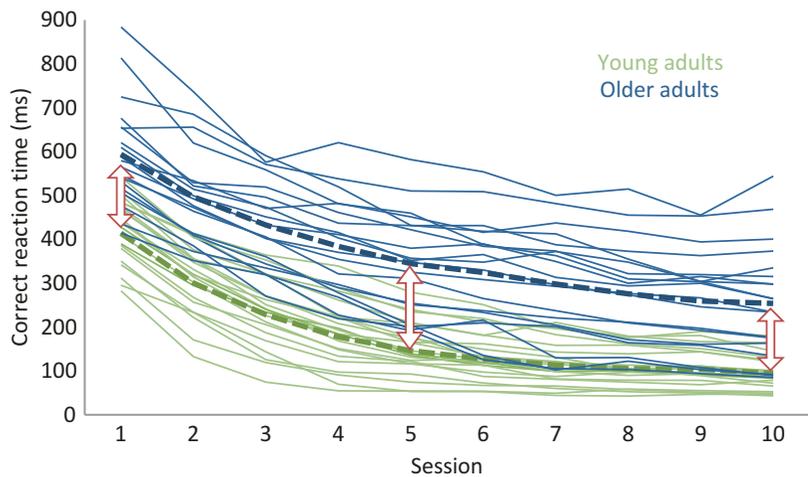
The individual training curves are plotted in Figs. 2 and 3. The interindividual differences are quite large between and within age groups. It is striking that the interindividual differences are larger in the group of older adults in both training



**Memory, Procedural, Fig. 1** Illustration of the training tasks. Working memory training (*left panel*): illustration of a 3-back example in the adaptive *N*-back task training.

Serial reaction time task training (*right panel*): illustration of a part of the trial sequence, each number corresponds to the response button which has to be pressed

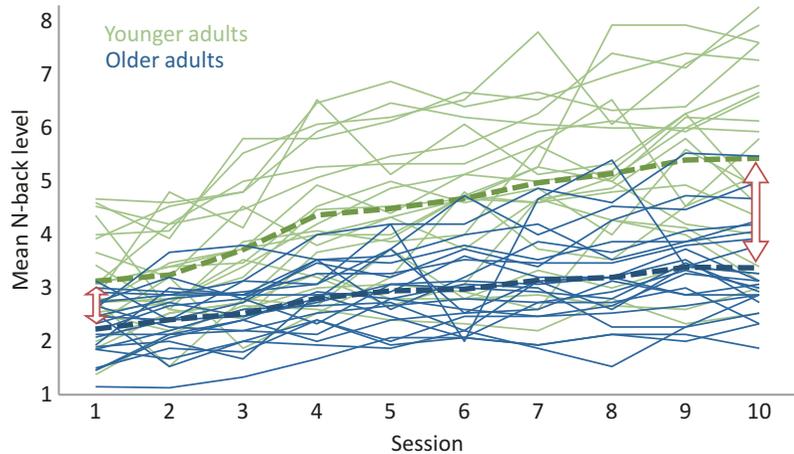
**Memory, Procedural, Fig. 2** Serial reaction time task training. Individual training curves of the averaged correct reaction time as a function of session, the *bold dashed lines* represent the mean of each age group



conditions. Results suggest that in the serial reaction time task training, younger and older adults decreased dramatically in reaction times over the ten training sessions. The age differences remained the same in training sessions one and ten (Fig. 2: note the similar size of the arrow at sessions 1 and 10). However, the analysis of the interaction of age group and training session revealed that younger adults reached the asymptote, i.e., no more reaction time improvement, earlier than older adults (see the increased size of

the arrow at session 5 compared to the arrows at sessions 1 and 10 in Fig. 2). Results of the working memory training revealed that similarly to the serial reaction time task training, younger and older adults increased in task performance and that age differences persisted over training sessions. Contrary to the serial reaction time task, however, the analysis of interaction age group and session shows that older adults attained the asymptote earlier than younger adults and that age differences were larger by the end of the

**Memory, Procedural,**  
**Fig. 3** Working memory training. Individual training curves of the averaged *N*-back level as a function of session, the *bold dashed lines* represent the mean of each age group



training compared to the first training session (Fig. 3: note the larger arrow at session 10 than at session 1).

The findings illustrate that the training curves in procedural memory tasks are different from the ones in a working memory task. In particular the age differences in the training curves are not the same between tasks and show that the total amount of learning between groups was similar for the serial reaction time task but not for the working memory task. As regards the asymptote, older adults reached it later in the serial reaction time task training and earlier in the working memory training than younger adults. Based on these results, it can be claimed that in simple procedural memory tasks, the learning rate is slowed down by age but the total amount of learning is preserved in older age, contrary to working memory tasks.

### Gait Analysis in the Clinical Setting

Essential everyday skills such as walking are subject of research in the clinical geriatric setting. Gait is a highly automated procedural memory skill, and it is still in older age but to a reduced degree. However, older adults tend to fall more often and walking speed is decreased compared to younger adults. In their seminal study, Lundin-Olsson et al. (1997) found that some older adults stopped walking while answering a simple question. The authors showed that 80% of these older adults fell at least once in the following

6 months, while in the group of older adults who continued walking while talking fell much less. This documents the association of procedural memory, cognition, and fall risks.

In recent years, an electronic gait analysis was developed as a diagnostic tool for fall risk and cognitive impairments (Kressig and Beauchet 2004). Gait analysis measures the degree to which gait is no longer an automatic and purely procedural motor task and therefore requires attentional control. Importantly, gait analysis with walking as a single-task condition alone is often insufficient to reveal deficits. The use of a dual-task paradigm, walking while simultaneously performing a cognitive task, is required to assess the effects of divided attention on motor performance and gait control. When, for instance, a healthy older adult is asked to walk while simultaneously naming animals, walking speed is generally decreased and step-to-step variability is increased as compared to walking without performing an additional task (Springer et al. 2006).

A gait analysis is often employed by using an electronic walkway system which consists of a carpet of approximately ten meters. The carpet is equipped with sensors registering the spatial and temporal parameters of the entire gait pattern. A standardized gait analysis includes usually the assessment of first, a motor single tasks, i.e., walking at normal pace. Then, in order to assess the walking reserve, that is, the difference from the normal walking speed to faster and to slower

walking speed, the participant is asked to walk at a fast and then at a slow pace as compared to his normal pace. Subsequently, cognitive-motor dual tasks, such as walking at normal pace while naming animals or walking at normal pace while counting backward, are employed. Finally, the performance in the cognitive single tasks, that is, naming animals and counting backward while sitting, is assessed. Walking parameters such as gait speed and variability in step length and width are analyzed. The most sensitive marker of the gait analysis is the difference in gait parameters between the single normal walking task and a cognitive-motor dual task, the so-called dual-task costs. The larger the dual-task costs, the more severe the impairment. Larger changes in gait parameters than commonly observed in older adults are associated with mild cognitive impairment, Alzheimer's disease, Parkinson, or with increased falling risk (Bridenbaugh and Kressig 2015). Thus, alterations in procedural memory performance assessed with the cognitive-motor dual-task paradigm are very sensitive for detecting alterations in executive function and attention and provide important diagnostic information.

### **Explanations from the Lifespan Research Account**

The finding that with advancing age procedural memory performance has an increased dependence on attentional resources can be set into the framework of the lifespan research account. In this framework, a generally observed pattern shows a decreasing correlation between different cognitive and sensorimotor variables from childhood to young adulthood and then an increase with advancing age. This phenomenon has been described in the differentiation-dedifferentiation hypothesis (Baltes et al. 1980). It says that the various cognitive, motor, and sensory abilities become more differentiated during child development until young adulthood and then again less differentiated and increasingly explainable by a single factor with advancing age. Observations from the large-scale Berlin Aging Study, for example, showed an increasingly stronger

connection between cognitive, perceptual, and motor variables with advancing older age (Baltes and Mayer 1999). The correlation between sensory and sensorimotor abilities such as vision, hearing, gait, balance, and cognitive abilities was much larger in old adults than in younger adults. The authors claim that there is a dedifferentiation with advancing adult age toward a general factor explaining a large amount of individual variance in brain performance.

Two explanations were proposed which are not mutually exclusive and explain the lifespan differentiation-dedifferentiation process from different perspectives. The first is called the common-cause hypothesis (Lindenberger and Baltes, 1994). The hypothesis suggests that a general neurobiological mechanism regulates the integrity of the brain across a wide range of regions and functional networks. This general mechanism affects all brain functions similarly and is more important during childhood, where the development is in progress, and becomes again more important during older age.

The second approach constitutes the aging-induced permeation of sensorimotor functioning with cognition, the so-called cognitive permeation (Lindenberger et al. 2000). The cognitive permeation hypothesis describes that, with advancing age, more cognitive resources have to be attributed to sensory and sensorimotor functions. In turn, fewer resources are available for intellectual tasks, as the already generally reduced resources in older adults have to be increasingly shared. So the resource overlap and competition between domains increases and compensatory resource allocation trade-offs become more frequent (Li and Lindenberger 2002). Therefore sensory and sensorimotor processes, including procedural memory tasks, are no longer fully automatically executed but require increased cognitive resources and turn into more attentional control demanding tasks in older age.

### **Conclusions**

Overall, procedural memory performance is not as much affected by aging as compared to other memory functions such as working memory. In

simple laboratory tasks, although older adults perform slower than younger adults, there are no substantial age differences in procedural learning and memory. Experts in a particular skill are even able to compensate for the age-related decrease in speed by increased exercise or other strategies. There is nevertheless evidence for qualitative differences in procedural memory performance in more complex tasks, such as dual tasking. Older adults recruit more attentional resources to accomplish a complex procedural task than younger adults. Thus, the nature of task execution is changing and shifting from an implicit to an explicit memory task. This fact is used in clinical geriatric practice in order to detect deficits in attentional processes.

Future research should nevertheless examine the compensatory potential of procedural memory in older adults for deficits in other kinds of memory, since it is less affected by age. Recent research for instance showed the potential of relying on procedural memory to optimize learning of new technologies which may serve as compensatory tools (Bier et al. 2015).

## Cross-References

### ► Memory, Implicit

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function and higher vulnerability to death (López-Otín et al. 2013). While the United Nations considers a person above the age of 60 years to characterize an “older” or “elderly” person, high-income countries use the chronological age of 65 years as the reference point for older age. Aging is considered a primary risk factor for a number of major human pathologies, including cancer, diabetes, cardiovascular disorders, and neurodegenerative diseases (López-Otín et al. 2013). The process of aging can be characterized by three main features: (1) an exponential increase in mortality with age, (2) physiological changes which typically result in functional decline with advancing age, and (3) an increased susceptibility to age-related diseases.

*Mental health* is defined as “a state of well-being in which every individual realises his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to her or his community” (WHO 2014). It is considered to provide individuals with the vitality needed for active living, to achieve goals and interact with others. Mental health problems are characterized by cognitive, emotional, and behavioral disorders which interfere with the lives and productivity of a person. They can affect the ability of older adults to carry out basic activities of daily living, reducing their independence, autonomy, and quality of life and contributing to their isolation, loss of independence, loneliness, and psychological distress (de Mendoca Lima and Mintzer 2013).

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## Mental Health and Aging

Moyra E. Mortby<sup>1</sup> and Kaarin J. Anstey<sup>2</sup>

<sup>1</sup>Centre for Research on Ageing, Health and Wellbeing, The Australian National University, Canberra, ACT, Australia

<sup>2</sup>Centre for Research on Ageing Health and Wellbeing, Research School of Population Health, The Australian National University, Canberra, ACT, Australia

### Synonyms

Ageing; Behavioural problems; Gerontology; Mental health; Old age

### Definition

*Aging* is the biological process of growing older. It is characterized by the progressive loss of physiological integrity, which leads to impaired

### Aging and Mental Health

The World Health Organization (WHO) estimates that the number of adults above the age of 60 years will rise to over two billion people by 2050. Older adults are faced with a number of health challenges, which impact on their ability to live independently (e.g., limited mobility, frailty, physical or mental health problems) and may require long-term care. Social, demographic, physiological, and biological factors all affect the general and mental health status of an individual, especially in older age. Factors include changes to

socioeconomic status resulting from retirement, social isolation, loss of independence, loneliness, death of a spouse or partner, or loss of social networks as a result of decreased mobility, change in residence, or death and negative community attitudes and/or stigma toward aging and mental health issues (Yasamy et al. 2013). The concept of agism is commonly used to refer to stereotypes toward the active process of aging, in which older adults are considered to be frail, “past their sell-by date,” unable to work, physically weak, mentally slow, disabled, or helpless. Such age discrimination has a negative impact on individuals’ well-being (Yasamy et al. 2013).

While the majority of older adults maintain good mental and physical health in older age, approximately 20% experience mental or neurological disorders, including dementia, depression, anxiety, substance use, and self-harm (Yasamy et al. 2013). However, mental health problems in older adults are generally underidentified by both health-care professionals and older adults themselves, in part as a result of the stigma associated with mental health issues and the reluctance of older people to seek help due to this associated stigma (Yasamy et al. 2013). While a number of mental health issues are associated with old age, this entry focuses specifically on dementia and depression.

## Dementia

Dementia is one of the most common mental health issues associated with old age. By 2050 it is estimated that over 115 million people worldwide will suffer from dementia. Dementia is a leading cause of disability and death in older adults above the age of 65 and has significant social and financial costs. Dementia is not a normal part of the aging process, and currently there is no cure.

*Dementia* is an umbrella term used to describe a wide range of symptoms linked to a decline in memory or thinking skills which impact on an individual’s ability to perform everyday activities. According to the *Diagnostic and Statistical Manual of Mental Disorders (DSM) fifth edition*,

dementia is split into major and mild neurocognitive disorders. *Major neurocognitive disorder* involves significant cognitive decline in memory, language, or learning that interferes with independence in activities of daily living. In contrast, *minor neurocognitive disorder* involves modest cognitive decline which does not interfere with activities of daily living, although greater effort is required to complete such activities. Different types of dementia exist, including Alzheimer’s disease, vascular dementia, dementia with Lewy bodies, Frontotemporal lobar degeneration, mixed dementia, and Parkinson’s disease dementia. Each type of dementia is characterized by distinctive symptoms and brain abnormalities.

## Alzheimer’s Disease

Alzheimer’s disease is the most common type of dementia, accounting for up to 80% of cases. It is a progressive neurodegenerative disorder of the central nervous system, affecting cognitive function. The American Psychiatric Association defines Alzheimer’s disease as the development of multiple cognitive deficits manifested by memory impairments (in the ability to learn or recall information) and at least one cognitive disturbance, such as aphasia (language disturbance), apraxia (impaired motor activity), agnosia (recognition/identification failure of objects), and executive function disturbance (e.g., planning, judgment). Cognitive abilities are affected selectively and at different stages during the progression of Alzheimer’s disease (e.g., language remains intact for longer, while episodic memory is disrupted early on in the disease). The main cognitive deficit exhibited in Alzheimer’s disease is early failure of episodic memory and the later appearance of semantic memory dysfunction. Further cognitive deficits include attention, awareness (in particular to the impairment itself), and executive function (working memory), while significant impairments are also observed in social and occupational functioning.

The progression of Alzheimer’s disease is classically characterized by a gradual onset and continuous cognitive decline in which the extent of

cognitive loss varies between patients in terms of progression and severity. The early stages of Alzheimer's disease are characterized by progressive cognitive decline and classical clinical features (including amnesic memory impairment, language deterioration, and visuospatial deficits), while later stages are highlighted by motor and sensory abnormalities, gait disturbances, and seizures. Patients with Alzheimer's disease often display symptoms of anosognosia (unawareness of impairment to their memory or cognition) in early disease stages. Functional and behavioral disturbances also typify this disease, with functional impairments being observed in higher-level activities of daily living (e.g., eating, grooming, toileting) and behavioral changes (e.g., depression, anxiety, apathy) appearing in the early stages of the disease and progressing in later stages.

## Depression

Depression is a further common mental health issue affecting older adults above the age of 65. It causes significant suffering and impairment to daily life functioning and is not a normal part of the aging process. Late-life depression (i.e., depression first experienced after the age of 60) is commonly associated with aging-related physical health problems. The WHO defines depression as a "common mental disorder, characterized by sadness, loss of interest or pleasure, feelings of guilt or low self-worth, disturbed sleep or appetite, feelings of tiredness, and poor concentration." Notably, the DSM-IV previously excluded a diagnosis of depression for people within 2 months of a bereavement. However this exclusion has been removed in the new DSM-V, recognizing that while grief and depression are distinct, they may also co-occur. The DSM-V classification seeks to clarify that it is normal to feel sadness and loss when grieving but that these feelings are not normal in everyday life and indicate a mental disorder that is treatable.

Depression is widely under-recognized, misdiagnosed, and under-reported in older adults. While global prevalence rates of major depressive disorders in community-dwelling older adults are

quite low (i.e., between 1% and 5%), the inclusion of subthreshold depressive symptoms significantly increases prevalence rates to approximately 12% and 15%, with a tendency to increase with age (Beekman et al. 2001). Notably, depression in older women is more common. Recurrence and persistence levels are also higher in older adults, with one in three older adults with depression developing chronic symptoms and chronic depression being particularly common in institutionalized older adults (Anstey et al. 2007). The presence of depression in older adults with intact cognition is considered a risk factor for cognitive impairment and dementia, eliciting clinical symptoms of cognitive decline and depleting cognitive resources.

The *vascular depression hypothesis* argues that cardiovascular risk factors affecting brain aging also play a key role in the etiology of late-life depression. Depression also occurs with higher frequency after stroke, and there is a bidirectional relationship between depression and cardiovascular disease. It is thought that vascular brain changes may underlie both late-onset depression and vascular cognitive impairment (Alexopoulos et al. 1997). However, a recent autopsy study found that depression in late life was not predictive of dementia-related neuropathology, even among those who developed dementia. The types of neuropathology examined included b-amyloid plaques and tau tangle density in multiple brain regions, neocortical Lewy bodies, hippocampal sclerosis, and gross and microscopic cerebral infarcts (Wilson et al. 2014).

Depression is also more prevalent among adults with eye disease such as macular degeneration and cataract but not necessarily with glaucoma (Eramudugolla et al. 2013). Research has shown that depression in later life is accompanied by cognitive changes such as slower processing speed. It has been difficult to disentangle whether cognitive deficits precede depressive symptoms or vice versa. Statistical modeling of longitudinal data has investigated the temporal associations between depression and cognitive slowing and shown that the best model is one where depressive symptoms precede cognitive slowing (Bielak et al. 2011).

## Depression: A Risk Factor for Dementia

In addition to being part of the prodrome of dementia, depressive symptoms are also associated with an increased risk of developing late-life dementia (Barnes et al. 2012). In late life, depressive symptoms increase the risk of mortality, particularly for males (Anstey and Luszcz 2002; Burns et al. 2013). There is a small increase in depressive symptoms in very late life, though most of this increase is attributable to comorbid medical conditions (Burns et al. 2013).

Depression is often considered an initial symptom in Alzheimer's disease, appearing in mild to moderate stages and becoming less prevalent in advanced stages. It is a common neuropsychiatric occurrence in Alzheimer's disease but is considered an atypical form of depression, given motivational symptoms and delusions are experienced more frequently by Alzheimer's disease patients than those non-cognitively impaired. Depression in Alzheimer's disease is characterized by high frequencies of motivational disturbances, symptoms of social isolation, withdrawal, irritability, or emotional distress, and vegetative symptoms of diminished interest, psychomotor retardation, fatigue, hypersomnia, and lack of insight.

Alzheimer's disease-related depression contributes significantly toward impairments in quality of life, activities of daily living, and executive function, while no difference is observed for attention, language, memory, or visuospatial functions when compared to patients with no change in mood. It is associated with an increased likelihood of physical aggression, being discharged from an assisted living facility, earlier entry into a nursing home, higher mortality and suicide, and higher levels of carer depression and burden. Risk factors for depression in Alzheimer's disease include a family history of mood disorders (affective disorders) in first-degree relatives, prior personal depressive history, female gender, and younger age of Alzheimer's disease onset.

With the progression of Alzheimer's disease pathology, the expression of depressive symptoms changes and it becomes more difficult to diagnose. Symptoms of psychomotor slowing, emotional lability, crying spells, insomnia, weight

loss, inability to verbalize affective state, and pessimism are prevalent in both depressed and nondepressed Alzheimer's disease patients. The diagnosis of depression in older adults is further complicated by their tendency to deny the presence of depressed moods and instead report a lack of feeling or emotion, or loss of interest and pleasure in activities. Due to aphasia, many dementia patients lack the ability to express their distress coherently, further complicating the diagnosis and contributing to the under-recognition of late-life depression as a result of clinical and nosological ambiguities.

## Behavioral and Psychological Symptoms of Dementia

Progressive cognitive decline and functional disturbances are typical clinical hallmarks of dementia. However, neuropsychiatric symptoms such as agitation, anxiety, irritability, illusion and delusions, apathy, depression, disinhibition, aberrant motor behaviors, and sleep disorders are intrinsic conditions associated with the neurodegenerative process of dementia (Stella et al. 2014). Such symptoms are commonly referred to as Behavioural and Psychological Symptoms of Dementia (BPSD) and form a major aspect of old-age mental health.

BPSD are defined by the International Psychogeriatric Association as "signs and symptoms of disturbed perception, thought content, mood or behaviour that frequently occur in patients with dementia" which may be prominent in some, but not all, phases of Alzheimer's disease – at times occurring prior to the onset of cognitive symptoms (i.e., either in early or late phases). They are a heterogeneous group of noncognitive symptoms which affect up to 90% of people with dementia. BPSD are associated with more functional disabilities, poorer prognosis, more distress, and medication misuse. Presence of BPSD causes a further loss of independence, linked to greater carer distress and burden, reduced quality of life for both the person with dementia and carers, breakdown of community care, earlier institutionalization, and long-term hospitalization. Symptoms can occur individually or in combination, and affect the

ability of people with dementia and their carers to perform everyday activities, thus reducing quality of life and increasing disease burden. While cognitive dysfunction in dementia (e.g., memory, attention, concentration, praxis) declines over time, BPSD symptoms fluctuate.

### Mild Behavioral Impairment

Neuropsychiatric symptoms are beginning to be acknowledged as an intrinsic aspect of prodromal stages of dementia and as an early marker of dementia risk which precedes the onset of cognitive symptoms and clinical diagnosis. The concept of “Mild Behavioural Impairment” (MBI) has been proposed as a late-life transitional state between normal aging and dementia (i.e., prodromal stage of dementia), in which the presence of neuropsychiatric symptoms in the absence of cognitive symptoms (i.e., cognitively normal individuals) confers an increased risk of developing dementia (Ismail et al.). This concept has been proposed as a diagnostic construct aimed at identifying individuals at an increased risk of developing dementia who do not exhibit cognitive symptoms and which will enable earlier detection of incipient neurodegenerative illness (Ismail et al.).

MBI is hallmarked by changes in behavior or personality which start in late life (after the age of 50 years) and which persist, at least intermittently, for 6 months. These represent a clear change from the person’s usual behavior or personality and is evidenced by at least one of the following:

- Decreased motivation (e.g., apathy, asponaneity, indifference)
- Affective dysregulation (e.g., anxiety, dysphoria, changeability, euphoria, irritability)
- Impulse dyscontrol (e.g., agitation, disinhibition, gambling, obsessiveness, behavioral perseveration, stimulus bind)
- Social inappropriateness (e.g., lack of empathy, loss of insight, loss of social graces or tact, rigidity, exaggeration of previous personality traits)
- Abnormal perception or thought content (e.g., delusions, hallucinations)

To meet the operationalized criteria for MBI, the behaviors must be of sufficient severity to produce at least minimal impairment to either interpersonal relationships, other aspects of social functioning, or ability to perform in the workplace. Individuals with MBI generally maintain independence of function in daily life and require minimal aids or assistance.

According to the operationalized criteria for MBI, individuals may have comorbid conditions, however behavioral or personality changes may not be attributable to another current psychiatric disorder (e.g., generalized anxiety disorder, major depression, manic or psychotic disorders), traumatic or general medical causes, or the physiological effects of a substance or medication, nor may they meet clinical criteria for a dementia syndrome (e.g., Alzheimer’s disease, frontotemporal dementia, dementia with Lewy bodies, vascular dementia, other dementia) (Ismail et al.). However, Mild Cognitive Impairment (a prodromal stage of dementia) can be concurrently diagnosed with MBI (Ismail et al.).

Behavioral and psychiatric symptoms are universally present in people with dementia. Their presence in prodromal dementia (i.e., Mild Cognitive Impairment) is recognized as an indicator of increased risk of conversion to dementia. The concept of MBI recognizes another population at risk of developing dementia. Acceptance of the syndrome of MBI as a prodromal stage of dementia will have significant implications for improving early detection, prevention, and treatment of dementia by providing a better understanding of the very early consequences of neurodegenerative disease.

### Conclusion

A number of factors can affect the mental health of a person. Cognitive, emotional, and behavioral factors are particularly pertinent in affecting mental health in old age. Early identification and treatment of risk factors is vital in order to improve well-being and reduce the prevalence of mental health issues in old age.

## Cross-References

- ▶ [Activity Theory, Disengagement Theory, and Successful Aging](#)
- ▶ [Age-Friendly Communities](#)
- ▶ [Aging and Psychological Well-Being](#)
- ▶ [Aging and Quality of Life](#)
- ▶ [Attitudes and Self-Perceptions of Aging](#)
- ▶ [Behavioral and Psychological Symptoms of Dementia](#)
- ▶ [Disability and Ageing](#)
- ▶ [Psychological Theories of Successful Aging](#)

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## Metacognition in Older Adulthood

Sarah (Uma) K. Tauber and Amber E. Witherby  
Department of Psychology, Texas Christian  
University, Fort Worth, TX, USA

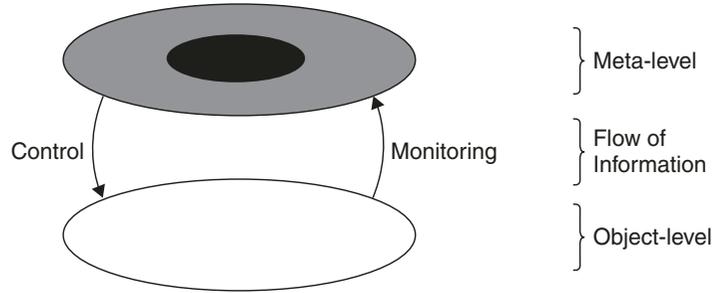
## Synonyms

Aging; Control; Metamemory; Monitoring; Older adults

Metacognition can be broadly conceptualized as “thinking about thinking” (Flavell 1979). It is multifaceted and often considered with respect to memory processes – thinking about memory (for a review, see Dunlosky and Metcalfe 2009). For instance, *metacognitive knowledge* refers to a person’s knowledge about his/her own memory. *Metacognitive monitoring* involves assessments of the current status of learning or of retrieval from memory. Finally, *Metacognitive control* involves self-regulatory processes used during learning or retrieval from memory. To illustrate these concepts, consider an older adult (65+ years old) who tends to have more difficulty remembering the name of a newly introduced person compared with other information about that person such as a hobby or occupation. Perhaps this older adult believes that she usually has difficulty remembering names (metacognitive knowledge). Because of this belief, when she meets new people for the first time she makes assessments to

### Metacognition in Older Adulthood,

**Fig. 1** Metacognitive framework that includes monitoring and control processes (Adapted Nelson and Narens (1990) and taken from Dunlosky and Metcalfe (2009) With permission from John Wiley and Son)



determine whether she will remember their names in the future (metacognitive monitoring). Finally, if she determines that she has not yet learned someone's name, she may decide to spend time using effective strategies to aid in learning it (metacognitive control). Exploring how these metacognitive processes function with aging into adulthood is the primary focus of this entry.

Researchers have increasingly focused on metacognition and in particular on the function of metacognitive processes in older adulthood. The focus of this entry is on healthy aging, but see Ernst et al. (in press) for a review of how neurodegenerative disorders that occur with age, such as Alzheimer's disease, influence metacognition. The normal aging process is associated with decline in most (but not all) types of memory (Hultsch et al. 1992; Salthouse 2010). Even so, older adults (65+ years old) have lived longer than young adults (college-aged) and therefore have more life experiences. Such experiences may preserve metacognitive abilities even though older adults suffer from cognitive deficits. Intact metacognitive abilities could be valuable, because older adults may be able to capitalize on them to enhance actual memory. For instance, if older adults are aware that they generally have poorer episodic memory relative to young adults, then they can make appropriate adjustments (e.g., use more effective strategies like external aids) in an effort to improve their memory in the future. Thus, accurate metacognitive processes can help older adults improve their quality of life, simply because metacognition is intimately related to cognition and mutually they influence each other.

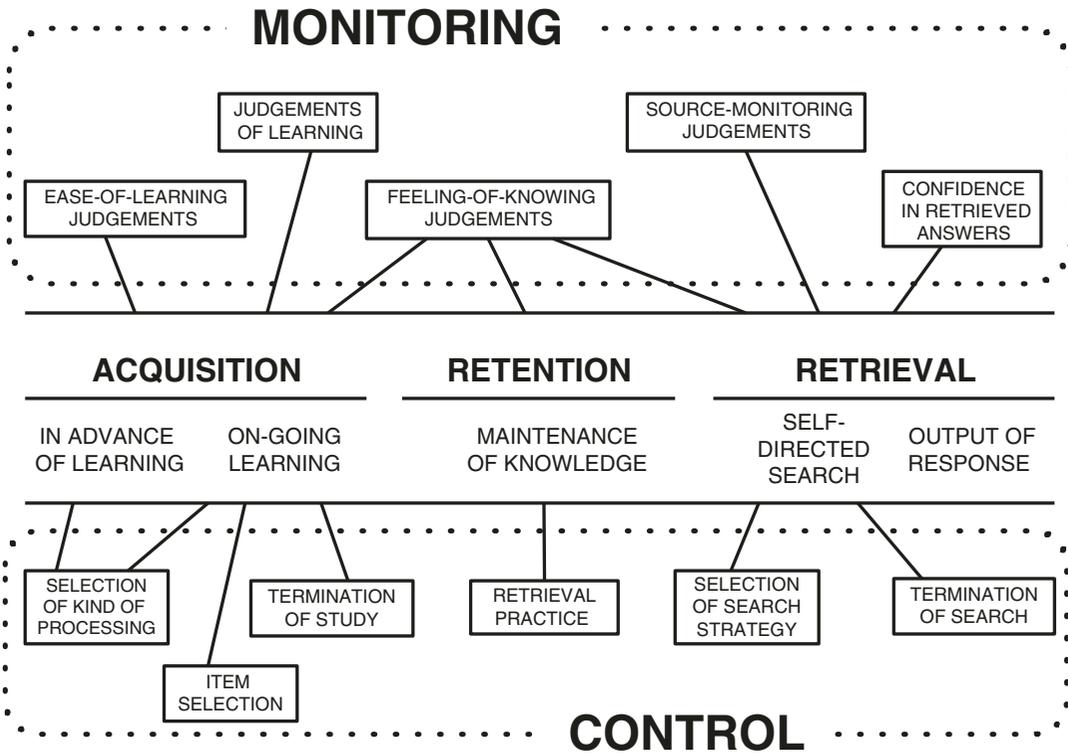
This interrelated nature between metacognition and cognition is illustrated by Nelson and

Narens's (1990) model (Fig. 1). In this model, cognition is represented in the object level and metacognition is represented in the meta level. Information flows from the object level to the meta level via monitoring, and it flows from the meta level back to the object level via control. Nelson and Narens (1990) used their model to produce a methodological framework of measures that can be used to evaluate monitoring and control. The framework (Fig. 2) includes measures of monitoring and control that are organized by the phases of learning: acquisition, retention, and retrieval. As is evident from this framework, several measures can be used to evaluate monitoring and control processes. In this entry, the focus is on the most commonly used measures to evaluate older adults' metacognitive monitoring (i.e., item-by-item judgments of learning and feelings-of-knowing, for reviews of how aging influences other measures, see Castel et al. in press) and of metacognitive control (i.e., item selection and self-paced study, for reviews of how aging influences other measures, see Hertzog in press). Next are discussions of older adults' metacognitive knowledge and of their monitoring and control.

### Metacognitive Knowledge

Early metacognitive research focused on beliefs about one's cognition, the importance of which is explained well by Cohen and Faulkner (1984):

...It is important to know what elderly people *believe* about their own memories to find out whether particular aspects of memory are considered to be more affected by age, and what particular problems are encountered in everyday life. (p. 49, italics in original)



**Metacognition in Older Adulthood, Fig. 2** Metacognitive framework organized by the phases of learning adapted from Nelson and Narens (1990) and taken from

Dunlosky et al. (2007b). Reprinted from *Psychology of Learning and Motivation*, Thomas O. Nelson, 125–173. Copyright (1990), with permission from Elsevier

One way to illustrate metacognitive knowledge is by considering cognitive complaints made by older adults. Research using checklists (e.g., Schweich et al. 1992) and questionnaires (e.g., Cargin et al. 2008; Cohen and Faulkner 1984) has revealed some consistency in older adults’ cognitive complaints. For instance, Cargin et al. (2008) evaluated the cognitive complaints of older adults with normal memory abilities and older adults with declines in their memory. Participants in both groups reported their memory and cognitive complaints on the Cognitive Failures Questionnaire (CFQ), which was completed twice over 2 years. Difficulty remembering names was the top complaint for both groups, and concerns about concentration and distractibility were next on the list. Given that names can be more challenging for older adults to remember relative to other information about an individual (James 2004; James et al. 2008, 2012), this

suggests that older adults’ metacognitive knowledge reflects actual memory performance.

To more closely evaluate the relationship between older adults’ metacognitive knowledge and cognition, researchers have used questionnaires about cognition and compared them with actual memory performance. To do so, two questionnaires have been frequently used: the metamemory in adulthood questionnaire (MIA) and the memory functioning questionnaire (MFQ). The MIA includes eight factors to evaluate the multifaceted nature of metacognition: understanding of memory tasks, knowledge of memory capacity, perception of changes in memory, knowledge of memory in anxious states, memory motivation and achievement, activities supportive of memory, use of memory strategies, and locus of control in memory (Dixon and Hultsch 1983b; Dixon et al. 1988). The MFQ was designed to evaluate people’s awareness of

daily cognitive experiences, and it includes four factors: general frequency of forgetting, seriousness of forgetting, retrospective evaluation of memory functioning, and use of mnemonics (Gilewski et al. 1990).

The psychometric properties of these questionnaires have been evaluated, and they (as well as others) have been used extensively to evaluate older adults' metacognitive knowledge (e.g., Dixon and Hultsch 1983a; Hertzog et al. 1989; Johansson et al. 1997) and the relationship between it and actual memory (Dixon et al. 1986; Gilewski and Zelinski 1986). The relationship tends to be modest (Hermann 1982). Indeed, a recent meta-analysis including 20,319 older adults established an effect size of  $r = 0.062$  (Crumley et al. 2014). Why might this be? There are a number of possible explanations (Pearman and Storandt 2004). For example, older adults' metacognitive knowledge can be influenced by cues that may not influence actual memory. One possible (and misleading) cue may be older adults' self-efficacy in their memory.

Memory self-efficacy (MSE) refers to beliefs about the ability to use your memory in various situations. If older adults' MSE is high, they may feel confident in their memory abilities and therefore take on more cognitively challenging tasks. If older adults' MSE is low, they may feel like they are doomed to fail and avoid learning and memory tasks altogether. Further, when engaged in a memory task, they may be less strategic when completing problems (Lachman and Andreoletti 2006). To evaluate MSE, researchers use a number of measures including subscales of the MIA or MFQ as well as the memory self-efficacy questionnaire (Berry et al. 1989). Unfortunately, older adults tend to have lower MSE relative to young adults (Berry et al. 2013; Hultsch et al. 1987; West and Berry 1994). Further, MSE tends to be weakly related to actual memory performance (McDonald-Miszczak et al. 1995; Valentijn et al. 2006). This suggests that older adults hold some beliefs about their cognition that are not evident on actual cognition – that is, they have inaccurate metacognitive knowledge. Thus, training to improve metacognitive knowledge and MSE is an important focus for intervention studies

(for a review, see Floyd and Scogin 1997). Critically, by improving older adults' MSE, subsequent improvements in quality of life have been observed (e.g., Aben et al. 2014).

## Metacognitive Monitoring

As previously noted, metacognitive monitoring refers to assessments of the current status of learning or of retrieval. Current theoretical perspectives on monitoring suggest that it is an inferential process that is based on available cues (Koriat 1997). According to this framework, monitoring judgments will be accurate when they are based on cues that similarly influence (or are related to) actual memory, and they will be inaccurate when they are based on cues that do not influence (or are unrelated to) memory. The focus of this entry is first on monitoring of learning that occurs during encoding followed by monitoring of retrieval processes.

### Monitoring During Encoding

Rabinowitz et al. (1982) were among the first to evaluate older adults' monitoring during encoding. To do so, young and older adults were instructed to study word pairs for an upcoming test. The word pairs were highly related (e.g., grass-cow), moderately related (e.g., wallet-cow), or unrelated (e.g., airplane-cow). Half of the participants were additionally instructed to use an effective study strategy by forming a mental image of the word pairs interacting (imagery group) and the other half did not receive additional instructions (learn group). Immediately following study, participants made a judgment of learning (JOL) predicting the likelihood of remembering the target (e.g., cow) when given the cue (e.g., grass – ?) on a future test. JOLs were made on a scale from 1 to 10, with 1 indicating certainty that the cue would not be remembered and 10 indicating certainty that the cue would be remembered. Finally, participants received a cued-recall test on which each cue (e.g., grass-?) was presented and participants attempted to recall the target word (e.g., cow) associated with each. Rabinowitz et al. evaluated

*judgment sensitivity*, which can be defined as the degree to which the magnitude of judgments varies based on available cues – in this case, item relatedness. Young and older adults' JOLs were sensitive to item relatedness in both the imagery and learn groups: JOLs were highest for highly related word pairs, were moderately high for moderately related word pairs, and were lowest for unrelated word pairs. Thus, young and older adults' JOLs were similarly sensitive to item relatedness. This pattern was also evident on young and older adults' memory: Recall was best for highly related word pairs, followed by moderately related word pairs, and unrelated word pairs.

Recently, Tauber and Dunlosky (2012) evaluated the degree to which older adults' JOLs are sensitive to the emotional valence of to-be-learned information. To do so, young and older adults studied words that were positive (e.g., bunny), negative (e.g., cancer), or neutral (e.g., fabric). Participants made an immediate JOL for each word and received a free recall test. Young and older adults' JOLs were sensitive to emotional valence: JOLs were higher for emotional words than for neutral words. However, older adults' JOLs did not discriminate between positive and neutral items. This may suggest that older adults have impairments when monitoring their learning for positive information. However, follow-up research suggests that older adults' insensitivity was attributable to the type of materials to-be-remembered (Tauber et al. submitted). In particular, when older adults make JOLs for emotional images, their JOLs are sensitive to positive emotion. Thus, older adults' JOLs are largely sensitive to emotional valence. Relatedly, young and older adults' JOLs are similarly sensitive to memories of past test experiences and can be influenced by multiples cues (Hines et al. 2015; Tauber and Rhodes 2012).

An alternative method to evaluate the accuracy of JOLs is to estimate *monitoring resolution*. Monitoring resolution provides an index of the degree to which participants' JOLs discriminate between what will and will not be later remembered (Nelson 1984). To illustrate, consider research conducted by Hertzog et al. (2010b). Young adults, middle-aged adults, and older

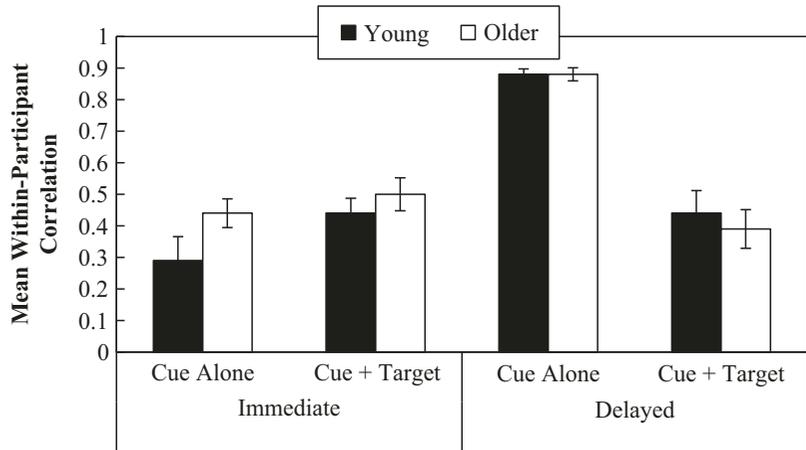
adults studied related and unrelated word pairs. They also received information about effective study strategies such as creating interactive mental images for each word pair. Immediately following study, participants made a JOL for each pair and received a final cued-recall test. To estimate monitoring resolution, JOLs were correlated with cued-recall performance for each participant and the substantial correlations (0.4–0.62) did not decrease with age. Indeed, a wealth of research has established minimal age-related differences in monitoring resolution (Hertzog and Hulstsch 2000; Hertzog et al. 2002, 2010; Robinson et al. 2006; Tauber and Rhodes 2012; but see Daniels et al. 2009).

Although there are no age differences in monitoring resolution, accuracy can be rather low (albeit above chance); hence, there are methods to improve upon young and older adults' accuracy. The primary question is whether such methods improve the accuracy of older adults' JOLs to the same degree as that of young adults. Connor et al. (1997) investigated this issue by manipulating the timing of the JOL and the cues available when JOLs were made. Specifically, young and older adults studied word pairs, made a JOL for each, and received a cued-recall test. JOLs either immediately followed study (i.e., immediate JOL) or were made after a delay (i.e., delayed JOL). Further, JOLs were either cued by the entire word pair (i.e., cue + target) or by the cue alone. Young and older adults' correlations were higher for delayed JOLs than for immediate JOLs and were higher for cue alone JOLs than for cue + target JOLs (Fig. 3). Monitoring accuracy improved with delayed JOLs and with cue only JOLs most likely because participants relied on retrieval from long-term memory rather than short-term memory (see Rhodes and Tauber 2011 for a review). As is evident from Fig. 3, correlations did not differ between the age groups. Thus, the accuracy of older adults' JOLs increased to the same degree as for young adults when they were delayed and when prompted by the cue only.

Another method to improve JOL accuracy is to allow participants to learn from task experience. In a typical knowledge updating paradigm,

### Metacognition in Older Adulthood, Fig. 3

JOL accuracy as measured via within-participant correlations between JOLs and final test performance (Data estimated from Connor, Dunlosky and Hertzog (1997, Table 7))



participants experience one study-JOL-test cycle. During this cycle, participants gain information about how a cue might influence their memory. The critical question is whether they update their knowledge about that cue and adjust their JOLs accordingly on a second study-JOL-test cycle (for a review, see Mueller et al. 2015). For example, Matvey et al. (2002) had young and older adults learn word pairs, make an immediate JOL for each, and take a cued-recall test. The targets of the word pairs were cued with letters (e.g., ic – ice), a rhyming word (e.g., hurt – dirt), or the category label (e.g., a diagram – chart). Then, participants completed a second complete trial with new word pairs that were cued in the same ways. The cues influenced actual memory performance: Young and older adults' memory was best for the category cued word pairs. To evaluate knowledge updating about this cue, difference scores were calculated and relative accuracy was estimated. Difference scores were calculated by subtracting average recall performance from average JOLs so that positive scores indicated overconfidence and negative scores indicated underconfidence. Improvements in JOL accuracy occurred across trials for both young and older adults. As important, relative accuracy improved across trials, and older adults' correlations were not lower than those of young adults. Thus, older adults updated their knowledge to the same degree as young adults (Dunlosky and Hertzog 2000; Price et al. 2008). Even so, knowledge updating is

often incomplete (for both young and older adults), and in some instances, older adults demonstrated less updating than did young adults (Bieman-Copland and Charness 1994; Hertzog et al. 2012). Thus, discovering why (and when) age differences arise in knowledge updating is an important avenue for future research.

In sum, the literature on older adults' monitoring during encoding converges on the conclusion that young and older adults tend to use similar cues as a basis for their JOLs. Further, monitoring resolution tends to remain stable with age. Such evidence supports the conclusion that monitoring of learning is spared with age.

### Monitoring During Retrieval

Monitoring retrieval processes comes in many forms (see Fig. 2). Monitoring retrieval occurs when estimating how confident one is in the accuracy of a retrieved memory, and it occurs during the frustrating experience of not currently being able to recall something but believing that the information is known (tip-of-the-tongue experience, Brown and McNeill 1966). The current focus is on monitoring retrieval during the subjective state of believing that something can be recognized in the future, even if it cannot be currently recalled. This is referred to as a feeling of knowing; it is commonly measured with feeling of knowing (FOK) judgments, and the field of metacognition began with its investigation (Hart 1965, for a historical review, see Tauber and Dunlosky in press). Accurate feeling of knowing states are

important because feeling as though something will be recognized correctly can contribute to strategic choices to search for additional information, whereas the feeling that the answer is not known and will not be recognized later will lead to terminating search strategies.

Lachman et al. (1979) were among the first to evaluate the accuracy of older adults' feelings of knowing. They recruited college-aged adults, middle-aged adults, and older adults, and these participants made FOKs in a semantic memory task. Specifically, they answered general knowledge questions (e.g., *What is the former name of Muhammad Ali?*), and if participants did not know the answer (*Cassius Clay*), they responded by saying "I don't know." Next, for each question that participants did not know, they made an FOK by estimating the degree to which participants knew the answer even though it could not be currently recalled. FOKs were made by selecting one of four options: definitely do not know, maybe do not know, could recognize the answer if told, could recall the answer given hints and more time. By selecting the first option participants indicated that they did not know the answer, by selecting the second or third option, they indicated that they were uncertain, and by selecting the fourth option, they indicated that they knew the answer. Finally, participants received a multiple choice test on the same items. To evaluate FOK accuracy, Lachman et al. (1979) estimated the proportion correct on the final test as a function of FOK judgment. More questions were correctly answered with a "do know" FOK relative to "uncertain" FOKs and "don't know" FOKs, and young and older adults' FOKs were similar.

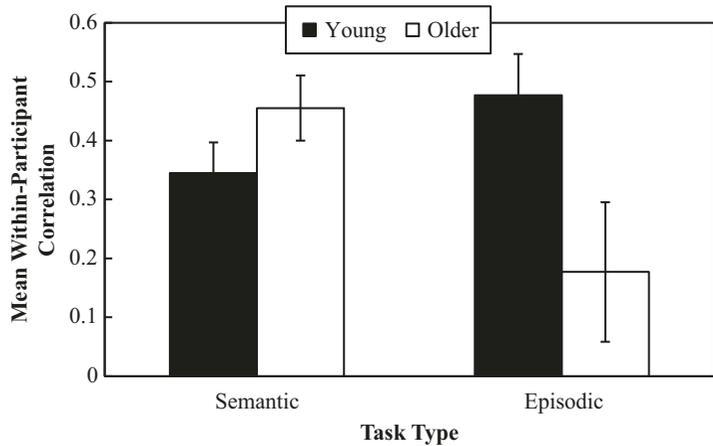
Evidence of age equivalence in FOK accuracy during semantic memory tasks is also evident with other estimates of relative accuracy (e.g., Allen-Burge and Storandt 2000; Butterfield et al. 1988; Hertzog et al. 2010a; Marquie and Huet 2000). For instance, Butterfield et al. (1988, Experiment 2) measured FOKs by having participants make *relative* FOK judgments or *absolute* FOK judgments. Relative FOKs judgments were made by selecting one general knowledge question (relative to others) for which the correct answer would be correctly recognized on a

later test. Absolute FOK judgments were made by making a binary yes/no judgment, indicating whether the answer to the general knowledge questions would be correctly recognized on a later test. Butterfield et al. (1988) evaluated the relative accuracy of both types of FOKs by calculating within-participant correlations between FOKs and final test performance. Correlations were moderate (0.44–0.57), they significantly exceeded chance, and they did not differ between the age groups.

In contrast with semantic memory tasks, the accuracy of older adults' FOKs in episodic memory tasks is less clear. In some cases, older adults' FOKs are less accurate relative to young adults' FOKs (e.g., Morson et al. 2015; Perrotin et al. 2006; Souchay and Isingrini 2012; Souchay et al. 2007; Thomas et al. 2011). For instance, Morson et al. (2015) evaluated the accuracy of young and older adults' FOKs on an episodic memory task as well as a semantic memory task. For both tasks, participants attempted to recall the answer to a general knowledge question, provided a yes/no FOK judgment if an answer could not be retrieved, and received a recognition memory test. The episodic memory task included an initial study phase prior to the first recall attempts during which participants studied the general knowledge questions with the correct answers. As is evident from Fig. 4, young and older adults' correlations did not significantly differ on the semantic task. However, older adults' correlations were significantly lower on the episodic memory task than on the semantic task, and they were significantly lower than those of young adults. Thus, aging negatively influenced the accuracy of FOKs when the task involved episodic memory.

It is perhaps unsurprising that older adults demonstrate deficits in the accuracy of the FOKs during episodic memory tasks. Older adults typically have deficits in learning new information (i.e., episodic memory), but semantic memory typically maintains (or even improves) with age (for a review, see Zacks et al. 2000). Thus, older adults' poorer episodic representations would produce fewer or less diagnostic cues and hence lead

**Metacognition in Older Adulthood, Fig. 4** FOK accuracy as measured via within-participant correlations between FOKs and final test performance (Data estimated from Morson et al. (2015, Table 1))



to lower FOK accuracy. Further, deficits in episodic memory can be related to deficits in frontal lobe functioning, which may explain why older adults demonstrate deficits in FOK accuracy during episodic tasks. To test this idea, Souchay et al. (2000) evaluated young and older adults with neuropsychological tests and found that frontal lobe functioning accounted for a large proportion of individual's variance in FOK accuracy.

Even so, age-related deficits in FOK accuracy are not always observed in episodic memory tasks (e.g., Eakin et al. 2014; Hertzog et al. 2010a; MacLaverly and Hertzog 2009). The explanation for the mixed results in the accuracy of older adults' FOKs in episodic memory tasks remains in question, and there are several explanations for the disparate outcomes. One is that each study employs slightly different methodology – such as the nature and organization of the information to-be-learned, how FOKs are measured, and the nature of the final test. A second possibility is that differences in the samples of young and older adults across studies could contribute to the discrepant outcomes. Participant characteristics such as level of education and executive functioning are likely to influence the accuracy of FOKs. Thus, if different samples of older adults were targeted, this may contribute to conflicting conclusions across studies. These are just two of many possible explanations, so what is clear is that additional research is needed to delineate when older adults will have impairments

in the accuracy of their FOKs and when they will not.

In sum, the literature on older adults' monitoring during retrieval is somewhat mixed. In some cases, older adults demonstrate impairments, and in others they do not. Conclusions are as follows: (1) To-date, the majority of evidence suggests that older adults' monitoring during retrieval maintains with age. (2) Nevertheless, some important deficits have been discovered, so additional research is needed to clarify when age deficits will occur in the accuracy of monitoring during retrieval.

### Metacognitive Control

A primary way to assess older adults' ability to control their learning is to examine whether they make good decisions when studying and/or retrieving information from memory. Effective decisions are critical because they can influence actual learning and memory: When study decisions are effective, learning will be optimized, and when study decisions are ineffective, learning will suffer. For the purposes of this entry, the focus is on older adults' ability to regulate their learning via item selection and study time allocation (see Fig. 2). To preview, the typical finding is that older adults' ability to control their learning is intact; however, there are a few instances in which age-related differences in control have been observed.

### Item Selection

One way to evaluate the quality of older adults' study decisions is to determine whether they choose to study items that they have already learned or items that they have yet to learn. Ideally, older adults should select to study more unlearned items compared with well learned items. Dunlosky and Hertzog (1997) investigated this issue by presenting young and older adults with 36 word pairs and having them make a delayed JOL for each. One group of participants (self-chosen-items group) was instructed to select 18 items for restudy. In the other group (worst-learned-items group), a computer selected 18 items for restudy by choosing the items for which participants had assigned the lowest judgments. Both young and older adults in the self-chosen-items group chose to study the items that they had learned less well (i.e., the items that they had given lower JOLs). Thus, young and older adults made beneficial study decisions by selecting items they have yet to learn.

It is also informative to examine whether older adults choose to study easy or difficult items and if their selections differ from those made by young adults. Price et al. (2010) investigated this by presenting young and older adults with a  $3 \times 3$  grid of Spanish–English vocabulary translations with item difficulty (easy, medium, difficult) explicitly labeled. In each grid, the Spanish words were presented and participants selected an item to get the English equivalent. This allowed for the observation of which words were selected, how difficult the selected items were, and how long they were studied. Both young and older adults' selections began with easy items and progressed to more challenging items. Further, older adults selected to study easy items more frequently than did young adults. This is consistent with Metcalfe's (2002) region of proximal learning model, which suggests that people select items for study that are closest to their current level of mastery. Price and Murray (2012) replicated and extended these findings using Chinese–English translations without explicitly stating the normative difficulty of the items.

As previously noted, older adults typically have deficits in episodic memory, so it is imperative that they focus on remembering the most important information. Interestingly, Castel et al. (2002) demonstrated that older adults are able to do this. They presented young and older adults with multiple lists that each contained 12 words. Each word was paired with a point value from 1 to 12. Further, they instructed participants to earn as many points as possible by remembering as many words as possible and by placing emphasis on the words paired with the higher values. They found that both young and older adults selectively remembered more high value items than low value items. This finding has been consistently observed (e.g., Castel et al. 2007, 2011, 2013), suggesting that older adults do have the ability to exert control over their learning in an advantageous way (i.e., remembering more valuable information). However, Price et al. (2010) showed that when the high value items were difficult (rather than easy), older adults no longer opted to study those items. Although this could be taken as evidence of impaired metacognitive control, Price et al. (2010) found that older adults' avoidance of the difficult items was correlated with lower memory self-efficacy (MSE). Thus, it is possible that older adults avoided difficult items because they had less confidence in their memory generally, which produced lower learning goals. Even so, there are a few cases in which older adults' item selection is suboptimal.

Tullis and Benjamin (2012) presented young and older adults with a list of concrete (e.g., table-dog) and abstract (e.g., justice-gravity) word pairs and had participants assign delayed JOLs. After study, participants were instructed to select half of the items for restudy. Participants in the honor group restudied the items they selected, and participants in the dishonor group restudied the items they did not select. Finally, participants received a free recall test. As with previous work, young and older adults chose to restudy the less well-learned items (i.e., those with lower JOLs). Further, young adults' recall benefited from having their study decisions honored. However, older adults did not show this benefit, which may indicate that the

older adults had a deficit in control. Even so, older adults have a hard time remembering abstract words (e.g., Hertzog et al. 2013). Thus, they may have selected a disproportionate number of abstract items for restudy, which would be more challenging to remember and could have contributed to the apparent age-related control deficit.

In sum, research on older adults' ability to control their learning via item selection suggests that older adults exert control over their learning in a similar manner as do young adults (i.e., they select least well-learned items, items that are closest to their current level of mastery, and items of higher value). Although there is some evidence of age-related impairments in control (e.g., Tullis and Benjamin 2012), the literature largely converges on the conclusion that self-regulated learning via item selection is largely spared with age.

### Study Time

Do older adults allocate study time in a similar manner as do young adults in order to retain the maximum amount of information? Hines et al. (2009) investigated this question with two study-test trials during which they presented young and older adults with word pairs and had them make immediate JOLs. On the first trial, presentation time was experimenter paced (4 s for young adults and 6 s for older adults) to equate memory performance on the first test. On the second trial, presentation time was self-paced. After each study trial, participants engaged in a recognition memory test on which they determined whether each word pair had been previously studied and provided a confidence judgment (CJ) of how certain they were in their answer. Both age groups spent more time studying the items with lower JOLs, lower CJs, and items they got wrong on the first trial. This demonstrates that older adults effectively used their monitoring (JOLs and CJs) to guide their study behaviors (study time allocation) in the same manner as did young adults.

In addition, Froger et al. (2012) found that older adults adjusted their study time based on item difficulty when provided with effective strategies to enhance their memory. Specifically, they presented young and older adults with highly

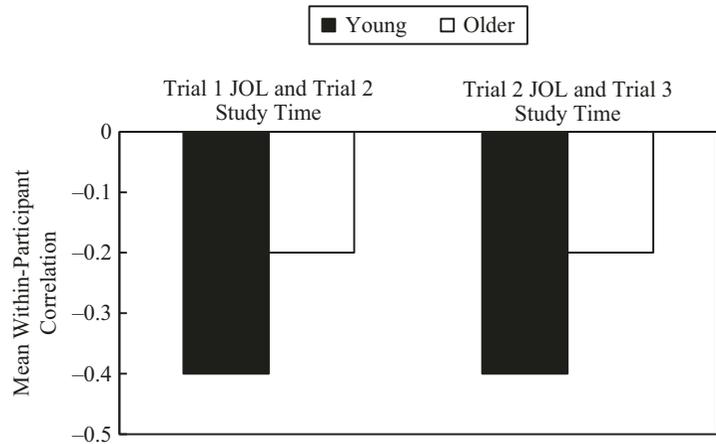
related word pairs (easy items) and weakly related word pairs (difficult items) and varied how much "environmental support" they gave each group. In the high environmental support group, participants were informed of study strategies (e.g., sentence formation, route rehearsal) to use to remember the word pairs as well as the effectiveness of each strategy. In the low environmental support group, participants were informed of study strategies with no information about their effectiveness. Finally, in the no support group, participants were not given any information about study strategies. When no environmental support was given, older adults spent a majority of their time studying easy items. However, in the high environmental support group, older adults spent more time studying the difficult items, suggesting that when given information about how to effectively learn difficult items, older adults shifted their study behaviors to enhance memory for the difficult items. Froger et al. (2012) determined that this shift in study time was a result of the increased time it takes to implement these study strategies. This suggests that older adults do not spontaneously adopt effective study strategies, but when they are instructed to use them, older adults do so.

Finally, research has demonstrated that older adults are able to efficiently allocate study time to valuable or important information. For instance, Castel et al. (2013) presented young and older adults with a grid of 30 point values (labeled 1–30) with corresponding words hidden from view unless a particular value had been selected. Participants were given 2 min to study items to elevate their score. They found that older adults chose to study high value items more frequently (Castel et al. 2002) and for longer durations than did young adults. For older adults, this is beneficial, because they will be unable to remember everything, and they can compensate by spending more time on the important information.

Even if older adults make similar choices as young adults, it is critical to determine the degree to which they use monitoring to guide their study time (Dunlosky and Connor 1997; Krueger 2012). To that end, Dunlosky and Connor (1997) presented young and older adults with word

### Metacognition in Older Adulthood,

**Fig. 5** Within-participant correlations between JOLs and Study time on each trial and for each age group (Data estimated from Dunlosky and Connor (1997, Fig. 2, Top panel))



pairs and allowed them to self-pace their study on three study-test trials. In addition, they collected delayed JOLs for each item to determine whether participants were using their metacognitive monitoring (JOLs) to regulate their study behavior (study time allocation). On each of the three tests, participants engaged in a cued-recall test for one-third of the items. Young and older adults chose to restudy the items that they had learned less well (via lower JOLs and recall). Further, correlations between JOLs on one trial and study time on the next trial were negative for both groups: higher JOLs were associated with less study time. However, correlations were lower for older adults than for young adults (see Fig. 5). This could be taken as evidence that the older adults had a deficit in their ability to use monitoring to allocate study time because they appeared to use their monitoring to a lesser extent than their younger counterparts (Dunlosky and Connor 1997; Souchay and Isingrini 2004). However, older adults tend to show inferior memory performance and have lower memory self-efficacy (MSE) relative to young adults. Thus, it is also possible that the older adults focused their study time on the items they had already learned to ensure that they retain those items on a later test. Further, age-related differences in the relationship between monitoring and control are not always observed (Stine-Morrow et al. 2006).

In sum, older adults make similar decisions as do young adults when allocating study time, suggesting that metacognitive control is spared

with age. However, the extent to which older adults use their monitoring to guide control via study time is unclear. Some evidence suggests that older adults use their monitoring to a lesser extent than did young adults; however, other evidence reveals no age differences.

### Conclusions

The field of metacognitive aging continues to expand and increase knowledge of metacognitive function with aging in adulthood. Evidence to-date suggests that older adults have some impairments in metacognitive our understanding. Older adults' metacognitive monitoring remains largely intact with age, although there are a few instances in which older adults' monitoring is impaired. Similarly, older adults' metacognitive control remains largely intact with age, although older adults demonstrate some deficits in control. Accurate metacognitive function is critical because metacognitive processes are inter-related, and they influence actual cognition. Thus, older adults may be able to compensate for age-related impairments in cognition, so improving upon metacognitive processes is an important point of intervention. Metacognitive intervention studies have established improvements in monitoring and self-regulation following interventions that were also associated with improvements in older adults' cognition (e.g., Bailey et al. 2010; Dunlosky et al. 2003, 2007a). Most importantly,

increasing the accuracy of metacognitive processes and improving upon older adults' cognitive functioning have the potential to improve the quality of older adults' lives.

## Cross-References

- ▶ [Aging and Quality of Life](#)
- ▶ [Aging and Strategy Use](#)
- ▶ [Cognitive Control and Self-Regulation](#)

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## mHealth Applications Use and Potential for Older Adults, Overview of

Deborah Vollmer Dahlke and Marcia G. Ory  
Health Promotion and Community Health  
Sciences, Texas A&M Health Science Center and  
School of Public Health, College Station, TX,  
USA

### Synonyms

Mhealth synonyms include the following:  
eHealth; Mobile health; Telehealth; Telemedicine

### Definitions

mHealth: mobile and wearable health information including sensing technologies and mobile web

and mobile device applications (apps) with the potential to improve physical and mental well-being.

## Introduction

Innovation in mobile and wearable health information and sensing technologies and applications (mHealth) has the potential to improve well-being, both physical and mental, and to reduce the cost of health care among older adults in numerous ways (Parker et al. 2013). From health monitoring and health education and behavior change to falls sensing and mobile health alerts to the simple pleasure of communication and connectedness, mobile technologies are changing the lives of older adults. The ongoing study of mHealth in fostering health behavior change among older adults will require a multidisciplinary approach to consider proximal (e.g., physical activity, chronic disease management, cancer survivorship) and distal (e.g., social engagement and participation) aspects as well as the development of perspectives of how mHealth may affect psychosocial changes in older adults (Ziegelmann and Koll 2015; Gellis 2015). This chapter will cover the challenges and opportunities for mHealth for older adults and a summary of current uses of mHealth for chronic disease self-management and care.

By the year 2030, one-fifth of the US population will be age 65 or older, growing from 40 million in 2010, to an estimated 72 million in 2030 (Parker et al. 2013). With age comes an increased likelihood of multiple chronic health problems or comorbidities leading to an increased need for health and chronic disease management (Centers for Disease Control and Prevention (CDC) 2003; Federal Interagency Forum on Aging-Related Statistics 2012). Aging demographics combined with ongoing innovations in mobile health technology and apps suggest that mHealth interventions may hold great potential as a platform to reduce healthcare costs and improve health outcomes among older adults. However, adoption among older adults differs from the general population in a number of important ways

and demands a closer look. According to the Pew Internet Research Center, older adults in the US have been slower than their younger counterparts to adopt mobile technology. However, adoption continues to deepen over time (Smith 2014).

As with any demographic group, older adults are highly heterogeneous and, not surprisingly, adoption of mobile technologies varies by segment along age groups and sociodemographic status. According to a 2014 Pew study, a majority of older adults (77%) own cell phones, but only 17% of these older adults are using smartphones. Among older adults, adoption of tablets and e-readers is higher than smartphones, with some 27% of seniors owning a tablet, an e-book reader, or both (Smith 2014). Among seniors, those who graduated from college are nearly three times more likely to own a tablet or smartphone than those who did not attend college; those with annual household incomes of \$75,000 or more are four times more likely to own mobile technology than those with household incomes of less than \$30,000 per year (Smith 2014). According to a 2012 Pew study on mHealth, the most commonly downloaded health apps are those pertaining to exercise, fitness, pedometers, or heart rate monitoring. Across all age groups, 38% of health app users download apps for those uses.

Younger adults are more likely to use health apps than their older counterparts. Among younger users ages 18–29, 24% had health apps, as compared with 19% for those ages 30–49. Among older users ages 60–64, 16% used health apps as compared to 10% among those ages 65 and older (Fox and Duggan 2012).

## Challenges of mHealth Apps: Poor Form Factors and Infrequent Use of Health Behavior Change Theory

Improvements in two areas of design may make mHealth apps of greater use to older adults and help resolve barriers to adoption: (1) Inclusion of form factors that support physical needs of older adults including hearing loss, poor eyesight, and lessened dexterity; and (2) Application of

intervention design elements, content, and activities that adhere to health behavior change theories that may make the apps more relevant to older adults' daily lives.

Wildenbos et al. developed a framework for usability analyses of mHealth tools for older adults. Their framework includes factors such as cognitive barriers, physical impairments, motivational issues, and visual/perceptive barriers. The results of their analyses suggest that longer learning time and poor visual acuity were among the most common barriers (Wildenbos et al. 2015). The issues of longer learning time among older adults may affect motivation for adoption as well. Optimally, mHealth app developers could engage with older adults to review interface design (e.g., size of font, button colors, and placement) as well as reviewing navigation and task flow logic. Other factors such as privacy and security and the ability to have apps personalized, preconfigured, and loaded with data may also support increased adoption.

An important question is the extent to which mHealth apps for chronic disease management and other apps for older adults are theory based. In a study of 65 cancer survivorship mHealth apps, built on both the iOS and Android platforms, Vollmer Dahlke et al. used qualitative coding methods to assess the application of health behavior change and communication theories (Vollmer Dahlke et al. 2015). The apps were assessed using a coding derived from taxonomy of 26 health behavior change techniques developed by Michie et al. (2013). The taxonomy was adapted based on the characteristics of mHealth apps that are specific to information processing and human computer interaction such as control theory and feedback systems. The mHealth apps in the Vollmer Dahlke study varied greatly based on their rankings in use of theoretical elements of health behavior change including personalization, tailoring, and interactive feedback. The study's findings were consistent with prior research that asserts that mHealth interventions could benefit from increased use of health behavior and communications theories in their design (Vollmer Dahlke et al. 2015).

## Health Apps Research and Use Among Older Adults

Despite concerns for low adoption rates, there are a number of types of mHealth apps and technologies targeted for older adults, some for use with medications and others focused more on health or disease management interventions, including lifestyle changes and health monitoring. While not a systematic review, the following sections provide a current snapshot of the field of mHealth apps designed for the purposes of improving or managing health of older adults. An underlying assumption is that better self-management leads to enhanced quality of life, as demonstrated in national studies of chronic disease self-management programs (Ory and Smith 2015).

### Physical Activity Apps and Older Adults

The major chronic diseases of older adults including cardiovascular disease, cancer, stroke, obesity, and Type 2 diabetes are linked to lack of regular physical activity and increased sitting time. Accelerometers built into smartphones, smart watches, and wearable sensor devices are increasingly used in mHealth apps to provide cost-efficient and user-directed ways to enhance physical activity. The apps use data collected by the smartphone's technology including accelerometers, cameras, voice recorders, and speakers to collect and wirelessly share the data with the apps' cloud-based databases. App databases may include the users' goals and physical characteristics, and the app algorithms can be designed to record, summarize, and report user data. Many physical activity apps provide feedback through motivational messaging via social media and additional incentives through social leader boards, game-like virtual prizes, and trophies.

Current research on the use of mHealth physical activity apps among older adults is relatively sparse, and there is a need for well-designed studies. A recent review of 379 physical activity apps by Knight et al. (2014) suggests a continued failure of mHealth apps for physical activity in providing guidance on current public health

recommendations for adults to engage in 150 min weekly of moderate exercise and muscle strengthening activities for at least 2 days per week. None of the apps in the systematic review provided evidence-based information on moderate physical activity, and only seven of the apps reviewed provided evidence-based information on muscles strengthening activities (Knight et al. 2014). A limited efficacy study (30 participants drawn from a convenience sample) of iCanFIT, a mobile web application, suggested that older adult cancer survivors' quality of life and engagement in regular physical activity improved significantly after the use of iCanFit (Hong et al. 2015). The iCanFit app used evidence and theory-informed design and deep engagement with older stakeholders to ensure usability and acceptability (Hong et al. 2013).

### **Mental Health and Social Connectedness**

Prior research in life expectancy and quality of life in mental health literature indicates that older adults with integrated social support and connectedness (e.g., family, friends, neighbors, church, and community groups) are generally less depressed and report greater well-being (Fiori et al. 2006). Beyond email, Facebook is the mobile technology most used by older adults. However, a recent Pew study suggests that among online adult users age 65 and over, 16% use Pinterest and 12% are on LinkedIn (Fox and Duggan 2012). As of September 2014, fully 72% of online American adults (approximately 62% of the entire US population) use Facebook. Among those, 48% are users ages 65 and older (Smith 2014). Video calls (e.g., Skype, AppleTalk, Google+) are also used by approximately 15% of older adults to connect socially with friends and family (Fox and Duggan 2012). A study by Hutto et al. (2015) of older Facebook users indicated that, after controlling for factors such as age, gender, ethnicity, socioeconomic status, and marital status, directed mobile communications as opposed to broadcast communications or passive consumption of content was correlated with reduced loneliness as well as increased social role satisfaction among older adults (Goins et al. 2011).

### **Activities of Daily Life and Aging in Place**

Older adults prefer to remain in their homes for as long as possible, and the thought of being "forced" to leave home is stressful for many older adults (Fiori et al. 2006; Hutto et al. 2015; Bacsu et al. 2012). Healthy aging in place is more than just a matter of physical health. According to current literature, it also involves elements of culture, community, and spirituality and is strongly related to self-efficacy and self-perceptions of health and well-being (Goins et al. 2011; Pierce 2001; Tang and Lee 2011). Remote monitoring of health status for older adults, especially for those in rural areas or who are homebound, vary from simple alert necklaces linked to a home security system to full telehealth systems associated with medication adherence and chronic disease monitoring. In a recent study by Paniker and Kumar, the development and validation of a tablet PC used in conjunction with a noninvasive body sensor system was tested as a rural telehealth application (Panicker and Kumar 2016). The system included real-time, continuous collection of physiological parameters (i.e., blood pressure, pulse rate, and temperature) and fall detection of a patient using a wrist device sensor unit. Wireless transmission of acquired health data was transmitted to a tablet PC managed by the medical staff in a primary health center. Any abnormal conditions were automatically identified and alert messages were given to a medical professional in real time (Panicker and Kumar 2016).

Other emerging mHealth technologies including robots connected through mobile technology hold promise to support physical activity, aging in place, and psychosocial support through the provision of care and companionship. Use of robots is currently limited due to expense and lack of safety standards (Smarr et al. 2014) but adoption of robots and associated apps is expected to increase over time. Current robot technology for older adults is focused on Activities of Daily Life (ADL) by assisting in fetching objects or retrieving dropped objects. For example, the Dusty robot aids older adults by picking up objects dropped on the floor. This is especially helpful as older adults drop items an average of 5.5 times per day and reaching and bending to pick up objects may be

associated with falls (Smarr et al. 2014). Developed by the German firm, Fraunhofer IPA, Care O Bot is able to move safely among humans, to detect and grasp typical household objects, and to safely share them with their human companions (Graf et al. 2009).

### Type 2 Diabetes

Self-management is now considered the appropriate strategy for Type 2 Diabetes in which lifestyle and diet are considered critical to management. Health professionals have traditionally delivered chronic disease self-management (CDSM) interventions for Type 2 diabetes to individuals in one-on-one or group situations, often with regular follow-up as reinforcement. mHealth technologies appear to offer less expensive and resource intensive interventions and may also be tailored to be culturally and linguistically appropriate. Examples of Type 2 Diabetes apps are those that provide diet tracker and food selection guidance. Some apps also provide goal setting for increased physical activity. A framework study by Hale et al. reviewed mHealth apps for Type 2 Diabetes using a health behavior theory-based approach (Hale et al. 2015). The researchers suggest that patients would benefit from guidance from health care providers in a patient-centered approach to match apps to individual health needs and goals, and that such a practice had greater potential to increase the effectiveness of therapy (Hale et al. 2015). A systematic review by Arnhold et al. included a usability examination of Type 2 Diabetes apps to determine if the available apps served the special needs of diabetes patients aged 50 or older (Arnhold et al. 2014). Their findings suggested that usability of apps for this age group was moderate to good. However, this finding applied to apps offering a small range of functions and documentation of analytical functions in these apps showed significantly lower usability scores. The researchers suggested that future development of apps for this age group should include significant participation from both providers and older adults and that transmission of data to health providers would be an important future feature (Arnhold et al. 2014).

### Cancer Care and Survivorship

The probability of developing invasive cancer increases dramatically with age: for males age 60–69, the probability is 1 in 7; for females age 60–69, it is 1 in 10; for males age 70 and over the probability increases to 1 in 3; and for females age 70 and over it is 1 in 4 (Siegel et al. 2015). Cancer patients undergoing chemotherapy and radiation and survivors having completed therapy experience both medical and psychosocial side effects of their care that can negatively affect their well-being and quality of life. mHealth technologies that allow prompt intervention early in the process can help minimize side effects and also provide important education, communication, and psychosocial support for cancer survivors and caregivers.

The mHealth cancer care and survivorship apps that appear to be firmly based in health behavior change theory are similar in that they require personalization and some degree of tailoring, are highly interactive, include some type of quality of life questions or assessments, suggest goals and actions, and provide social engagement and the mobilization of social norms taking into account both the physical and psychosocial needs of survivors (Vollmer Dahlke et al. 2015). The more potentially effective apps were either developed by cancer advocacy groups, clinical associations, or academic researchers, which suggests that the information offered in these apps is more likely to be based on evidence and clinical research and developed using health behavior theories. Examples include the following: (1) *Livestrong Cancer Guide and Tracker* app, available only for iPad; (2) *Cancer.net* developed by the American Society of Clinical Oncology, available on iOS and Android platforms (and also offers a Web-based version and one that is translated into Spanish); (3) *My Cancer Manager* developed by the Cancer Support Community and available only as an iOS app; and (4) *MyHealthFinder*, a mobile web, iOS and Android app to help cancer survivors and those affected by other chronic diseases find clinical and non-clinical care resources using geolocation tools and web-based information developed by the Texas A&M Health Science Center School of Public Health.

### Falls and Falls Prevention

Each year, millions of older people fall, with one of three older people falling each year: falling once doubles the chances of falling again. Annually, 2.5 million older adults in the USA are treated in emergency rooms for falls (Kramarow et al. 2015). In 2013, unintentional injuries were the eighth leading cause of death among US adults aged 65 and over, resulting in nearly 46,000 deaths (Kramarow et al. 2015). Continuing advances in inexpensive, miniature, wireless sensors and wearable smart devices can quickly and accurately quantify and monitor body motion producing objective measures of an individual's balance and gait. These devices can help therapists focus on specific physiological reasons for difficulty in walking or balance during activities of daily life. Body monitors can be used to measure and document increased changes in sway or gait measures and also provide documentation of changes as a result of therapy. The relationship between functional disability, fear of falling, falls, and quality of life may be reciprocal, with each affecting and interacting with one another, suggesting that in addition to physiological issues, psychological and psychosocial issues including fear, should be considered as part of falls prevention training and education (Patil et al. 2013).

Falls monitors can be designed to provide immediate biofeedback to users and provide supporting behavioral and training cues to allow them to focus attention and engage in exercise or activities to support improved balance. The engagement of therapists participating in remote data analysis could be used for telemedicine communication to support home and community-based falls prevention exercise programs and allow older adults more opportunity to age safely in place. While the mobile technology for falls monitoring and prevention may be developing and emergent in the marketplace, there is little data on adoption and little current research on usability and acceptability among older adults.

A systematic review of 44 studies of technology devices for falls and injury prevention by Omaki et al. included only two mobile device studies. Both of these studies indicated that mobile technologies improved behaviors

around injury prevention (Omaki et al. 2016). A randomized control study currently underway by Delbaere et al. (2015) is focused on falls prevention using a tailored, home-based balance training delivered through a tablet computer. Intervention participants are being asked to complete 2 h of exercises per week for 2 years. Both groups will receive an education program focused on health-related information relevant to older adults, delivered through a tablet computer via weekly fact sheets. The intervention group is receiving balance training delivered through a tablet computer at home and are given exercise equipment (i.e., a foam cushion, a stepping box, and exercise mat). This large, 500 person trial will measure falls and fallers over a 12 month period as measured through falls diaries. Secondary outcome measures will be assessed to understand how mechanisms underlie any fall reduction and to determine to what extent the training transfers to other falls prevention-related outcomes such as balance, gait, and mobility; concern about falling; cognitive function; and overall physical activity levels (Delbaere et al. 2015).

### Alzheimer and Dementia Care

Mobile phones and smartphones are being used for different purposes in dementia and Alzheimer care including location finding through Global Positioning Systems (GPS) and use of photos in smart phones to support memory recall. GPS, available in most mobile phones, can be used as an assistive technology for caregivers – both home and institutional – to create virtual geographical “fences” and to prevent elopement in wandering behavior of older adults with dementia. The prevalence of older adults who wander is reported to be as high as 63% among those suffering from Alzheimer's (Petonito and Muschert 2015). Wandering in unsafe environments increases risks of falls, hip fractures, sleep disturbance, getting lost, elopement from care facilities, and death.

Cipriani et al. reviewed several studies related to accurate and successful location of persons who had wandered using mobile phones as reliable tracking devices (Cipriani et al. 2014). Bosco and Laconi are experimenting with the use of

smartphones that can be programmed to take photos every 5 min during the day to aid in developing interventions aimed to improve adaptive responses to environmental situations. Audio recordings can also be enabled for use with photos to promote self-awareness and to record and reproduce autobiographical multimedia that can be used during reminiscence tasks that may take place with caregivers and supportive staff (Bosco and Lancioni 2015).

### Palliative and End-of-Life Care

Four illness trajectories that are most prominent for patients with progressive chronic illness are cancer, organ failure, the frail elderly, and dementia. Physical, social, psychological, and spiritual needs of patients and their caregivers for palliative and end-of-life care are likely to vary according to which trajectory patients are following (Murray et al. 2013). mHealth apps may have a role in each of these trajectories in minimizing symptom distress and supporting the well-being – both for patient and caregiver. Smart phones and tablets have the potential to support remote symptom monitoring and management and can provide linkages to both healthcare professionals and caregivers as part of palliative care supporting communication and psychosocial care in addition to symptom and medication management. McCall et al. explored the use of mobile phones for communication of symptom management between patients and health professionals in order to assess acceptability and usability. In addition to self-reporting of symptoms, the platform provided semi-tailored self-care advice (McCall et al. 2008). While their systematic review did not include smart phones or tablets, the researchers suggested the potential for mHealth technology including Skype, Twitter, and blogging as digital tools to support palliative care and end-of-life communications among patients' families and healthcare professionals (McCall et al. 2008).

The smartphone app, *My Health Care Wishes: An Advance Directive Manager* developed by The American Bar Association offers management and storage for both individual and family profiles and documents including advance directives, living wills, healthcare powers of attorney, do not

resuscitate (DNR) orders, and Physician Orders for Life-Sustaining Treatment (POLST) documents ([http://www.americanbar.org/groups/law\\_aging/MyHealthCareWishesApp.html](http://www.americanbar.org/groups/law_aging/MyHealthCareWishesApp.html)). The app is offered both as a free, basic version and as a more advanced paid version and is designed to ensure and support information sharing during a medical crisis so that advanced care directives are immediately at hand and can be delivered wirelessly in minutes via PDF format to the ER, the hospital, and medical professionals ([http://www.americanbar.org/groups/law\\_aging/MyHealthCareWishesApp.html](http://www.americanbar.org/groups/law_aging/MyHealthCareWishesApp.html)).

### Conclusion

A significant consideration for adoption of mHealth applications among older adults is the role of perceived relevance to daily life – how does an app fit with the older adults' perceived needs, interest, and relevance (Sourbati 2009). Additional concerns for older adults, especially those 80 and older, are design and interface issues, the need for training and support, and cost factors in relation to a limited or fixed income. Older adults may also have greater concerns for the security and sharing of personal and health information with mobile technologies. Of significant concern for adults who fail to adopt mobile and Internet technology is missed opportunities to receive important communications at the local, state, and national levels, including emergency notifications and financial and community communications.

Advancements in mobile technologies show great potential for significant impact and reach in health education, monitoring, and support for health behavior change and improved quality of life among older adults. Increased penetration and adoption of smartphones and tablets across sociodemographic groups, race, and cultural divides suggest ongoing increase and uptake of mHealth applications and technologies. Perhaps, we should not be surprised at adoption of mHealth technologies among those who are 65 and older or those shortly approaching this age group. Older adults ages 65 and older still in the workforce, or

preparing to soon retire, may have already worked 30-plus years with technology starting with mainframes and progressing through desktops, laptops, smartphones, and tablets.

Thus, it is not surprising that older adults, including those in their 80s and 90s, have the potential to embrace mobile technology for health and well-being. Mobile technology is making it easier for older adults to stay in touch with family, friends, and medical professionals to age in place and live and travel more independently. According to the Pew studies, older mobile technology users are confident in their ability to search for health information and to find and get help when they need it (Smith 2014; Fox and Duggan 2012).

A better understanding of mHealth usability and accessibility and perceptions of benefit and relevance among older adults, perhaps segmented by age groups and socio-demographics, may help direct future interventions and research studies aimed at improving the health and well-being of this growing segment of the US and global population.

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## Migration and Aging

Shuang Liu<sup>1</sup> and Laura Simpson Reeves<sup>2</sup>  
<sup>1</sup>School of Communication and Arts, The University of Queensland, Brisbane, QLD, Australia  
<sup>2</sup>Institute for Social Science Research, The University of Queensland, Brisbane, QLD, Australia

## Synonyms

Aging in distance; Immigrants; Immigration

## Definition

*Human migration* refers to the movement by people from one place to another with the intention of settling temporarily or permanently in the new location. Migration can refer to movement from one country to another or to movement within the same country, such as rural farmers moving to cities to permanently settle in urban areas. This entry, however, focuses on international migration, which almost always involves cultural transition.

## International Migration and Cross-Cultural Adjustment of Older Immigrants

Globally, international migration has been steadily increasing. According to the Population Division of the Department of Economic and Social Affairs of the United Nations ([www.unpopulation.org](http://www.unpopulation.org)), the number of international migrants worldwide reached 232 million in 2013, an increase from 175 million in 2000 and 154 million in 1990. A growing concentration of international migrants is found in developed regions. In 2013, migrants constituted 10.8% of the total population in developed regions compared to 1.6% in developing regions. Europe and Asia combined host nearly two thirds of all international migrants worldwide, with Europe hosting the largest number (72 million), followed by Asia (71 million) and North America (53 million). Other major destination regions are Africa (19 million), Latin America and the Caribbean (9 million), and Oceania (8 million). The ever-increasing flow of people through international migration is one of the most significant contributors to the multicultural society we live in today.

Older migrants who come to settle in the receiving country are aging alongside the rest of the rapidly growing aging population. Take Australia, for example. The Australian Bureau of Statistics reports that Australia's population is currently growing at 1.8% per annum, the fastest among OECD countries. Most striking, the 65<sup>+</sup> population is growing more than twice as fast (84.8%) as that of the total population (36%). Moreover, within this fast-growing aging population, the percentage of older adults from culturally and linguistically diverse backgrounds is expected to rise from 23% in 2011 to 30% by 2021 (Migliorino 2013). It has been widely recognized by scholars that a diverse aging population presents major challenges to aged care services, as well as to individuals, families, and communities. This is because differences in beliefs, values, and worldviews due to life experiences under different economic, social, and cultural conditions may lead to variations in

expectations of aging and aged care. Meeting these expectations requires social support, family support, community care, and intergenerational communication, all of which can positively contribute to the successful aging of older adults from diverse backgrounds.

Although the reasons for migration vary, all immigrants face the same task of *cross-cultural adjustment*—a process through which immigrants are integrated into the host cultural environment. Previous research consistently indicates that integration (maintaining home culture *and* participating in host culture) is the most preferred strategy by immigrants because integration offers them the opportunity to keep their heritage cultural traditions while developing a positive relationship with the mainstream (host) society. Previous research evidence indicates that integration is linked to better psychological adjustment, a sense of belonging, and a feeling of acceptance (e.g., Berry 2005). However, the path to achieving integration is not straightforward. People adapting to new cultures face changes in diet, climate, housing, roles, social networks, communication, norms, and values. Integration requires immigrants to move between their home culture and the mainstream culture of their new country. This process often involves a mental reconciliation of sometimes incompatible pressures for both assimilation into the mainstream culture and differentiation from it. Some immigrants flourish and achieve identity harmony through the process of cross-cultural adjustment, while others flounder and experience identity conflicts.

Over and above cross-cultural adjustment that immigrants of all age groups undergo, older immigrants face the challenge of aging in a foreign land. Broadly speaking, there are two groups of older adults with diverse cultural backgrounds: those long-term immigrants who grew old in the receiving country and those who migrated at an older age (65<sup>+</sup>), including those who have become separated from family networks in their homeland to join their children who have already settled in the receiving country. For both groups of older immigrants (i.e., those who migrated at an older age and those who grew old in the receiving country), aging in distance creates a range of

challenges not only for themselves but also for their younger family members, as detailed below.

For those older immigrants who made the migration journey during their later years, they not only face the daunting challenge of leaving their homeland at an older age, but they also have to tackle adjustment problems in a new country that is often different from their home country in terms of values and lifestyles. Even for those older immigrants who moved to join their adult children in the receiving country, they very often feel isolated from their younger family members because they are unable to adjust to life in the new country as quickly. A key barrier to their cross-cultural adjustment in the new country is their lack of host language proficiency. In a study on older Koreans in New Zealand, a participant who could not speak English well stated, "I felt becoming deaf, blind, and mute after immigration and living in an inconvenient paradise" (Park and Kim 2013, p. 159). Similarly, Lee and Yoon (2011) reported that a lack of English language competency is a significant predictor of lower well-being among this immigrant group, as evident in higher levels of anxiety and depression, lower self-control, and lower general health. Research examining how cultural transition influences older immigrants' health has found that the lack of host language competency, a large distance between heritage and host cultures, the loss of old friendship circles, and perceived prejudice by the immigrant are important factors that negatively affect older immigrants' psychological well-being (Chou 2007).

For those who migrated to the receiving country in their earlier years and thus grew old in the host country, things might not be necessarily easier. In a number of studies involving multiple older immigrant groups who migrated at a young age and grew old in the United States, researchers found that older immigrants from Korean, Chinese, Mexican, Russian, and Eastern European backgrounds are subject to higher health risks than non-immigrants, often resulting from depressive symptoms and disorders (see Chou 2007). One explanation may be that older immigrants tend to maintain close ties with their heritage culture and prefer to live in ethnic enclaves,

which in a way restrict their social network to co-ethnics. In contrast, current young immigrants who are better educated than earlier generations, in general, and second or third generations of immigrants are more likely to have wider social networks in the host country, and they tend to adapt more easily to the host cultural environment. Intergenerational differences in values and lifestyles might lead to conflicts between the older immigrants and their adult children or their grandchildren. For example, many older Asian immigrants in Western countries treasure collectivist culture, which emphasizes the importance of viewing the self as inherently connected to the social network of family members and friends. In contrast, their children, who grew up in more individualist cultures like North America, tend to value personal independence and the importance of individual goals over group goals (Wong et al. 2006). In traditional Asian cultures, decisions concerning the marriage of adult children need to be made by the extended families on both sides because marriage in collectivist cultures means alliance of two extended families. However, for the younger immigrants who grew up in the more individualist cultures, whom to marry is a decision that is supposed to be made by the couple themselves. Conflicts might occur between the older generation and the younger generation with regard to decision-making process for the choice of marriage partners. Intergenerational conflicts could negatively affect communication between the older immigrants and their adult children.

At the societal level, receiving and giving social support occur through an individual's social network. Social support provides both instrumental support (e.g., help from a friend to get medication from a chemist store) and emotional support (e.g., companionship provided by a friend from the home country). Such social relationships are beneficial to health and psychological well-being. Early generations of immigrants who grew old in the host country tend to limit their social networks to friends from the same ethnic background. This may be due to convenience, as such ethnic network is often developed from networks of their family or extended families or neighbors from the

same ethnic background, or it may stem from a desire to remain connected with their old home country. As older immigrants' mobility decreases with age and as their children move out of the family house when they reach adulthood, the opportunities for their children to drive them to different places to meet with friends are likely to decrease. Lack of opportunities to participate in social activities can further contribute to older immigrants' feeling of social isolation, which negatively affects health and well-being.

Clearly, older immigrants experience unique stressors related to social isolation, identity loss, depression, anxiety, low self-esteem, and communication barriers (Chow 2004). Those stressors might be broadly grouped into three categories: (a) physiological changes which make them more vulnerable to the effect of loss of control over their own life; (b) age-linked changes or loss of old social roles and the demand to adapt to changes in new social roles, such as retirees or immigrants; and (c) loss or diminished social support due to decreased mobility, health problems, and cultural transition. Such experiences not only limit their successful aging opportunities and psychological well-being but also negatively affect their families and their community. They often feel that they neither belong to where they come from nor to where they are residing. Although such feelings might be experienced by immigrants of all age groups, this sense of belonging to nowhere tends to be felt more strongly among older immigrants as they become more dependent on others in the later years of their life. Despite these challenges, most research on migrants has focused on younger populations, leaving us with very limited knowledge of how older immigrants simultaneously deal with cross-cultural adjustment and aging in a foreign land.

### **Culturally Appropriate Aged Care for People from Diverse Backgrounds**

The capacity to successfully embrace and navigate a new culture has been an important factor that influences the perception of health and well-being among older immigrants. A multitude of

social, personal, cultural, and family constraints associated with being an older immigrant presents significant challenges to successful aging. They affect access to and utilization of resources and highlight the need for a coordinated approach to filial responsibilities, honoring traditions, personal values, and meeting social expectations. Due to early childhood socialization in the home country, immigrants often arrive with an established set of ideas regarding aged care, family relations, religious beliefs, and access to formal care services. Those culturally based assumptions often result in culture-specific understandings of aged care, which may not be understood or shared by the host society. Yet little is known about the experience of aging as an immigrant, particularly for those who find themselves aging in a country which is culturally and linguistically distinct from their country of origin.

Intercultural researchers have acknowledged that cultural isolation and linguistic difficulties increase immigrants' dependence on their children and a diminished probability of seeking assistance from formal care providers. Panagiotopoulos and colleagues (2013) conducted a study to delineate differences in the well-being of Greek and British Australian widowed immigrants and to compare the impact of widowhood on well-being. Their findings showed that support from family is more crucial for the well-being of Greek widows compared to their British counterparts. Similarly, many older immigrants from Asian backgrounds are often economically dependent on their children, and they are reluctant to access formal care for fear that it would be seen as familial rejection. However, while a culture of family care is held strongly among many older immigrants, social norms associated with the tradition of filial piety (i.e., the expression of responsibility, sacrifice, and respect for one's elders and ancestors, including taking care of one's parents) have changed due to the contemporary family structure and mainstream cultural systems which are oriented toward individualism.

Specifically, research on Asian immigrants in Western countries show significant departures from the norms of filial piety and an overall

Westernization of care practices, both in relation to what families actually do for their elderly parents and what older people themselves now expect (Chow 2004). While it is widely accepted that the role of the family is more vital for older immigrants who age in a foreign land than if they remained in their homeland, intergenerational relationships between older immigrants and their offspring may have changed in the new cultural context. In traditional Chinese culture, daughters-in-law, who become part of their husband's family, are responsible for caring for their husband's older parents. Older Chinese parents who sacrificed their personal interest for the betterment of their children (e.g., working to provide better education opportunities for their children) would expect a reciprocal filial obligation from their children or children's family to care for them. However, such expectation might not be shared by younger generations of immigrants who view their roles of caring for their older parents more in the provision of financial support, rather than fulfilling the role of a personal carer. Consequently, those who were once considered the primary carer for older parents are no longer obligated to provide personal care, but rather duties of filial piety is fulfilled by providing financial support to older parents. Therefore, the experiences of older immigrants can be adversely affected by a hidden source of isolation and exclusion in the new cultural context. Discrepancies in the expectations of elderly immigrants, their family, their community, and the larger society can negatively impact the capacity of aged care services to effectively meet the needs of older immigrants and their families.

The cumulative effects associated with migration to a foreign country, cultural distance between old-world traditions and the new cultural environment, and difficulties in accessing culturally and linguistically appropriate health care and resources are detrimental to older immigrants' well-being. While public health policies have focused on meeting the increasing demand for formal aged and health-care facilities and services, one often overlooked dimension of population aging is the diversity of the aging population. It is essential that care capacity building occurs in tandem with an understanding of the experiences

of older people and their families from diverse cultural backgrounds. In an attempt to illustrate this point, Lood, Gustafsson, and Ivanoff (2015) conducted a pilot study to evaluate a person-centered 4-week health program in Sweden. The program used translated information materials and bilingual health professionals and evaluators for both program development and provision. The 40 participants were at or over 70 years of age and had migrated to Sweden from Finland, Bosnia and Herzegovina, Croatia, Montenegro and Serbia. Over a 4-week period, the participants in the *senior meetings* group held weekly meetings to discuss about different tools for health promotion in everyday life; each participant in the *preventative home visit* group was visited by one of the health professionals involved in the study to provide information and advice on various forms of activities to support aging in the community. The participants in the *control group* did not receive any intervention, but they had access to conventional aged care services from the municipality (e.g., home-help services). The findings from this study showed that the linguistically and culturally adapted health programs had a high retention rate of participants (86%), largely due to its person-centered approach. The participants responded favorably to the program being tailored to their language preferences. They also welcomed an approach that focuses on how each person can convert his or her resources into the actual achievement of a desirable state of health. The study shows the importance of tailoring health programs to linguistic preferences of older immigrants in order to build authentic and productive relationships between older immigrants and caregivers. This study also highlights the importance of connecting older people from culturally and linguistically diverse backgrounds with their communities and families to help them age well by remaining socially connected and active.

Recent research on older adults from Western cultures shows that group processes and social identities are effective resources to improve psychological adjustment in response to life changes (Haslam et al. 2014). The social support gained from a large network can provide individuals with

meaning and purpose in life, promote a sense of well-being, and allow integration into the larger society, thus positively influencing health and well-being. Older adults who have supportive social networks tend to enjoy better physical and mental health compared with those who are without such social networks. However, these processes and interventions need to be understood, adapted, and implemented for linguistically and culturally diverse communities. Moreover, improving the possibilities for older adults to take control over their health is an increasingly important public health practice. For example, Consumer Directed Care (CDC) is a new approach in community aged care that is being introduced in many Western countries (Laragy and Allen 2015). It is a radical departure from the traditional agency-directed aged care in that it aims to give more choice and control to aging persons. CDC programs aim to assist older people to live as independently as possible in their own homes and to maximize their choice and decision-making abilities while ensuring their safety and promoting restorative health. Health promotion in this area has previously been visualized to succeed with this approach, but the research has primarily focused on older adults who are native born, leaving the generalizability to people who are foreign born unexplored. However, CDC opens up a new avenue for the provision of culturally appropriate care to older people from diverse backgrounds.

Culturally appropriate aged care has significant consequences for the well-being of elderly immigrants, their children, communities, and the wider society. There is a need to advance our understanding of when and how individuals, their family, and the community can work together to promote successful aging. To date, documented research supports claims that the quality of community care depends on older immigrants having access to the services along with family support, yet little is known about why social isolation persists. Notably, we have limited knowledge of how older migrants' expectations match, or do not match, those of their family and community. Culturally appropriate interventions can also be delivered through digital medium. Through

Internet-enabled devices such as tablets, iPads, mobile phones, and computers, many older immigrants can keep contact with their old social circles such as old friends in home country, access news in their ethnic language, seek advice on health issues from medical professionals, and participate in workshop discussions virtually. All these activities may help to keep older immigrants socially connected and integrated. In an aging and culturally diverse society, it is important from both ethical and public health perspectives to explore how aged care services can become more culturally appropriate for older adults from diverse backgrounds.

## Conclusion

Global trends of international migration have resulted in a sizable population aging outside of their places of origin. This demographic shift means that those countries with large aging migrant populations have economic and social imperatives to support successful aging of people from diverse backgrounds. This has resulted in a growing demand for culturally appropriate care, with implications for government, communities, aged and health-care providers, and social services. In particular, most developed nations share the growing need to support those who are aging in a foreign land, although the size and projected growth of the aging migrants vary across countries. A cross-cultural perspective is crucial for service delivery and policy development to meet the specific care needs of the diverse aging population.

Many variables including age, gender, living arrangement, length of residence in the migrated country, health, social roles, education, income, and social support contribute to psychological stressors in older immigrants. Older immigrants may have different health-care needs due to differences in cultural values, beliefs, and language. Differences in expectations of family support, cultural background, length of residence in the receiving country, possibility for returning to their country of birth, morbidity patterns, and language skills are but a few of the many factors

that are likely to shape experiences of aging and need for aged care among elderly immigrants (Kristiansen et al. 2015). Formal aged care providers need to ensure that their service takes into account the important role of family in providing vital informal support while also addressing the difficulties posed by language and literacy for older immigrants when they are faced with the need to access formal care. Developing culturally appropriate models of care to enhance successful aging and improve health outcomes is a challenge that we face today because service development and delivery need to be responsive to the culturally diverse population.

## Cross-References

- ▶ [Cross-Cultural Aging](#)
- ▶ [Emotional Development in Old Age](#)
- ▶ [Filial Responsibility](#)
- ▶ [Loneliness and Social Embeddedness in Old Age](#)
- ▶ [Psychological Theories of Successful Aging](#)
- ▶ [Social Connectedness and Health](#)
- ▶ [Social Policies for Aging Societies](#)
- ▶ [Social Support and Aging, Theories of](#)

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## Mild Cognitive Impairment

Sylvie Belleville, Simon Cloutier and  
Nick Corriveau-Lecavalier  
Psychology Department, Research Centre, Institut  
Universitaire de Gériatrie de Montréal, Montréal,  
QC, Canada

## Synonyms

Cognitively impaired not demented (CIND); Mild cognitive decline; Mild neurocognitive disorder

## Definition

Alzheimer’s disease (AD) is a neurodegenerative disorder and its symptoms progress on a continuum from very mild deficits to dementia. Thus, the transition from normal cognition to dementia is not sudden, but rather a gradual process during which the number and severity of symptoms increase over time. The term mild cognitive impairment (MCI) is used to identify older adults whose performance on neuropsychological tests

is deemed abnormal for their age and educational level but is insufficient to interfere notably with activities of daily life and to justify a diagnosis of dementia. Many individuals who meet the criteria for MCI will progress to more severe symptoms. Hence, the condition might indicate a prodromal phase of Alzheimer's disease. Persons with MCI might also suffer from other age-related neurodegenerative disorder. It has been proposed that an MCI phase might also precede Parkinson's disease dementia, Lewy-body dementia, vascular dementia, and frontotemporal dementia.

## Current Knowledge

### The Concept of Mild Cognitive Impairment in the Continuum of Alzheimer's Disease

Dementia is a syndrome characterized by pervasive cognitive impairment and loss of autonomy. The number of individuals suffering from dementia worldwide was estimated to be 44 million in 2013 and is expected to rise considerably with the increase in population and life expectancy, especially in low- and middle-income countries. Though dementia can result from a range of brain illnesses, its most common cause is AD. AD is a progressive neurodegenerative disease characterized by two core pathological hallmarks: extracellular deposits of amyloid beta protein and intracellular neurofibrillary tangles. The disease has devastating impacts on the social, economic, and psychological well-being of affected individuals, and it requires that substantial research efforts be devoted towards its understanding. Yet the cause of AD remains elusive. One major challenge is to identify patients as early as possible. Early diagnosis would facilitate identification of the causal mechanisms of the disease. It would also allow for the early implementation of prevention strategies or treatments, before the devastating effects of AD can take place.

Currently, AD is only confirmed by its histopathological hallmarks upon postmortem examination. The premortem diagnosis is provided on the basis of a set of inclusion criteria to confirm abnormal deterioration of cognitive functions and

exclusion criteria to reject other etiologies as causative of the cognitive deficit. For many decades, the clinical diagnosis of AD was provided at the dementia phase, when cognitive impairment was pervasive and severe enough to significantly impact autonomy. Yet, it is now agreed that the clinical criteria for dementia identify patients many years after the onset of pathological events that lead up to AD and that the prodromal phase can span up to 15–20 years preceding dementia. This has generated considerable belief that AD could be diagnosed much earlier. A large number of terms have been proposed to identify this prodromal phase of AD; however, MCI is the one that prevails.

### Historical Background

One of the earliest syndromic classifications of age-related cognitive decline was provided by Kral (1962), who contrasted “benign senescent forgetfulness” with “malignant senescent forgetfulness.” In this syndromic classification, “benign senescent forgetfulness” referred to a gradual decline of memory or cognition, which did not impact significantly on daily functioning. This was contrasted with a “malignant” form that was associated with dementia. The use of the term “mild cognitive impairment,” to describe patients who present significant cognitive decline but do not yet meet the criteria for dementia, may be originally attributed to a research team at New York University that used it in 1991 in the context of the stages proposed by the Global Deterioration Scale (GDS) (Flicker et al. 1991; Reisberg et al. 1982). The GDS comprises six stages of cognitive decline: Stage 1 – no cognitive decline, Stage 2 – very mild cognitive decline, Stage 3 – mild cognitive decline, Stage 4 – moderate cognitive decline, Stage 5 – moderately severe cognitive decline, and Stage 6 – severe cognitive decline. Stage 4 corresponds to early dementia. Patients in Stage 3 only experience mild deficits that would not interfere notably with activities of daily life. In 1991, Flicker and colleagues (1991) found that the mildly impaired subjects (classified in Stage 3) showed significantly poorer performance than healthy controls on tests of recent

**Mild Cognitive Impairment, Table 1** Summary table of the main MCI criteria

			MCI due to AD		Minor neurocognitive disorder (DSM-5 2013)
	MCI		(NIA/AA 2011)		
	(Petersen et al.)		MCI	MCI+	
	1999	2001	(Winblad et al. 2004)	Clinical Biomarkers	
Concern reflecting a change in cognition	√	√	√	√	√
Demonstration of memory impairment by cognitive testing	√				
Demonstration of cognitive impairment by cognitive testing		√	√(or)	√	√
Evidence of cognitive decline over time			√	√	
Intact ability to perform activities of daily living	√	√		√	
Intact ability to perform basic activities of daily living			√	√	
Minimal impairment in performing complex activities of daily living			√		√
Preserved overall cognitive functions	√	√			
Absence of dementia	√	√	√	√	
Cannot be explained by other causes or mental disorder				√	√
Indicate if etiology is consistent with AD				√	√
Biomarkers of amyloid deposition (CSF or PET)				√(or)	
Neuronal injury (Tau, FDG, SPECT, structural MRI)				√	



memory, remote memory, language function, concept formation, and visuospatial praxis. They used the term MCI to identify this condition. Following this first conceptualization, Zaudig proposed (1992) three types of MCI based on the *Diagnostic and Statistical Manual of Mental Disorders*, 3rd Edition-Revised (DSM-III-R), and on the World Health Organization’s *International Statistical Classification of Disorders and Health Related Problems*, 10th revision (ICD-10). Type 1 only involved memory impairment, Type 2 was characterized by impairment of memory and another cognitive domain, and Type 3 involved Type 1 or 2 with deterioration of emotional control, social behavior, or motivation. These early works laid the foundation for some of the more recent MCI classifications (Petersen et al. 2001; Winblad et al. 2004), NIA/AA (Albert et al. 2011).

**Recent Conceptualizations and Criteria**

Based on follow-up studies of a large clinical cohort by the Mayo Clinic in the 1990s, Petersen and his colleagues posited that many persons with MCI were in the prodromal phase of dementia. They proposed a set of criteria to identify those individuals (Petersen et al. 1999) (see Table 1 for a summary of the main criteria for MCI based on recent conceptualizations): Persons with MCI complained about their memory, showed objective memory difficulties beyond what is expected considering their sociodemographic characteristics, did not show general cognitive impairment, still performed their daily activities independently, and failed to meet clinical criteria for dementia. Follow-up studies of the group indicated that every year 10–15% of persons meeting those criteria went on to develop AD, a far higher

rate than that observed in the normal population (1–5% per year) (see Gauthier et al. 2006). Later studies indicated that the progression rate of MCI varied as a function of their recruitment source, criteria, and follow-up length but was still much larger than that of non-MCI individuals. The work led by Petersen at the Mayo Clinic has had a considerable impact on the field, by providing well-defined criteria that stimulated an explosion of studies investigating prodromal AD and facilitated cross-study comparisons. Overall, these studies showed that the clinical and pathophysiological characteristics of MCI are close to those found with dementia of the Alzheimer type, supporting the notion that MCI captures a group of individuals in a transitional state between normal aging and dementia.

In spite of their heuristic value, the initial criteria were criticized on a number of grounds and other conceptualizations were proposed (Table 1; Petersen et al. 2001; Winblad et al. 2004). One major criticism was that MCI is a heterogeneous condition and that cognitive symptoms are not restricted to the memory domain. As the initial criteria only included memory deficits, they failed to cover the entire range of symptoms that are found in prodromal AD. Thus, it was proposed that individuals with MCI and only memory deficits should be identified as having amnesic MCI, and the term “multidomain amnesic MCI” should be used to identify those with deficits in memory as well as in other cognitive domains. In turn, the authors suggest using the term nonamnesic single- or multidomain MCI for individuals presenting deficits in one or more domains other than memory (Petersen et al. 2001). There are also discussions regarding the heterogeneous etiology of MCI. It is now broadly agreed that different profiles might represent different etiologies, supporting the importance of qualifying the symptomatic profiles of MCI.

In 2011, the National Institute on Aging and the Alzheimer’s Association workgroups (NIA/AA) on diagnostic guidelines for Alzheimer’s disease proposed an updated set of criteria for MCI that distinguished clinical criteria from criteria to support research ([http://www.alz.org/research/diagnostic\\_criteria](http://www.alz.org/research/diagnostic_criteria) and Table 1) (Albert

et al. 2011). They proposed that the MCI clinical criteria be based on two processes. First, the clinician should establish the presence of clinical and cognitive criteria: (1) presence of a concern about a *change* in cognition, reported by the patient, an informant, or a clinician; (2) evidence of an impairment in one or more cognitive domains; (3) preservation of independence in functional abilities; (4) not demented. Second, the clinician should examine if the etiology is consistent with AD pathophysiology by: (1) ruling out vascular, traumatic, medical causes of decline; (2) providing evidence of cognitive decline over time, where possible; (3) reporting history consistent with AD genetic factors, where relevant. For research purposes, the workgroup proposed the use of biomarkers to document the likelihood of AD as the underlying etiology. Hence, the presence of positive markers of amyloid deposition (Cerebrospinal fluid (CSF) or Positron emission tomography (PET)) and neuronal injury (Tau, Fludeoxyglucose-PET (FDG-PET), structural MRI) would indicate that there is a high likelihood that the MCI is due to AD.

The DSM-5 (American Psychiatric Association 2013), published in 2013, also incorporated the notion of prodromal AD. However, the terminology is strikingly different from that used to describe MCI. The manual proposed three types of acquired neurocognitive disorders: delirium, minor neurocognitive disorders, and major neurocognitive disorder, with etiological subtypes for the latter two. Major neurocognitive disorder refers to dementia and, where applicable, can be attributed to Alzheimer’s disease. The criteria for minor neurocognitive disorder are similar to those generally proposed for MCI (Table 1). They include: (1) a modest decline of at least one cognitive domain; (2) the decline has no significant impact on professional or social activities, though it is recognized that those activities might require more effort, adaptation, or compensation; (3) the decline does not occur during an episode of delirium; and (4) it is not explained by another mental disorder. When diagnosing a minor neurocognitive disorder, the clinician is expected to specify its etiology and whether it is accompanied by behavioral symptoms. The clinician will

diagnose possible AD when there is objective decline in memory and at least one other cognitive domain, onset is insidious, decline is gradual, and when there is no evidence of a mixed etiology. To support a diagnosis of minor neurocognitive disorder with probable AD as an etiology, the clinician must have evidence of insidious onset, gradual decline, *and* presence of a genetic mutation related to AD.

### Cognitive Symptoms

Characterizing the cognitive deficits found in MCI is critical for neuropsychologists who contribute to diagnose AD and MCI and whose assessments are used to guide intervention strategies. For this reason, the study of cognitive impairment in MCI has been the subject of considerable research efforts. As a result, clinicians now have a fairly well-delineated picture of the impairments found in MCI. Episodic memory – the record of personal events encoded in their spatiotemporal context – is impaired early and quite extensively in persons with MCI. Episodic memory deficits were reported when tested with verbal or nonverbal material, with or without retrieval cues (Belleville et al. 2008). Among the different measures of episodic memory, delayed recall and associative memory, the ability to bind different items, are particularly sensitive in MCI (Belleville et al. 2008). This is unsurprising, given the hippocampal damage found early in prodromal AD. In addition, numerous studies reported evidence of impaired executive functions and attentional control in MCI. Impairments were found using tests that reflected different executive components: inhibition capacities, working memory, switching, and divided attention (Belleville et al. 2007, 2008; Dannhauser et al. 2005). Impaired executive functions might indicate a more severe stage of MCI. However, it has also been suggested to reflect comorbid conditions that are characterized by executive deficits, particularly vascular diseases and/or depression.

AD and MCI are both progressive; however, most studies have failed to reveal the patterns of changes as cognitive deficits unfold. Natural history studies can characterize these changes that

occur as MCI progresses and provide the opportunity to study the trajectory of symptoms in different cognitive domains. Findings from natural history studies show that the decline occurs faster in MCI persons, compared to cognitively healthy controls (Wilson et al. 2010). However, the trajectory of this decline varies greatly depending on the cognitive domain. Decline in a number of nonmemory cognitive domains (e.g., visuospatial abilities, inhibition) appears to be a gradual process, a continuous, linear trend (Cloutier et al. 2015). In contrast, episodic memory and working memory present a distinct pattern of decline: years of stable performance followed by a rapid decline, just prior to a dementia diagnosis. This decline pattern suggests that dementia may coincide with a failure of compensation in these memory domains (Twamley et al. 2006; Clement and Belleville 2010).

### Noncognitive Symptoms

Although MCI is typically defined as a cognitive syndrome, other noncognitive symptoms often occur. Many individuals report depressive symptoms, anxiety, signs of apathy, and sleep disturbances (For a review, see Apostolova and Cummings 2008). It is not entirely clear whether those symptoms are psychological reactions to the cognitive changes of MCI or whether they are pathognomonic. Notably, many studies indicate that those symptoms can predict progression from MCI to dementia (Apostolova and Cummings 2008). This finding supports the notion that they are not due to the psychological distress caused by memory challenges, but rather result from biological changes associated with the disease. One possibility is that the symptoms reflect the presence of neuropathology in regions involved in emotional regulation.

### Neuroimaging Studies and Other Biomarkers

Neuroimaging is a prominent field of MCI research, because it has tremendous potential to provide early in-vivo biomarkers of MCI pathophysiology. In addition, functional brain imaging can reveal the patterns of compensation and neuroplasticity that occur during progression of MCI.

Pittsburgh Compound-B (PiB) is a tracer used in positron emission tomography (PET) to observe amyloid deposition in the brain. Persons with MCI who have significant amyloid burden are at a higher risk of converting to AD, and a higher PiB retention is correlated with poorer performance on episodic memory tasks (Forsberg et al. 2008). CSF can also provide sensitive markers of MCI pathophysiology. Compared to controls, MCI patients who will later progress to dementia have significantly lower CSF A $\beta$ 42 (marker of amyloid) levels and higher CSF Tau (marker of neuronal injury) and phosphorylated Tau (pTau; marker of tangles) levels (Andreasen et al. 2003), a pattern similar to that found in demented AD patients. These biochemical changes in CSF are the first detectable markers of the disease, and the combination of low CSF A $\beta$ 42 and high CSF Tau/pTau is a strong predictor of future cognitive decline in MCI.

Fludeoxyglucose (FDG)-PET is a marker of glucose uptake, which is an indirect measure of brain activity and metabolism, and reflects neuronal integrity. Hypometabolism, particularly in the temporoparietal regions, is a predictor of future progression in persons with MCI (Chetelat et al. 2003). Evidence of hypometabolism using FDG-PET, one of the earliest markers of the disease, was demonstrated in regions associated with episodic memory (hippocampus, entorhinal cortices), prior to showing cognitive symptoms or significant atrophy in presymptomatic carriers of familial type AD mutations (see section on genetics) (Mosconi et al. 2006).

Because the technique is widely available, noninvasive, reliable, and not costly images based on magnetic resonance imaging (MRI) have been well investigated. Structural MRI studies have demonstrated that the atrophy rate of many regions of the brain follows a linear and distinct sequence as the individual progresses toward dementia (Risacher and Saykin 2013). At the very beginning of the disease, atrophy is principally observed in the medio-temporal lobe, as the hippocampal volume reduces by 3% annually. As the disease becomes more severe, atrophy tends to spread to other cortical regions like the lateral temporal, parietal, and frontal lobes

(Risacher and Saykin 2013). Moreover, Apolipoprotein e4 (ApoE4) allele, a well-investigated gene in AD, has been shown to have a modest but significant effect on the annual atrophy rate (ApoE4 Risacher and Saykin 2013). More precisely, ApoE4 carriers show a faster annual rate of atrophy of the hippocampal and entorhinal cortices.

Whereas neuronal integrity decreases gradually during the MCI phase, fMRI studies have shown a paradoxical inverted u-shape function to express task-related brain activation. Dickerson et al. (2004) were the first to report such a selective relationship between fMRI activation, degree of impairment, and subsequent clinical decline among individuals with MCI. They found that greater activation in the parahippocampal gyrus (PHG) and hippocampal formation (HF) during encoding was associated with future clinical decline over an average of a 2.5-year follow-up period. They came to the conclusion that hyperactivation in these regions probably reflected compensatory mechanisms that are specific to predementia patients. Clément and Belleville (2012) elaborated a model of compensation-related activation in the brains of individuals with MCI, according to disease severity and task nature. They proposed that during the early phase of MCI, when there is only mild neuropathology in the region involved in a task, performance would be optimized by hyperactivating that region, as well as by recruiting additional regions that were not implicated in the task. However, as the disease gets more severe and affects compensatory regions, the brain would no longer have the capacity to overrecruit and compensate. This compensation breakdown would result in less activation and fewer regions involved in a task, a pattern similar to that found in demented patients. Clément and Belleville (2012) proposed that the point at which compensation-related mechanisms would be observed during the progression of the disease is related to the nature of the task. They found that compensation occurs earlier for associative recognition, which relies on brain regions that are altered early in the disease, than for item recognition, which depends on brain regions impaired later in the disease. In this study, the

brains of participants in a very early phase of MCI showed greater activation in regions known to be involved in episodic retrieval (e.g., dorsolateral and ventrolateral prefrontal cortices). Moreover, their brains recruited also additional regions: more posterior (i.e., precuneus, right temporal lobe, inferior and superior parietal lobules) and bilateral regions (i.e., prefrontal cortex) that are not usually involved in verbal episodic tasks or retrieval. Individuals with more severe MCI showed a shift in compensation mechanisms on tasks involving cognitive processes that are impaired later in the disease (an item recognition task). During the item recognition task, their brains showed hyperactivation in regions known to be involved in episodic retrieval and recruited additional bilateral regions (e.g., the prefrontal cortex). In contrast, the associative memory task resulted in lower activation, fewer regions involved in the task, and poorer performance. This suggests that these individuals' brains were not able to compensate for that task.

To summarize, the neuroimaging techniques and biomarkers available to clinicians and researchers help facilitate early diagnosis, identify the etiology, and understand the pathophysiology of the disease, as well as the dynamic processes of compensation. Different markers have different uses and advantages. For instance, PiB-PET and FDG-PET show similar diagnostic accuracy for MCI, but PiB-PET may be better for identifying AD as an etiology of MCI. However, PiB retention is thought to rapidly reach a plateau during the prodromal phase, and hence, might not be the best indicator of disease severity.

### The Genetics of MCI

One of the most well-known and researched genes in AD is the ApoE gene. The  $\epsilon 4$  variant increases one's risk of developing MCI and converting to AD (Poirier et al. 1993). Genetics research has identified many other "risk genes" of AD, such as the clusterin (CLU) gene or the complement receptor 1 (CR1) gene (Bettens et al. 2013). Mutations on these genes augment one's risk of developing dementia but are not causative. A very rare type of AD, called autosomal-dominant familial AD, is caused by mutations on the amyloid

precursor protein (APP), presenilin1 (PSEN1), and presenilin2 (PSEN2) genes (Bird 2012). This familial type is characterized by early onset, generally before the age of 60, and represents fewer than 1% of all AD cases. This form of AD is preceded by a prodromal, or MCI, phase. Therefore, autosomal-dominant MCI and AD represent a unique resource to study: not only the cognitive profiles of the mutation carriers but also the imaging and biochemical markers of the disease in its early phases.

### Predicting Dementia in Persons with MCI

A problematic issue regarding MCI is that its prognosis is uncertain. Whereas the majority of individuals with MCI will progress to dementia, a proportion varying between 13.5% and 44% will remain stable or revert back to normal (see Gauthier et al. 2006; Albert et al. 2011). It is thus critical to identify those individuals who will develop AD. Many studies use longitudinal and prospective protocols to differentiate persons with MCI who will progress to dementia from those who will not. Cognitive measures have demonstrated very promising results for predicting dementia. Tests of episodic memory, especially associative memory, have been shown to be the most robust predictors; measures of working memory, executive functions, perception, and language have also been shown to be reliable predictors (Belleville et al. 2014a, b). However, prediction is optimal when neuropsychological assessments examine episodic memory along with multiple cognitive functions. For example, Belleville et al. (2014a) assessed a cohort of individuals with MCI using a battery of tests measuring episodic memory (macro elements of the MEMO-TEXT and free recall of words in the Free and Cued Recall Test), working memory, executive functions and attentional control (Alpha-Span), perception (orientation match and object decision of the BORB), and language (object-naming of the DO-80). Over an average of a 4.5-year follow-up period, their test battery predicted the individuals with MCI who would later develop AD and those who would remain stable, with an overall accuracy of 87.7%.

In the field of neuroimaging, most studies have focused on medial temporal structure. Atrophy within these structures is observable many years prior to diagnosis, with the hippocampal volume being the strongest predictor (Trzepacz et al. 2014). For example, hippocampal and entorhinal cortex atrophy have been shown to predict AD in those with MCI, with an accuracy of 60% over a 2.5-year follow-up period. When combined with clinical data, the accuracy reached 78.8% (Belleville et al. 2014b). Other parts of the brain have also been shown to be reliable predictors of dementia. Peters et al. (2014) assessed individuals with MCI over a 2-year follow-up period using neuropsychological and MRI data. They demonstrated that atrophy of the right anterior cingulate and the right middle frontal gyri could predict progression toward dementia with an accuracy of 75%. Furthermore, they elaborated a model combining atrophy of the right anterior cingulate gyrus with neuropsychological tests measuring episodic memory (immediate free recall and immediate recognition of the Memoria Battery). Their model showed prediction accuracy of up to 87.5%. PiB-PET amyloid imaging has also been shown to be a reliable prediction technique, especially in combination with MRI measures. Trzepacz et al. (2014) assessed individuals with MCI using PET and MRI techniques over a 2-year follow-up period. The MRI scan of the temporal cortex showed 72% accuracy, followed by a PiB-PET scan of the lateral temporal cortex and MRI scans of the entorhinal cortex and hippocampus, both with 68% accuracy. Combined, the MRI and PiB-PET data had an accuracy of 76%.

Overall, studies have shown that both cognitive and neuroimaging measures are useful in predicting progression to dementia. Predictive accuracy increases substantially when the different types of predictors are combined. As research begins to focus on earlier phases of the disease, an approach combining multiple cognitive measures with biomarkers will be required to support predictive accuracy and to understand the interaction between these predictors. This reflects the

NIA/AA criteria for MCI of the Alzheimer type, where biomarkers take a prominent role in combination with clinical indicators to identify the underlying etiology of the disorder.

### **Management, Prevention, Intervention**

In the absence of disease-modifying treatments, many scholars have recommended using prevention or intervention strategies to delay the onset or progression of the cognitive symptoms of AD. To have the greatest effect, these strategies would likely have to be implemented early, specifically during the MCI phase, when the individual is still motivated and has the capacity to learn and apply new strategies and behaviors. Many studies have examined whether cognitive interventions – techniques and programs designed to increase or optimize cognition – improve cognitive functioning in persons with MCI. Different types of training have been tested but most of them focused on episodic memory. Most of the programs that were used in MCI to improve their memory relied on compensatory techniques. Hence, participants were taught different mnemotechnics that make use of their intact visual imagery of semantic knowledge capacities to support memory encoding. A few programs have also relied on less demanding memory techniques, for instance, spaced retrieval techniques or vanishing cues. Most of the programs provided to MCI were multicomponential in that they not only targeted memory but also other cognitive domains, most often attention/executive functions. Results indicate that episodic memory, attention, and well-being can be improved by strategic attentional or memory training and that it can sustain over time (Simon et al. 2012). In addition, brain imaging indicates that those interventions can increase brain activation in alternative and specialized regions (Belleville et al. 2011; Hampstead et al. 2011). Those studies indicate that cognitive training programs can be a powerful tool and have beneficial effects during the MCI phase. Furthermore, cognitive training has a direct effect on the brain of those individuals, which indicates that it might increase brain reserve and brain plasticity.

Epidemiological studies have shown that lifestyle factors can increase the risk of cognitive decline, dementia, and AD and might account for up to 50% of the AD cases worldwide. Physical activity, diet, vascular risk factors, education, depression, and lifelong cognitive stimulation are among the modifiable risk factors that have the strongest relation with dementia. A successfully implemented prevention approach that targets these modifiable factors in persons at risk of AD has the potential to have a tremendous impact on the number of cases. Large-scale multimodal prevention trials are being carried out worldwide to determine whether improving some protective lifestyle factors in older age can reduce cognitive decline in persons at risk for the disease. The Finnish Geriatric Intervention Study to Prevent Cognitive Impairment and Disability (FINGER), a double-blind randomized control trial, enrolled 1260 older adults with a vascular risk of dementia. Participants received an intervention of healthy diet, physical exercise, vascular risk monitoring, and cognitive training versus general health advices. The authors recently reported that the intervention reduced the rate of cognitive decline over a two-year period when compared to the control group (Ngandu et al. 2015). The Multidomain Alzheimer Preventive Trial (MAPT) study (Vellas et al. 2014) examined whether a multidomain intervention including nutritional counseling, physical exercise, cognitive training, and social activities, in combination with omega-3 fatty acid supplementation, would reduce cognitive decline in older adults with a subjective complaint or risk of frailty.

### Future Directions

The study of MCI has been influential and is growing quickly. Yet, there are still a number of unresolved issues related to the criteria, prognosis, early clinical manifestation, progression, and management of MCI. Given that new criteria have been proposed to identify those in the early stage of AD, studies will be required to test their

validity and evaluate whether all items are necessary. Another important challenge is to identify the source of interindividual variability among cognitive profiles and resistance to pathology and to identify the factors that contribute to different profiles. Studies on brain resilience and brain reserve will contribute to better understand why individuals vary in their resistance to neurodegenerative diseases.

Longitudinal studies of MCI and the use of complex methodology and statistical models will be critical to better understand how symptoms change during the early phase of the cognitive disease. For instance, it is generally assumed that decline occurs in a linear fashion; however, it is possible that more complex trajectories better explain the progression of cognitive symptoms during the MCI phase. Recent studies suggest that some domains are characterized by many years of stable performance, followed by a rapid decline just prior to AD diagnosis. Thus, future studies will have to assess complex patterns to provide an accurate picture of how the decline unfolds in the years preceding a dementia diagnosis. These should include persons with subjective cognitive decline. Some of these individuals might stand in a very early phase of the disease and their longitudinal assessment might be the key to reveal the earliest cognitive symptoms of AD.

The study of familial Alzheimer's disease (FAD) mutation carriers has been an important area of research. Carriers of mutations on the APP, PSEN1, and PSEN2 genes represent an ideal population for studying the early phases of dementia, due to the certainty that they will receive a future AD diagnosis. It is also possible to estimate their age of onset, based on the age at which their parent received his/her diagnosis. However, we need to know when and how symptoms unfold in mutation carriers and to assess whether individual or lifestyle characteristics affect the symptomatic expression of the disease in this population. We also need to improve our knowledge of how the preclinical phase of FAD compares with that of sporadic AD.

There is still work to be done in the field of cognitive test development. As research moves towards studying earlier phases of the disease, neuropsychologists will need access to more sensitive measures and algorithms to identify the earlier cognitive changes. Technological advances in the fields of virtual reality, information and communication technologies, continuous performance monitoring, wearable or environmental sensors, and online testing might provide promising innovations. In addition, multimodal biomarker models that combine cognitive and clinical measures with innovative biomarkers will be necessary to optimize predictive models of dementia. Furthermore, future studies involving neuroimaging should examine the relationship between structural damage and activation patterns. Because compensation mechanisms are likely highly active during prodromal AD, functional brain imaging can contribute knowledge of these mechanisms taking place as brain damage progresses. Such knowledge will shed light on the way by which the brain expresses resilience during the early phase of the disease.

Finally, the MCI phase has been identified as one that might be a suitable target for intervention and secondary prevention strategies. Reducing the cognitive symptoms and delaying their impact on independence are potentially powerful approaches to reduce the number of dementia cases worldwide. However, designing and implementing efficient intervention and prevention strategies is challenging and will require more research to identify responders, optimal temporal therapeutic windows, and ways to overcome barriers to behavioral changes.

Supporting such an ambitious research agenda will require large longitudinal studies of well-characterized cohorts with clinical follow-up and, ideally, postmortem analysis of the brain to identify the etiology. The increasing efforts to develop national and multinational initiatives that use large cohorts and allow analyses of big data sets will enable these questions to be addressed. To be successful, those efforts will require at least some partial harmonization of clinical and data collection procedures. In addition, there will be a need to train clinicians to the

notion of MCI in the context of slowly evolving neurodegenerative diseases so that the concept translate more rapidly from research to the clinical practice.

## Cross-References

- ▶ [Age-related Changes in Abilities](#)
- ▶ [Behavioral and Psychological Symptoms of Dementia](#)
- ▶ [Cognition](#)
- ▶ [Memory, Episodic](#)
- ▶ [Memory Training Methods and Benefits](#)

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## Mindfulness Approaches

Alissa M. Butts<sup>1,2</sup>, Angela Lunde<sup>1</sup> and Jane H. Cerhan<sup>2</sup>

<sup>1</sup>Mayo Clinic, Rochester, MN, USA

<sup>2</sup>Department of Psychiatry and Psychology, Division of Neurocognitive Disorders, Mayo Clinic, Rochester, MN, USA

### Synonyms

Mindfulness

### Definition

Mindfulness is “the awareness that emerges through paying attention on purpose, in the

present moment, and nonjudgmentally to the unfolding of experience moment by moment” (p. 145) (Kabat-Zinn 2003).

## Introduction

Mindfulness is an ancient practice that has gained popularity in Western cultures in the past few decades. There is a large body of research demonstrating a wealth of benefits of mindfulness practices in the adult population. Recently, there is growing interest in the benefits of mindfulness and its many approaches in the elderly given this population’s unique characteristics and challenges. In an era with increased awareness, inquisition, and proactive attitudes toward healthy aging, there is keen interest in behaviors and practices that may help prevent negative effects of aging. Excitingly, many mindfulness-based approaches are extending into the doctor’s office as a way to improve or maintain wellness throughout the life span, including in the elderly.

This entry will first review the general goals of mindfulness practice and evidence for its impact on multiple aspects of functioning and will report on clinical and non-clinical populations in which it has been studied. The second part of the entry will discuss factors that are unique to the elderly population that give rise to the benefits of consistent mindful practice. Next will be a discussion of select methods that have adapted mindfulness techniques specifically for the elderly and a review of the emotional, cognitive, and biologic benefit of mindfulness practice in this population. Finally, we will provide an illustrative example of one experience at the Mayo Clinic is presented in which mindfulness practices have been incorporated and embraced to promote quality of life, as well as cognitive and emotional wellness, in an elderly population with mild cognitive decline.

## Mindfulness Approaches and Methods

### Foundations of Mindfulness

Broadly stated, mindfulness is “the awareness that emerges through paying attention on purpose, in the present moment, and nonjudgmentally to the

unfolding of experience moment by moment” (p. 145) (Kabat-Zinn 2003). The practice of mindfulness is an active, conscious skill incorporating several interrelated foundational attitudes that, among many benefits, help to improve quality of life, cope with medical conditions, reduce stress, and live more simply (Sood 2013a). While there are many variations and definitions of mindfulness, most hold general principles in common, including non-judging, patience, a beginner’s mind, trust, non-striving, acceptance, and letting go (Kabat-Zinn 1991), which are reviewed here briefly.

The attitude of *non-judging* during conscious awareness of one’s thoughts and experiences disengages the automatic tendency to place a label or value on something as “good” or “bad,” “right” or “wrong” and instead allows the mind to simply observe that act, thought, or event as it is. With a nonjudgmental consciousness, a more steady state of awareness may be achieved rather than experiencing highs and lows. *Patience* within mindfulness practice allows the mind to be more fully present with the current experience, and observing (nonjudgmentally) all aspects of the experience, rather than letting the mind rush toward the future or wonder back to past events or thoughts. The attitude of *beginner’s mind* encourages awareness of each experience as if it is occurring for the first time. This curiosity of a novel stimulus allows a fuller awareness of its unique aspects that may have otherwise been clouded, distorted, or glossed over due to prior experiences or thoughts. A deeper sense of *trust* in one’s feelings and intuition develops through mindfulness practice and allows the individual to become more authentically oneself and able to see the good in others as well. The *non-striving* quality of mindfulness is another way in which the mind is aware of the moment to moment present. That is, rather than working toward a specific goal such as “to have less pain” or “to be less stressed,” the non-striving attitude gives one permission to experience fully each present moment as it is, rather than as a means to an end. The attitude to *accept* things, and observe them, as they are rather than wasting cognitive and emotional energy on wishing they were something else is strongly related to the final attitude of *letting go*. This is a

way of embracing the present for all that it is and to not let the mind reject certain thoughts or experiences and hold on to others. Instead, letting go allows the mind to freely, nonjudgmentally, accept each moment as it occurs for what it is in a manner that is open to patiently experience the next.

Although discussed individually, these attitudes are interrelated and improve with practice. The reader is challenged to consider these foundational principles of mindfulness throughout the discussion of how mindfulness may be incorporated and applied in a variety of settings and populations, with particular attention and benefit to the elderly.

### Mindfulness Interventions

Because of the adaptability of mindfulness principles and their benefit across populations, mindfulness-based techniques have been incorporated into treatments and interventions for a number of clinical and non-clinical populations. In particular, using the basic principles of mindfulness, Kabatt-Zinn (1991) created a mindfulness-based stress reduction (MBSR) foundational treatment approach. Traditionally, MBSR combines mindful meditation and yoga in an 8-week course requiring weekly meetings and home practice. This basic MBSR intervention has been applied to many different populations, including those with chronic pain, cancer, insomnia, substance abuse (Grossman et al. 2004 for review), and even neurodegenerative populations, including those with Parkinson’s disease (Pickut et al. 2013). Aspects of mindfulness and cognitive-behavioral therapy have been combined into other widely used interventions that have been shown to be effective, including dialectical behavior therapy, acceptance and commitment therapy, and mindfulness-based cognitive therapy for depression.

Attention and interpretation therapy (AIT) is a mindfulness approach developed by Dr. Amit Sood at the Mayo Clinic intended to decrease stress and enhance resilience (Sood 2013b). He asserts that human attention instinctively focuses on threats and imperfections, which in turn roots attention in the past and future. AIT focuses on

guiding attention away from overfocus on the self and redirecting attention to the present moment and replacing negative thoughts with those of gratitude and compassion. In AIT, learners use practice and journaling to focus on the five pillars of gratitude, compassion, acceptance, meaning, and forgiveness. The Stress Management and Resiliency Training, or the “SMART” program, is an adaptation of AIT which can be administered in just one or two brief sessions (less than 2 h total) (Sood et al. 2011). Originally designed to address stress among busy physicians, the SMART intervention has shown promise in clinical populations, including women with breast cancer (Loprinzi et al. 2011). Mindfulness-based interventions, such as SMART, AIT, and MBSR, are now offered at major medical centers across the United States and worldwide and are increasingly accepted as mainstream and covered by insurers.

Recent work has sought to apply the traditional MBSR program and in some studies customize mindfulness techniques to the unique aspects of the elderly population.

#### Factors Unique for Elderly

Each developmental stage in life brings with it unique challenges. As a cohort, individuals approach the later stages of life with cumulative experiences in their history and unique challenges and goals for the future. According to Sood et al. (2011), if left unfocused, the mind tends to wander and ruminate on past experiences or worry and attempt to anticipate future experiences. The content of these ruminations may differ decidedly for the elderly as they approach the latter stages of life. Alternatively, mindfulness challenges the elder to live in and fully experience the present nonjudgmentally. Thus mindfulness in the elderly may help to increase focus on an appreciation for the present, which ultimately may lead to increased quality of life.

The elderly population is more likely to experience a number of physical symptoms, from orthopedic pains to more severe chronic medical conditions. The accumulation and increased severity of these biological changes may lead to withdrawal from pleasurable physical activities

and the health benefits and social interaction they may provide. These changes may lead to an increase in negative emotions (Rejeski 2008). Cognition also changes as the biological system ages, even in healthy aging. This population may face unique financial challenges and is more likely to experience illness of friends and relatives (de Frias 2014). The elderly are at a unique stage where they are required to integrate these cumulative life experiences and stressors with a “conative balance,” or living their remaining life with values that may be different than when they were younger and in a way that will shape the way others remember them when they pass (Rejeski 2008). These challenges could be uniquely addressed by mindfulness approaches that promote awareness to the present without judgment or evaluation. Indeed, a recent study found elders who were more mindful had greater emotional health in late life and may be less reactive to external stressors (de Frias 2014), suggesting that mindfulness may help elders stay presently focused and remain resilient in the context of threats to quality of life.

Within the context of these characteristics, Zellner Kellar et al. (2014) are creating a Mindfulness-Based Cognitive Approach for Seniors (MBCAS), specifically geared toward the elderly. The goals of this 8-month program include training the conscious awareness of the elders to “observe current experience with non-judgmental awareness, identify automatic behaviors or reactions to current experiences that are potentially nonadaptive, and enhance and reinforce positive coping with typical difficulties they face in their daily lives” (Zellner Kellar et al. 2014). Preliminary data suggest that elders who completed this program reported a positive change in depression scores, well-being, and self-esteem (Zellner Kellar et al. 2014). While more data are needed, the structure and goals of this approach appear promising.

#### Applications and Effects of Mindfulness

Mindfulness techniques may be incorporated into daily activities and routines or can be practiced in dedicated sessions/settings. These techniques may also be practiced at either the individual or

group level. As distinguished from meditation, mindfulness does not necessarily require a quiet environment. Rather, mindfulness is about being fully in the sensory experience of each moment without judgment. As such, common applications of mindfulness techniques include mindful eating, mindful walking, mindful breathing (Sood 2013a), as well as body scan or systematic awareness of various aspects of the body, and sitting meditation (Kabat-Zinn 1991). Additionally, a growing practice of physical activity that readily incorporates aspects of mindfulness is yoga (Rejeski 2008). All of these activities are frequently applied to the elderly population, including in gentle yoga as will be described in the illustrative example at the end of this entry. There is growing literature demonstrating the benefit of mindfulness-based practice in the elderly, including emotional improvement and social well-being, cognitive health, and neurobiological benefits.

#### Emotional and Social Benefits

A growing number of studies suggest mindfulness benefits the emotional and social well-being as well as quality of life in the elderly population. For example, modifying the mindfulness-based cognitive therapy (MBCT) Segal et al. (2002) developed initially for depressive populations, Foulk et al. (2014) conducted a series of 8-week MBCT sessions for older adults (mean age 72.9 years) with symptoms of depression and/or anxiety. This team took care to modify experiential practice in the weekly sessions to improve physical comfort, such as sitting in a chair or using pillows for support during floor exercises, or incorporating a “body scan” physical awareness of sensation rather than walking meditation, to reduce physical burden. With these age-appropriate modifications, elders who completed the program reported significant improvement in symptoms of anxiety, less ruminative thoughts, and fewer sleep-related problems. They also found a trend toward less depressive symptoms (Foulk et al. 2014). Together, this study supports the value of combining mindfulness, cognitive, and behavioral strategies into a unified treatment as an alternative to pharmacotherapy.

Other studies that use the traditional MBSR also show emotional benefit in elders. For example, Lenze et al. (2014) found improvement in a self-report measure of worry in elders who completed either 12- or 8-week MBSR programs. Similar findings including general improvement in levels of emotional distress and mood measures after MBSR have been shown in older adults (Young and Baime 2010). Interestingly, one study involving 73 older adults found that those elders who scored higher on a mindfulness self-report measure also reported higher psychological well-being (Fiocco and Mallya 2015). Engaging in mindfulness practice has also been associated with improvements in perceptions of quality of life in nursing home residents (Ernst et al. 2008). In a comprehensive review, Prakash et al. (2014) theorize that these many emotional benefits of mindfulness in the elderly may be related to an increased ability to minimize one’s reactions to external events that are out of one’s control as well as to minimize the internal pains that one creates in response to undesirable events or thoughts. This theory is similar to the notion of disconnecting pain from suffering, which is a common goal of mindfulness-based approaches. With the emotional benefits of mindfulness practice, including enhanced emotional control and less reactivity, the individual may be more open to fully experience each moment without judgment or labeling. This more consistent steady state of emotional health lends well to enter into more meaningful relationships with others (Sood 2013a). Mindfulness has also been shown to reduce self-perception and thoughts of loneliness in elders (Creswell et al. 2012).

#### Cognitive Health

Data from behavioral and neuroimaging studies suggest that mindfulness practice in the elderly may improve cognitive control by developing an improved ability to maintain goal-directed attention (Prakash et al. 2014). A review of cognitive outcome studies of mindfulness practice reveals a positive impact on a variety of cognitive domains in the elderly, particularly attention, memory, executive functioning, processing speed, and overall general cognition (Gard et al. 2014),

perhaps related to improved maintenance of goal-directed attention. One study comparing the effects of 8-week and 12-week MBSR programs found improved memory on formal neuropsychological testing after MBSR, with similar benefit found with the 8- and 12-week programs (Lenze et al. 2014). Another review of mindfulness effects in the elderly found evidence for positive effects on attention, cognitive flexibility, memory, and verbal fluency and structural brain changes with the use of magnetic resonance imaging (MRI) (Marciniak et al. 2014). The authors further suggest that mindfulness may be of particular benefit as a non-pharmacological technique that may help prevent or delay cognitive decline.

### Biological Effects

In addition to the apparent cognitive benefits of mindfulness in the elderly, a number of studies have found that mindfulness is correlated with structural brain and biologic changes, implicating mindfulness as a potential way to promote brain health and plasticity. For example, Pickut et al. (2013) compared a group of patients with Parkinson's disease who completed an 8-week MBSR program and compared structural brain scans before and after the mindfulness intervention to a wait-list control group. The mindfulness group showed increased gray matter density in the right amygdala, bilateral hippocampi, and bilateral caudate compared to the control group (Pickut et al. 2013). This study suggests MBSR may be associated with brain plasticity even in a neurodegenerative clinical population.

Other biological effects of mindfulness include potential downregulation in pro-inflammatory gene expression in leukocytes of elders who completed mindfulness interventions (Creswell et al. 2012). Immune system response and changes in biomarkers of longevity as well as mood improvements are apparent even when incorporating mindfulness into sitting meditation, body scan, and particularly yoga in the elderly (Gallegos et al. 2013). Additionally, in a sample of elderly African Americans living in low-income urban housing, a greater reduction in systolic and diastolic blood pressure was found in a group who received MBSR compared to a

social support control group (Palta et al. 2012), which may have important implications for primary care settings as a non-pharmacological intervention aimed at reducing blood pressure and minimizing medical visits.

In summary, the apparent health and quality of life benefits of mindfulness have propelled its use into mainstream culture and, increasingly, into the healthcare setting. Efforts to promote health through mindfulness may have profound benefit at the primary care level of intervention to reduce later cost of those who may have otherwise developed medical conditions requiring expensive treatment and/or long-term care. Indeed, while more research is needed, mindfulness techniques may prove to be of particular benefit as non-pharmacological methods to prevent or slow the progression of cognitive decline in the elderly by modifying many known dementia risk factors such as hypertension, cerebral blood flow, depression, oxidative stress, and metabolic syndrome (Marciniak et al. 2014).

### Illustrative Example

Mayo Clinic offers a therapeutic intervention called HABILIT<sup>®</sup> – Healthy Actions to Benefit Independence and Thinking. HABILIT<sup>®</sup> is a 50-h program for persons living with mild cognitive impairment and their support partner to learn skills that compensate for memory loss through procedural based training, along with new lifestyle habits aimed at optimizing brain health and overall wellness. One of five components of HABILIT<sup>®</sup> is yoga that includes the practice of mindfulness.

Those diagnosed with mild cognitive impairment face an unpredictable future that often includes the likelihood of dementia; therefore it is natural for them to have negative feelings and to perceive their situation as unjust or even hopeless. Support partners (most often spouses) face their own health and emotional challenges that center on the ambiguity of the diagnosis, the changing relationship, and worries about the future. Stress seems inevitable for both the person with the diagnosis and the support partner.

Stress however results from the interface of the actual events in one's life and one's thoughts. Therefore, mindfulness practices offer a way for

HABIT<sup>®</sup> participants to focus their thoughts in a more positive way that can contribute to their overall well-being and quality of life.

Early on, some HABIT<sup>®</sup> participants are a bit reluctant about mindfulness practices, but this apprehension serves as more of a benefit than a barrier. After a few sessions participants realize that they “can do” yoga and practice mindfulness. They learn that what often gets in the way are their doubts brought on by thoughts telling them what they can or cannot accomplish. Because mindfulness does not rely on memory, in fact recalling the past or remembering can be an obstacle, the practice of mindfulness takes advantage of retained abilities. This provides the opportunity for couples to participate in yoga and mindfulness together and be a part of something not as a person living with memory loss or a care partner, but as a mutually shared experience.

Those who participate in HABIT<sup>®</sup> are most often over the age of 60, and the spousal couples have generally been together for a long time. As a result, they have established well-worn communication patterns. However, when memory loss happens for one of them, usual communication patterns break down. What follows are often episodes of blame, misunderstanding, agitation, and anger. Couples and families need new ways of communicating.

For those living with cognitive impairment, the verbal and nonverbal forms of communication they receive from a spouse or family member can set the tone for a positive or negative experience. By practicing mindfulness, care partners become aware of their body language, tone of voice, thoughts, and feelings. In doing so, they have a chance to slow down and reset the mind. As a result, they can respond with less reactivity and choose to communicate in a way that honors their partners' need to feel respected, validated, worthy, and capable. When this occurs, the relationship between the caregiver and the person living with dementia can transform into one of greater reciprocity and interconnectedness. Renewed hope can emerge.

“When it feels like we are having a failure to communicate moment, I know it’s time to slow down, hold hands, and just be.”

- HABIT participant

## Conclusion

There is a growing body of evidence supporting the benefit of mindfulness-based approaches in the elderly population. Mindfulness may be a stand-alone practice or can be incorporated into other interventions. It can also be practiced individually or in a group format. The flexibility of mindfulness makes it easy to incorporate into daily life activities, such as walking, eating, and sitting, all done mindfully, being aware of each sensation or thought and experiencing it for what it is without judgment or labeling. This practice has been shown to provide cognitive, neurobiologic, biologic, emotional, and social benefits in the elderly, which together contribute to optimal and peaceful daily living and enhanced quality of life.

## Cross-References

- ▶ [Acceptance and Commitment Therapy](#)
- ▶ [Cognitive Behavioural Therapy](#)
- ▶ [Plasticity of Aging](#)
- ▶ [Resilience and Aging](#)

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## Mood and Cognition in Aging Women

Cassandra Szoek<sup>1</sup>, Katherine Campbell<sup>2</sup> and Katherine Burn<sup>3</sup>

<sup>1</sup>Department of Medicine - Royal Melbourne Hospital, Consultant Neurologist Department of Neuroscience, Melbourne Health, The University of Melbourne, Parkville, VIC, Australia

<sup>2</sup>Clinical Psychologist, Department of Psychiatry, The University of Melbourne, Parkville, VIC, Australia

<sup>3</sup>Department of Medicine - Royal Melbourne Hospital, The University of Melbourne, Parkville, VIC, Australia

## Synonyms

Affect; Ageing; Anxiety; Brain; Cognitive health; Dementia; Depression; Emotions; Health ageing; Mental health; Neurocognitive; Psychological symptoms; Psychological wellbeing; Psychosomatic; Quality of life; Womens health

## Definitions

Empty nest – post-parenting period occurring after all children have left the family home.

Mental health – an umbrella term encompassing emotional and cognitive health.

Follicle-stimulating hormones (FSH) – a hormone essential to pubertal development menstrual cycle and fertility.

Estradiol – the primary female sex hormone.

Final menstrual period (FMP) – the last menstrual period signifying the onset of postmenopause.

“Disability-adjusted life years” (DALYs) – represent the number of years lost due to illness, disability, or early death.

## Women’s Mental Health

Women have a disproportionately high representation of cognitive and mental health disorders. Two-thirds of those with dementia are women (Alzheimer’s Association 2014), with more women than men suffering from mental health problems and with women having a 70% risk of developing depression in their lifetime (Diniz et al. 2013). Not only is the biological basis of disease different in women but increasingly the contribution of social and lifestyle factors to women’s mental health are being understood. There is important evidence that not only our social environments but also our work, occupation, attitudes to health, sociodemographics, lifestyle, and social psychology all significantly influence the presence of disease (Then et al. 2014). Women hold different roles in society and earn less than men, both of which influence health and well-being (Marmot et al. 2012). The impact of social factors on morbidity needs further investigation to improve women’s health in aging.

The menopausal transition and the onset of postmenopause are a time of considerable physiological and psychosocial change. This period leading up to the onset of postmenopause has been the main focus of research in women, although with our aging populations more than a third of a women’s life is now spent in the postmenopause. A discussion of women’s mental health necessitates a reference to the stages of reproductive aging, and hence we will begin by defining these.

## The Stages of Reproductive Aging

The final menstrual period (FMP) occurs between 47 and 51 years of age (McKinlay 1996) and is a physiological marker for the shift from the menopausal transition into the early postmenopause.

The first stage of the early postmenopause (Stage 1a) is determined retrospectively and represents the first 12 months following the final menstrual period (Harlow et al. 2012). The second stage of early postmenopause (Stage 1b) is also of 12-month duration and is the period in which follicle-stimulating hormones (FSH) increase and estradiol levels decrease as they move toward stabilization (Harlow et al. 2012). These rapid hormonal fluctuations are associated with increased vasomotor symptoms, such as night sweats and hot flushes, which are most likely to occur during the first 2 years following the FMP (Harlow et al. 2012). The third stage of early postmenopause (Stage 1c) is estimated to last between 3 and 6 years, during which time FSH and estradiol have stabilized (Harlow et al. 2012). The duration of the early postmenopause is therefore between 5 and 8 years. The late postmenopause follows the early postmenopause and continues for the remainder of a woman’s life.

With the advances in medical technology, and the increasing life expectancy of woman in developed countries, the duration of the late postmenopause can encompass up to half of a woman’s life (Harlow et al. 2012). Accordingly, research identifying significant health issues relevant to women in the late postmenopause is essential to improving the mental health of older individuals.

## Mood Disorders and Aging

One of the key areas of health impacted by increasing age is mental health. Mental health is a blanket term that encompasses both psychological and cognitive disorders such as dementia, depression, and anxiety. Mental disorders and associated substance abuse are the leading cause of years of life lost due to disability globally, and mental illness is more common in women (Whiteford et al. 2013). These issues are prevalent in the older population. A study of older emergent patients reported more than half had cognitive impairment, nearly a third were clinically depressed, and more than a quarter had delirium (Goldberg et al. 2012). There are dramatic increases in the incidence of mood

disorders after 65 years in women and 75 years in men (Mojtabai 2015).

The advent of cognitive decline and mood disorders is particularly relevant to aging women. By 2030, depression is predicted to be the second leading global cause of “disability-adjusted life years” (DALYs), which represent the number of years lost due to illness, disability, or early death (Lopez and Mathers 2006). Gender differences in the prevalence of depression have consistently shown women to be at greater risk, with a 2:1 to 4:1 ratio reported (Kessler et al. 1993). Data examining the relationship between aging and depressive symptoms is mixed, with some showing a decrease and others an increase as individuals get older. The mixed findings are thought to be a result of methodological inconsistencies, in particular differences due to sampling effects.

### **Trajectory of Mood in Reproductive Aging**

The higher incidence of depression in women has been shown to begin in adolescence before reducing when women are 55 years or older, corresponding roughly with the course of reproductive aging in women, as defined by the stages of reproductive aging criteria (Harlow et al. 2012). As such, it was proposed that the changes in ovarian sex steroids are associated with the stages of reproductive aging and may contribute to a woman’s increased risk of experiencing depressive symptoms during this period (Freeman 2015). Several studies have examined the relationship between biological transitions associated with changes in sex hormones, including the postpartum and the menopause.

Studies of depressive symptoms and negative mood in the stages of reproductive aging have provided mixed results, with some showing an increased risk for depressive symptoms and others showing no relationship. A recent investigation examining the ratings of depressive symptoms in relation to the final menstrual period (FMP) showed that the risk of depressive symptoms was higher prior to the FMP and lower afterward

(Freeman et al. 2014). The postmenopausal period can encompass almost half of a woman’s life and represents a period where both midlife and late-life risk factors for depression are present. Determining the true prevalence of depression in the late postmenopause, a period that continues for the remainder of a woman’s life, is complicated by the difficulties inherent in examining late-life populations in general.

Methodological inconsistencies make it difficult to determine the true rates of depression in older adults. In a recent review of the prevalence of depression in the elderly, Djernes (2006) found that 0.9–9.4% of individuals living in private households met criteria for depressive disorders compared to 14–42% in institutional living. He also found that being female and meeting criteria for cognitive impairment were two of the main predictors of depression (Djernes 2006). Depressive symptoms are often seen in individuals with dementia and are thought to often precede cognitive decline.

### **Factors Influencing Gender Differences in Mood**

Risk factors for experiencing depressive symptoms in midlife (ages 45–55 years) include a range of psychological, social, and physiological variables, including past history of depression, hot flashes, physical health problems, psychosocial stressors, financial difficulties, stressful life events, and negative attitudes to aging and menopause (Keyes and Goodman 2006).

Studies of older Western populations have found that risk factors for depressive symptoms in late life include pain, chronic illness, institutionalization, history of depressive disorder, bereavement, having a disability, living alone, insufficient social support, developing a new health condition, having a limited ability to perform physical activities, not having a spouse, and perceiving one’s health as poor (Djernes 2006 and Freeman et al. 2014). For women in the late postmenopause, the risk of depression appears to reduce, but remains higher for women having undergone surgical postmenopause (Campbell et al. 2015).

The influence of social activity on depressive symptoms in women is significant and different to that in men. Women are more vulnerable to social factors associated with depression (Carayanni et al. 2012), and social activity reduces depressive symptoms in women but not men (Flaherty and Richman 1989). There is good evidence that social support and engagement decreases stress and depression, while increasing life satisfaction and well-being (Glass et al. 2006). Targeting such factors is particularly important in women.

## Cognition and Aging

The second component of mental health encompasses cognitive function and disease. Cognitive function is critical to health, quality of life, and function in aging and impacts not just the individual but their entire community (Eddy and Rickards 2013). Cognitive impairment can be seen as a loss of self and may lead to other issues such as malnutrition, lack of physical activity, and comorbidity increasing the likelihood of dependence and institutionalization (Stange et al. 2013).

Cognitive function is particularly important in aging as cognitive decline is a risk factor and indicator of dementia (Mebane-Sims 2009). Dementia risk increases substantially with age, doubling every 5 years after the age of 65 (World Health Organization 2011). As the age of the population increases, the prevalence of dementia is predicted to almost double every two decades (Alzheimer's Disease International 2015). Alarmingly, there are an estimated 9.9 million new cases of dementia worldwide every year, approximately equating to a new case every 3.2 s. The global cost of dementia in 2015 was approximately US\$818 billion, a figure that is projected to increase to US\$2 trillion by 2030 (Alzheimer's Disease International 2015).

Given the substantial impact of dementia worldwide, factors that influence cognitive function in aging are critical to global health. Gender has been identified consistently as a key predictor of cognitive health in older age across the world (Alzheimer's Disease International 2015).

## Trajectory of Cognition in Aging

Some decline is experienced in cognitive functions as part of the normal aging process. Over the course of the lifespan, cognition changes in a curvilinear fashion, developing from infancy through to adulthood and then gradually deteriorating over the adult lifespan. Increasing age leads to significant reductions in several cognitive domains such as speed of processing and visuospatial ability (Hoogendam et al. 2014). This is due to changes in brain architecture which occurs with age. There are two key changes in brain structure: shrinkage of the frontal lobe and a decrease in white matter. Frontal lobe volume decreases at an approximately linear rate throughout adulthood, dropping by approximately 10% by the age of 80, caused by a reduction in both the overall number of neurons and synapses in this area (Lemaitre et al. 2012). White matter volume, on the other hand, peaks at around 45–55 years of age (coinciding with the age of menopause) and declines markedly after age 60 (Giorgio et al. 2010). Demyelination can result in a gradual slowing of neuron firing rates which negatively affects cognition (Lu et al. 2013). Both of these age-related processes can be expected to have profound effects on cognitive function.

## Sexual Dimorphism in Cognitive Health

There are marked differences between genders in aging cognitive health. Women are disproportionately represented in both the prevalence and severity of dementia. Prevalence figures illustrate that women are approximately two-thirds more likely to suffer from dementia than men (Alzheimer's Association 2015). Some have argued that this gender bias may be attributable to longevity; that as women tend to live longer, they have greater opportunity to develop age-related disease (Alzheimer's Association 2015). However, emerging research has found that women with the same level of Alzheimer's disease pathology are three times more likely to develop the disease than men (Erol et al. 2015). This finding suggests that women may be inherently more susceptible to cognitive disease

compared to men. Women have more severe disease and rapid decline (Holland et al. 2013) than age-matched men, and between the ages of 70 and 79, women are twice as likely as men the same age to develop Alzheimer's or other forms of dementia (Alzheimer's Association 2014). Women and men differ cognitively, and in cerebral pathology, and risk profiles are significantly different between the sexes. It is therefore unlikely that sexual dimorphisms in cognition are simply due to lifespan differences; rather, the evidence suggests that there are underlying sociobiological factors.

### **Psychosocial and Biological Factors Influencing Gender Differences in Cognition**

The biological differences between men and women may partially contribute to the variations in cognitive function. However, while there is significant pathophysiological evidence that hormonal exposure influences cognition, the relationship was questioned when the Women's Health Initiative was unable to demonstrate a cognitive benefit for hormone therapy (Klein and Rapp 2004). This has led to suggestions there may be a therapeutic window for benefit, with recent trials like ELITE designed to explore this potential with initial promising results (Hodis and Mack 2014).

It is important to note that sexual dimorphism in cognitive function is influenced by psychosocial factors as well as biological factors. Psychosocial risk factors have generated substantial interest in cognitive research in recent years, including education level, social activity, and employment. However these factors are all heavily influenced by gender and the social context. Women growing up in the early to mid-1900s were likely to have less educational opportunities than men (Alzheimer's Association 2015), and low educational attainment is a known risk factor for cognitive decline and dementia (Alzheimer's Association 2014). Similarly, women of that age bracket are less likely to be employed than men (Rice et al. 2011), a trend that may also predispose them to cognitive decline.

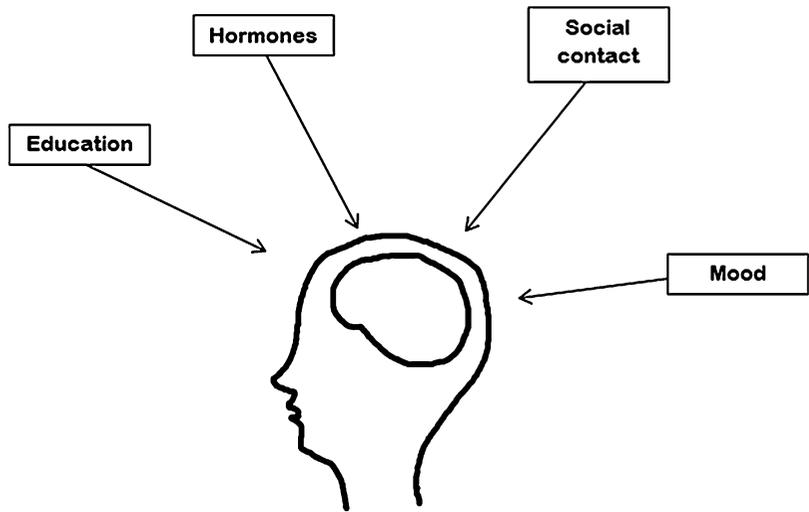
Changes to social contact occurring with age are of particular importance to the discussion of gender and cognition. The transition into aging marks a key shift in social identity, with a number of major life events including death of a spouse and the departure of children from the family home. These events are particularly relevant for older women's health, as women are more likely to experience widowhood and are prime candidates for empty nest syndrome (van den Hoonaard et al. 2013). Social activity is also especially important for older women's cognitive health. Women tend to have larger and more varied social networks than men (Simon et al. 2014). This is critical to cognitive health, as poor social engagement is known to increase the risk of cognitive impairment and dementia (Alzheimer's Association 2014). The detrimental impact of poor social engagement on cognition is often circular, with cognitively impaired women often lacking in social contact (Godfrey and El-Badri 2009). This effect is twofold, as poor social contact also increases the likelihood of depression, which may in turn increase the risk of cognitive disease (Fig. 1).

### **Mood and Cognition in Reproductive Aging**

The interrelationship between mood and cognition is integral to cognitive health. More than 10% of Alzheimer's disease cases worldwide are attributable to depression (Barnes and Yaffe 2011). Even milder depressive symptomology has been found to increase the risk of dementia by 60–70% (Cherbuin et al. 2015). Cognition also has equal impact on emotional health, with pathological cognitive decline often occurring concurrently with neuropsychiatric symptoms such as anxiety, depression and depressive symptoms, aggression, irritability, and apathy compared to cognitively normal individuals (Shahnawaz et al. 2013). As women are more likely to suffer from poor emotional and cognitive health than men, there may be a compound effect on mental health that far exceeds the burden of either in isolation.

### Mood and Cognition in Aging Women,

**Fig. 1** Cognitive function is influenced by a variety of factors, all of which can be affected by gender



### Conclusion

The menopause is thought to be a time of increased risk for the development of mood disorders, yet there continues to be no definitive answer as to the true influence of this biological transition (Freeman 2015). Depressive symptoms decline as women progress through the late postmenopausal stage and into late life (Campbell et al. 2015). The postmenopause also marks a key period for cognitive function, with the risk of dementia doubling every 5 years from age 65 (World Health Organization 2011). White matter volume also decreases rapidly after 65, leading to dramatic changes in cognitive abilities (Giorgio et al. 2010). As cognition and mood are intrinsically related, these constructs must be considered together in order to understand developmental changes. The gender differences in both mood and cognition in aging are not solely attributable to biological changes, but are influenced by a number of psychosocial factors and by the interrelationship between these constructs.

#### Chapter Summary

- 90% of the gains in life expectancy for postmenopausal women are spent with a disability.

*(continued)*

- 14–42% of older adults living in institutions meet criteria for depression.
- Depressive symptoms reduce as postmenopausal women age.
- Cognitive health is a key issue in the postmenopause.
- Postmenopausal women have greater prevalence and severity of cognitive disease compared to age-matched men.
- Psychosocial factors including educational opportunities, social contact, and hormones influence women's mental health.

### Cross-References

- ▶ [Active Aging](#)
- ▶ [Affect and Emotion Regulation in Aging Workers](#)
- ▶ [Aging and Psychological Well-Being](#)
- ▶ [Aging and Quality of Life](#)
- ▶ [Aging and Semantic Memory](#)
- ▶ [Aging and Slowing of the Neuromotor System](#)
- ▶ [Alzheimer's Disease, Advances in Clinical Diagnosis and Treatment](#)
- ▶ [Anxiety and Cognition](#)
- ▶ [Anxiety Disorders in Later Life](#)
- ▶ [Behavioral and Psychological Symptoms of Dementia](#)

- ▶ Burden of Disease and Aging
- ▶ Cognitive and Brain Plasticity in Old Age
- ▶ Cognitive Compensation
- ▶ Cognitive Control and Self-Regulation
- ▶ Cognitive Dissonance and Aging
- ▶ Cognitive Neuroscience of Aging
- ▶ Cognitive Rehabilitation
- ▶ Dementia and Neurocognitive Disorders
- ▶ Depression and Cognition
- ▶ Depression in Later Life
- ▶ Effects of Stress on Memory, Relevance for Human Aging
- ▶ Emotional Development in Old Age
- ▶ Emotion–Cognition Interactions
- ▶ Everyday Cognition
- ▶ Executive Functioning
- ▶ Executive Functions
- ▶ Frailty and Cognition
- ▶ Gender Differences in Memory and Cognition
- ▶ Grandparenthood and the Changing Nature of Social Relationships
- ▶ Health, Work, and Retirement Longitudinal Study
- ▶ Healthy Aging
- ▶ History of Cognitive Aging Research
- ▶ History of Cognitive Slowing Theory and Research
- ▶ History of Longitudinal Studies of Psychological Aging
- ▶ Interventions for Late-Life Cognitive Health
- ▶ Lifestyle Factors on Depression, Effects of
- ▶ Memory Training Methods and Benefits
- ▶ Memory, Autobiographical
- ▶ Memory, Episodic
- ▶ Memory, Implicit
- ▶ Memory, Procedural
- ▶ Mental Health and Aging
- ▶ Metacognition in Older Adulthood
- ▶ Mild Cognitive Impairment
- ▶ Neurocognitive Markers of Aging
- ▶ Normative Cognitive Aging
- ▶ Personality and Aging, A Historical Review of the Research
- ▶ Physiological Effects on Cognition
- ▶ Psychological Theories of Successful Aging
- ▶ Psychological Theories on Health and Aging
- ▶ Sensory Effects on Cognition in Later Life
- ▶ Sleep Effects on Cognition with Aging

- ▶ Social Cognition and Aging
- ▶ Spatial Cognition and Wayfinding
- ▶ Subjective Memory
- ▶ Working Memory in Older Age

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## Motivation to Continue Work After Retirement

Reidar J. Mykletun  
 Molde University College, Molde, Norway

### Synonyms

Bridge careers; Continuity; Life transitions; Motivation; Older workers; Re-employment; Retirement; Workforce retention

### Definition

The concept of *Retirement* implies leaving one's organizational position or career path of considerable duration, after middle age, with the intention of subsequent reduction of psychological commitment to work. *Motivation to work* implies the psychological process that influences how personal effort and resources are allocated to actions pertaining to work, including the direction, intensity, and persistence of these actions. Motivation to work after retirement might appear as a paradox. Nevertheless, retirement is changing from an abrupt event to a process often stretching over several years where the employee remains attached to work and contributes to the value creation, either in his/her career organization or a new one, on part- or fulltime contract. Central drivers of this behavior may be the meaning inherent to work, identity as an employee, social relations, and monetary gains.

### Introduction

The contemporary call for more years at work for older workers grows out of the demographic changes especially demarcated by the "baby boomers" who now retire from work, the decline in birth rates from the 1960s and onwards, and the increasing longevity that is taking place in the western world. Most western societies foresee future breaches of workforce and competences

and high pressures on pensions and social security systems, which will be difficult to handle due to the consequent changes in dependency ratios between those at work and those provided for. As a remedy to this, national authorities have urged for extensions of work careers for the older workers, motivated by financial concerns and fear of future poverty, especially among the aging population (<http://www.oecd.org/employment/livelonger-worklonger.htm>).

Several ongoing changes, at least in the OECD countries, may increase the likelihood of extended work careers and post-retirement re-employment to take place: The life expectancy is increasing as are the years with good health, leading towards a larger and more active aging population. Pension rules and regulations are being transformed in several countries to stimulate more years at work, which may be efficient as higher income is generally appreciated in consumer-oriented cultures. The life course has become more de-standardized and individualized, and the gender revolution, which led to a dramatic increase in women's participation in working life, has taken place. The level of education is higher. Organizational changes have been more frequent, in part driven by global economic turbulence (Sargent et al. 2012). In the contexts of a raising knowledge economy, much of the work requires less physical capacities but more cognitive activities and social interaction, which may make extended careers more interesting and challenging to older workers. These changes may affect retirement schemes and practices in several ways, and it may become easier and more attractive for some older people to continue working.

To some extent, the decision to retire "early," "on time," or "late" including to prolong one's work career beyond the "on time" age of retirement depends on the individual's own motivation. This entry discusses motivational factors that may add to our understanding of work career extensions for older workers. It is assumed that personal and proximal and distal context factors play a role in motivations for and decisions about retirement or post-retirement re-employment (Wang et al. 2014). The entry is organized as follows: As the concepts of retirement are undergoing a

change in meaning and becoming more dynamic in nature (Sargent et al. 2011), the entry first defines and discusses the retirement concept and its related concept of *bridge employment and bridge careers*. Second, recent development in the concept of *work motivation* is discussed before reviewing some recent and central research on *motivation for post-retirement re-employment and working beyond the retirement age*. The entry concludes with summarizing the current state of knowledge in this field and indicates areas for further research.

## Retirement

Retirement has been defined by Feldman as “. . .the exit from an organizational position or career path of considerable duration, taken by individuals after middle age, and taken with the intention of reduced psychological commitment to work thereafter” (Feldman 1994, p. 285). In most western countries, retirement was invented in the late nineteenth century mainly to cover several needs related to the growing middle class, among these to be a tool to attract loyal workers but also to administer the termination of their employment in what was thought of as being a most rational way, that is, at a given age. The development of the pension systems continued up to the World War II postwar period in order to solve some of the poverty problems for the older citizens from the working class (Sargent et al. 2012). Retirement has been rather abrupt as it has been mandatory at a certain age, varying today from 60 years of age (e.g., in Turkey) to 72 (e.g., in Norway, from July 1, 2015). The average mandatory retirement ages in the OECD countries are about 65 years for men and 63 years for women, as in some countries (e.g., Australia, Austria, Poland, and Turkey) different retirement ages for men and women have existed up to recently. The effective retirement ages are lower than the mandatory, and for OECD countries on average, only about 60% of the workforce aged 50–64 work in part- or full-time paid jobs (<http://dx.doi.org/10.1787/9789264201484-en>), leaving considerable room for escalation.

Lower mandatory retirement ages are often set for special occupations, such as air pilots, police, armed forces, sailors, and firefighters, and one might expect that previous employees in such occupations would be inclined to reengage in working life after their formal retirement.

Some countries have introduced an early retirement age, constituting a “window of retirement opportunities” between the set early retirement age and the mandatory retirement age. For instance, in Norway this window ranges from 62 to 72 years of age and in Finland from 63 to 69. Inside this window, the individual might start drawing on his pension. The longer the individual stays at work and the longer he/she waits before drawing on the pension, the higher is the annual pension allotted to him/her. Moreover, a few leading nations such as the USA, Australia, and the UK have abandoned the mandatory retirement ages but kept an age limit after which the individual is entitled to draw on pension schemes. In such instances, a relative definition of retirement age is needed, as, for instance, “Retirement age is when an employee chooses to retire” (<https://www.gov.uk/retirement-age>).

Retirement is a major role transition and probable end point of one’s work career. Major role transitions involve contrasts between the current and the new role, unclear structures and guidelines for decision making, potential elevated stress due to uncertainties, and the need for the individual to employ motivated behavior to form and execute plans for the adjustment to the new circumstances (Wanberg and Kammeyer-Mueller 2008). Role theory argues that retirement may demolish one’s work-role identity (see Bush and Simmons 1990, as cited in Wang et al. 2014). Such loss of role identity can lead to reduced well-being, depression, anxiety, and stress (Thoits 1992, as cited in Wang et al. 2014), especially for retirees that strongly identify with their work role (Quick and Moen 1998; Reitzes and Mutran 2004, as cited in Wang et al. 2014). The individual might be motivated to avoid the discomfort of losing his/her role identity, which in turn may become a motivator for work career extension in line with the continuity theory (Atchley 1989, see below). Holding negative expectations towards retirement

predicts willingness to extend one's work career (e.g., Davis and Cartwright 2011). On the positive side, the older workers who feel committed to his/her work prefer to retire late (Davis and Cartwright 2011). Regardless the outcome, motivational processes will be central in the decision processes and the adjustments to the new or more or less changed roles, including a probable resocialization in one's own family.

### **Bridge Employment and Post-retirement Re-employment**

In their classic contribution, Hornstein and Wapner (1985) identified four attitudinal dimensions towards retirement: "transitions to the rest of life," "a new beginning," "continuity," and "imposed disruption." As attitudes, they have motivational functions by allocation of individual resources towards the attitude-related behavior. While *imposed disruption* still applies to many workers with referral to mandatory retirement ages or being laid off due to health issues or otherwise made redundant, *continuity* and *a new beginning* have increasingly entered the agenda of the workforce's retirement decisions. The "nature" of retirement has been changing from being mainly an abrupt role transition from work to nonwork to gradually becoming deinstitutionalized, diversified, and individually tailored solutions including gradual reduction of workload, part-time employment, or post-retirement re-employment in the same or a different organization. These new ways of retirement may be conceived of as developmental processes where the individual gradually transfers the allocations of own efforts and resources from work to nonwork activities. Such gradual transitions may be supported by public and organizational pension schemes and flexible human resource management practices, which are becoming increasingly popular in the USA, Canada, the UK, Australia, Japan, and northern Europe (Alcover et al. 2014).

Working after retirement is often referred to as *bridge employment*, defined here as "...jobs that follow career or full-time employment and precede complete labour-force withdrawal" (Alcover

et al. 2014, p. 7, see also Henkens and van Solinge 2014 and Wang et al. 2014). Bridge employment may be regarded as forms of retirement that contribute to prolonging the individual's work career (Alcover et al. 2014; Wang et al. 2014). Such employment may be *career consistent*, that is, within the same type of work in the career organization or in another workplace, which would be attainable for workers with a lower level of education. For some, "phased retirement" applies, which means a gradual reduction in working hours in one's career job (Wang et al. 2014). *Noncareer* bridge employment is a job in another type of work in one's career organization or in another organization (Alcover et al. 2014). This adaptation might be easier for workforce with a higher level of education, which may be flexible in relation to new work demands (Wang et al. 2014). "Encore retirement" means to reduce or terminate one's career job to engage in voluntary work for the better of one's society (Wang et al. 2014); however, this type of engagement will not be included in the present discussion. Bridge employment may also occur as *self-employment* leaning on entrepreneurial skills in addition to the individual's career-related competences, while the expression *full retirement* may be used to denote the final withdrawal from the workforce (Alcover et al. 2014). The smallest role adjustments are required if the individual becomes re-employed in the same work and workplace as he is retired from, but motivation to continue in that partly new role is still required. Being re-employed in the same type of work in a different workplace requires more adjustments and in many instances a strong motivation to continue working. Full termination of paid work participation will require the largest adjustments and a different motivation.

However, in this field, some conceptual confusion exists with possible consequences for the interpretations of the research findings. When defined as above, bridge employment does not require that an actual retirement has taken place. Hence, bridge employment might refer to employment before the full retirement takes place, which is not always synonymous with the notion of working *after retirement*. Some researchers of

bridge retirement are not explicitly stating whether their sample consists of post-retirement employees. Gradually reducing one's workload (phased retirement) or reentering working life after retirement might matter concerning work motivation (Parry and Taylor 2007; Henkens and van Solinge 2014; Isaksson et al. 2014); however, there are few research studies explicitly addressing this topic. Furthermore, in some countries (e.g., Norway), it is possible to draw on a limited early pension while still being active in the same job as before and without any act of retirement. In such instances, receiving pension may not be used as an indicator of retirement; the partial pension is rather an economic encouragement to prolong the working career of the individual.

## Motivation to Work

Motivation to work may be broadly defined as "psychological process that influences how personal effort and resources are allocated to actions pertaining to work, including the direction, intensity and persistence of these actions" (Kanfer et al. 2008, p. 5). Defined this way, work motivation varies across individuals and across situations for the same individual. It is determined in the interfaces between individual (e.g., cognitive, emotional, physiological) and contextual (e.g., social, technical) factors and is subject to hurried as well as unhurried changes as functions of forces internal and external to the individual. The motivational processes connect intentions and resource allocations in relation to specific actions and include the concepts of self-regulatory and operational processes. The person's allocation of personal effort and resources to actions represents his/her means of personal control over his/her own behavior. Motivation must alter as an antecedent to a change of someone's voluntary behavior, and this is at the core of the issue of choosing to work after retirement. In that situation the choice of where to allocate personal efforts and resources is among a wider range of alternatives than usually found within the workplace, as work tasks are now competing with and compared to

leisure activities. It is here assumed that the salience of different goals will alter, depending on the attractiveness of various external structures and individual factors.

During the twentieth century, a multitude of constructs and theories has been proposed to capture aspects of work motivation, but no single theory accounts well for all individual characteristics, contexts, and situations. Concepts related to goal choice, goal striving, goal continuity, and self-determination theories hold strong positions in current research (Kanfer et al. 2008) and may be central to motivation for working after retirement. Of particular interest in the discussion of post-retirement re-employment is the self-determination theory proposed by Deci and Ryan (2000). This theory proposes that an understanding of the human motivation must acknowledge the innate psychological needs for competence, autonomy, and relatedness. These needs may be satisfied in several ways, but for an individual approaching retirement, re-employment should be tempting at a workplace that he/she had been strongly involved with, where challenges had been successfully managed and the social relationships had been rewarding (Isaksson et al. 2014). If the individual also holds a strong belief in his/her own abilities to master challenges in working life (work-related self-efficacy), a re-employment with a new employer or being self-employed should also be a way to satisfy these innate psychological needs.

Kanfer et al. (2008) argued that the three broad themes of *content*, *context*, and *change* capture most of the established knowledge about work motivation, and they are all relevant to the issues of re-employment after retirement. *Content* refers to the theories that focus on the individual's internal mental structure and the operations by which the self and the external events make meanings and drive motivated action. It is considered as "intrinsic," it may be learned or genetically disposed of, and it addresses biological, cognitive, personality, or affective structures that are observed to produce rather stable patterns of behavior. Goal striving and self-determination theories belong to these themes. For instance, a feeling of occupational goal attainment may pull

the individual out of work, while perceiving unfinished work-related goals may delay retirement (Bal et al. 2010). Some individual factors may change as a correlate of aging, for instance, a reduction in working ability, which is likely to be experienced by approximately 30% of the aging workers (Ilmarinen 1999; McGonagle et al. 2015) and which affects the reallocation of personal efforts and resources away from further participation in working life (McGonagle et al. 2015; Syse et al. 2014). On the contrary, good health, which constitutes one of the foundations of high work ability, relates positively to being engaged in bridge or post-retirement work (Wang et al. 2014). Age itself relates negatively to bridge employment and post-retirement employment: The higher the age, the less likely it is that the person will be involved in working additional years (Davis and Cartwright 2011; Kim and Feldman 2000). Likewise, life expectancy relates to motivation for prolonging one's work career. Those who for some reasons expect to have a shorter time left are unlikely to be involved in bridge employment or post-retirement employment, while those who believe they will have many years left to live more often plan for a longer work career (Wang et al. 2014). Subjective health may be an underlying factor influencing both subjective life expectancy and career planning. The higher the level of education, the more likely it is for workers to prolong their careers (Syse et al. 2014; Dorfman 2009; Kim and Feldman 2000).

*Context* refers to the external environments in private spheres and at the workplace. In the private sphere, various tasks and phases of life present a long list of challenges to the individual and to the balance between the private life roles and the work roles. A good financial status and leisure interests may pull the individual towards retirement. Family factors, such as having a retired spouse, act as a pull factor towards retirement for workforce with lower levels of education, while this "partner effect" is decreasing the higher level of education the focal person has got (Syse et al. 2014). At the workplace, factors such as work organization, structures, methods, and the tasks themselves may give access to resources that

are not available outside the workplace. This also applies to leadership, social relationships, and workplace climate. Thus, the quality of the workplace as compared to the attractiveness of the alternatives will affect the motivation to stay or go. Workers who report high work-stress levels may be less inclined to seek bridge or post-retirement employment as in such instances retirement may be an escape from stress (Wang et al. 2014). Moreover, it is obvious that basic issues such as the availability of bridge or part-time jobs and leaders who do not hold negative stereotypes about older workers and do not promote younger colleagues at the costs of the older ones will influence the decision latitude for older workers to take on post-retirement re-employment (Isaksson et al. 2014; Wang et al. 2014).

It should be kept in mind that the dominating career models still being held by managers and HR departments are based on theories about career models from the 1970s. In those models, retirement was one of the most predictable career stages happening at a time and "...being characterised by individual decline and disengagement" (Sargent et al. 2011, p. 315). Consequently, the organizational responses to the individual's request for reengagement after retirement may be negative and ruin the motivation for a prolonged work career, and some managers would not consider it as an option to offer a re-employment. Furthermore, as time passes, national and organizational pension systems and their development will guide the inhabitants to see what is expected to be the adequate retirement ages and, most likely, inspire the development of social norms and macro level abstractions such as national, regional, or even local retirement cultures. National differences in workforce participation by the older workers across nations (<http://dx.doi.org/10.1787/9789264201484-en>) indicate that such cultures exist, with cultures supporting the highest participation rates to be found in Northern Europe, Switzerland, Japan, New Zealand, and the USA, while cultures supporting the lowest participation rates found in Southern Europe. The individual who wants to extend his/her work career by engaging in post-retirement re-employment must transgress such

social norms and established cultures regarding retirement. Depending upon his/her personality and resources, this may either trigger or extinguish his/her motivation for even making an attempt.

*Change* refers to the dynamics of motivation over time and contexts. Singular events, such as retirement, may be a radical individual and contextual change that profoundly affects one's allocations of personal effort and resources from the work to the nonwork arena. The effect may vary across individuals and contexts depending on whether the person is anticipating or facing the consequences of one's own retirement decision, or being forced to retire by work-related push factors, such as loss of work ability, age discrimination, or set retirement ages (Wang et al. 2014). A perceived loss of control over these reallocation processes may follow from forced retirement or being pushed out from the workplace by negative attitudes towards aging workers. Such loss of perceived control over where to allocate one's personal effort and resources affects work motivation, work satisfaction, engagement, and commitment (Kanfer et al. 2008). Options for re-employment after retirement may then function as regaining perceived control. However, older workers who hold negative thoughts about retirement may be positive to engage in bridge or post-retirement employment (Davis and Cartwright 2011; Wang et al. 2014). Along similar lines, Achtle (1989) advocated the *continuity theory*, which claims that individuals will strive to maintain consistency in lifestyle and patterns over time. Thus, when about to leave work through retirement, individuals may strive for continuity in social relationships and if possible in activity patterns. When entering in bridge or post-retirement employment, the individual might reduce or eliminate the disruptive effects that may follow retirement and retain preretirement social, physical, and mental activities (Wang et al. 2014). The increasing popularity observed in the Netherlands (Henkens and van Solinge 2014) and especially in the USA (Wang et al. 2014) of post-retirement re-employment or bridge employment may be examples representing the continuity motivation, which

falls under the change theme, although it represents reluctance to undergo changes.

### **Empirical Studies on Motivation for Bridge Employment and Post-retirement Employment**

Motivation to work beyond retirement is still an under-researched topic. A few studies employing qualitative approaches exist along with some few leaning on quantitative, cross-sectional designs. Few longitudinal studies have yet appeared. Examples of qualitative studies will first be reviewed, followed by some quantitative studies and a study aimed at exploring special areas with the motivation theories. A major distinction in motivation lies in the difference between a consumption-based orientation and a producer-based orientation (Sargent et al. 2011, 2012). The consumption-based orientation embraces "...lifestyles including leisure, pleasure, experiences and the use of goods, knowledge and service, as well as education. Being producer-based refers to being engaged in market-based activities – working for pay as well as socially productive activities that contribute to the well-being of society such as the provision of volunteer services" (Sargent et al. 2012, pp. 12–13). Clearly, this indicates two distinct motivational patterns, the first marked by seeking hedonic pleasure tone and the second by enjoying eudemonic pleasures. However, indeed shades of gray apply here.

Parry and Taylor (2007) interviewed 12 men and 12 women living in three contrasting areas of England: a London inner city area with the most diverse labor market, a South West England semi-rural area with rather affluent and older population, and a former industrial urban area in the north with typically low income from the state pensions. Of those retired, 17 were re-employed in a broad range of branches, and some continued to be engaged in self-employed activities. Weekly working hours ranged from 10 to 35. Two distinct groups were identified, the "workers" and the "professionals/creatives." A third group, the "self-employed," overlapped both of these. The "workers'" orientation towards work was

instrumental and influenced by a strong work ethos: as being used to hard work and familiar with instable jobs, bad working conditions, and unemployment. Work was a needed source of income and was sharply separated from their private lives. They regarded their pension as merited rewards and held a consumer-based orientation to their retirement. Participation in unpaid voluntary work was uncommon. The *self-employed* expressed a desire for independence. Some had inherited their business or the family had traditionally run their own business. It was often a family affair, and running the business was in the blood. They enjoyed working after their retirement, demonstrated a more producer-based orientation towards retirement, and in particular, this was the case if they were not dependent on their income from their work.

Contrasting to this group, the professional and creative workers represented a middle-class group that had extended training and was familiar with careers that offered high levels of choice, autonomy, and flexibility. Their orientation towards work was different: Work was central to their identity and was to continue for their lifetime, and they did not see any boundary between their work and their lives. The nature of the work was more important than their salaries, and some engaged in voluntary, unpaid work. For the self-employed professionals in this group, practicing skills and developing their knowledge were key motivators, and work was a personal endeavor. The creatives, on the other hand, pursued their artistic desires by freelancing combined with some part-time work that secured their income. Some had a family background with this way of living. As retirees, they continued the lifestyle they had before retirement, and they appreciated the extra income from work on top of their pensions. The majority of the self-employed workers and professionals had a smooth transition into retirement. They continued their previous work but reduced the intensity, and their contributions were limited by age discrimination, progressive intensification of work, and labor-force restructuring. Their work often transgressed into the voluntary sector as unpaid work, and they were mainly able to choose the

most suitable combinations of financial and creative rewards.

Isaksson et al. (2014) reported results from a small qualitative study where nine Swedish workers aged 61–68 years participated. Six out of these nine were interested in post-retirement employment as a way to decrease work intensity and make the transitions between full-time work and full-time retirement stepwise and smooth. Most would prefer to continue in their present jobs. Extrinsic or contextual factors such as finance and the quality of the work and workplace played a role for all, but the importance of these factors varied between the workers, from very limited to very high. Intrinsic or content factors were more important, however. To feel needed in the workplace, help colleagues, and contribute to unit efficiency were central to all. Second, flexibility and variety were appreciated as an alternative to boredom, and ideally, individual non-standardized deals should be made with each older worker to create a win-win situation for him/her and the workplace. Third, possibilities for learning and self-development were sought for, and forth, the social relationships at work were highly valued.

A recent study by Sargent et al. (2011) additionally augmented the understanding of individual's motivation for post-retirement re-employment. They interviewed a nonrandom sample of 35 retired Canadian managers and executives with an average age of 59 years, who on average had been retired for 3 years. The analyses were based on metaphors and combinations of metaphors into meaningful units. The study identified four different retirement patterns, named after their content as: (a) exploring new horizons, (b) searching for meaning, (c) contributing on own terms, and (d) putting your feet up. None of these patterns were characterized by disengagement and decline. The group contributing on own terms was the most likely to engage in post-retirement re-employments, that is, "...staying the course, downshifting and detox. [...] These metaphors combine to tell a story of retirement as an opportunity to engage in professional activities on one's own terms and shifting to a more manageable life-style after being freed from a

demanding career” (Sargent et al. 2011, p. 321). The style chosen by this group keep them agile and prevent declines, and the search is more in direction of eudemonic pleasure. Contrary to this pattern of adjustment, the putting-your-feet-up pattern contained regaining of control, autonomy, and freedom from an oppressive work schedule where retirement was seen as a liberation from a psychic prison and a reward for a demanding work life. This style is more into seeking hedonic pleasure. The pattern of exploring new horizons was filled with excitement, exploration, and engagement. For this group, retirement meant moving forward and involved development of oneself and own identity, and the group was mainly consumer oriented. Finally, the pattern searching for meaning contained both a loss of structure and aimlessness, a detox, and a liberation. This group considered a turn towards a producer-based orientation, where re-employment might be an option. In interpreting these findings, one should bear in mind the rather low age of the interviewees and that they probably had access to wider decision latitudes and were better off financially than most people were. However, the findings do challenge the traditional decline and disengagement mental model of retirement; instead, they present retirement as “realignment” for a life of ease and pleasure where leisure is a resource needed to restore the organism after the long exposures to work demands.

Traditionally, academic workforce in positions as professors has been offered a working relationship as professors emeriti, which means retired professors, at their career institutions. The amount of remunerations for such post-retirement “re-employment” might vary from zero to a modest salary or just the access to research resources. Being highly educated and used to complex, autonomous, and varied work, this group constitutes one example of workforce and work environments that are becoming increasingly customary in the area of the knowledge-based economies. Dorfman (2009) conducted several studies of professors emeriti, including a follow-up study of why they continued to work after an age of 70 years. The sample of this study included

13 “survivors” of the initial sample of 18 professors, which in this study were reinterviewed at ages between 80 and 84 years. Their work consisted of research and teaching. The main reason for extending their work careers was professional in the sense of enjoyment of the work itself and the feeling of doing something important. Research was considered as a creative process that kept one going, always bringing up something new. The teaching was especially rewarding when students raised questions that forced the professor to rethink an issue. Teaching and research were considered interrelated activities, and there were weak boundaries between work and nonwork activities. Those who had withdrawn from work explained their decisions mainly by changes in personal resources and students’ attitudes.

Furthermore, a well-known study by Kim and Feldman (2000) from 1999 employed a sample of 879 professors who had accepted an early retirement offer in 1994 from the California University, and 42% of these responded to the survey. Predictors of bridge employment were the personal factors of low age, good health, long tenure, and low salary. Contextual factors such as a spouse still working and still supporting own children also predicted participation in bridge employment. Finally, it should be noticed that engagement in bridge employment predicted retirement satisfaction.

Such studies employing quantitative approaches add significantly to our understanding of motivation to prolong working careers beyond the point of retirement. Henkens and van Solinge (2014) analyzed data on post-retirement re-employment from the NIDI Work and Retirement Panel, an ongoing longitudinal survey of older workers in the Netherlands. The proportion of the workforce that had been re-employed increased from 19% in the 1936–1941 cohort to 39% in the 1950–1951 cohort. The results demonstrate the growing interest among older workers in bridge jobs, thus becoming more producer based in their retirement orientation, as well as showing how the labor market needs the competences of these experienced workers. The younger the individual was at the point of retirement, the

more likely he or she would be re-employed. Most of these jobs were part-time employment with an average of 17 h per week. Twenty-six percent were self-employed, another 8% switched between self-employment and salaried work, 12% worked with their previous employer, while 50% worked with a new employer. Near half of the reentrants were very satisfied with their bridge job, while only 30% had been very satisfied with their career job before their retirement. The higher level of education the reentrant had, the higher was the likelihood to have a bridge job, and the more challenging was the bridge job and the less job stress he/she experienced. Higher flexibility was an important advantage of the bridge job compared to the career job, especially with regard to being able to take extra days off from work.

The respondents in this study gave two main reasons or motivations for post-retirement re-employment. The primary motivation given was that they liked their work, and this motive was given by two-thirds of the self-employed. The second motivation was financial reasons. This motivation was reported by 20% of the re-employed but was the prime reason for 43% of those in poor health conditions, while reported by only 12% of those in good health conditions. Needs for social contacts and feeling bored paid only a modest role as motivation for re-employment.

Some theory-driven studies have addressed issues within motivation theories as they apply to older workers. For instance, Wöhrmann et al. (2014) tested a theoretical model for post-retirement career planning based on social cognitive career theory (SCCT) on a nonrandom sample of 124 German workers with a mean age of 56 years, ranging from 49 to 65 years of age. They found that occupational self-efficacy predicted interest in occupation-related activities and in post-retirement career outcome expectations, both of which predicted post-retirement career intentions, which finally predicted post-retirement career planning activity. However, the model accounted for only 9% of the variance in this end variable. This implies that other variables are important in explaining such career planning

activities, but still one may argue that self-efficacy, interest, and outcome expectations stand out as person-related factors of post-retirement re-employment motivation.

Bal et al. (2010) studied the role of future time perspectives in relation to psychological contract fulfillment among 176 retired and re-employed Dutch workers aged 65–69 years. Three types of psychological contract fulfillment were analyzed: economic, socio-emotional, and developmental. Such contracts were defined as “individual beliefs, shaped by the organization, regarding terms of an exchange agreement between individuals and their organization [...] Both employee and organization are assumed to have obligations towards each other, and these obligations are interdependent” (Bal et al. 2010, p. 475). Furthermore, the concept of future time perspective refers to “how much time individuals believe they have left in the future. It is a flexible, cognitive-motivational, and age-related construct that changes over time” (Bal et al. 2010, p. 475). Individuals holding an open and long-term perspective on the future were assumed to see opportunities and look for work and organizations that may fulfill their needs for long-term perspectives on development. These individuals focus on information and how to expand their knowledge also at the workplace. Individuals with shorter time perspectives will have lower demands for developmental opportunities and are less inclined to react to organizational inducements. The results showed that future time perspective is an important factor in the work motivation, especially for older workers. Individuals with an open future perspective received more developmental fulfillment and reacted more to psychological contract fulfillment related to employee obligations. Hence, the social, economic, and developmental exchange relationships are especially important for the older workers with an open future time perspective. As a consequence, the socio-emotional relationships between the older workers and their organization (leader) should be nurtured by increasing flexibility, healthy work-life balance, and respectful treatment. Older workers who feel their future time is

running out feel less obliged towards the organization when the organization offers financial inducements to increase their motivation and are more receptive towards inducements in the shape of benevolence.

## Conclusions

The review and discussion outlined above inform about ongoing transformations regarding the form, timing, and meaning of retirement. These transformations are partly driven by, and partly responded to, national governments calling for extensions of older workers' careers. Concerns about national economies are the prime driving factor, whereas fewer of the work organizations and the workers' unions have heralded the same questions yet. Such reluctance will most likely retard the wanted future changes in retirement policies and practices.

Individual orientations towards retirement seem to express two basic orientations: Either they are consumer based, searching for a more hedonic lifestyle, or they are producer based, searching for a eudemonic type of pleasure through the joy of work. However, other orientations are identified, like searching for new horizons and searching for meanings. To some extent, such patterns will reflect the available options of the actual retirement context, but in many instances, retirement does not reflect the career models from the 1970s where retirement was conceived of as decline and disengagement. At the content (or personal) level, motivation for taking on a producer-based orientation in retirement is supported by good health, low age, and high level of education. Contextual factors contributing to this orientation include financial needs, care for children, a spouse still employed, and the quality of the work and work environment. Especially, enjoyment of the work is a central theme, indicating that some workplaces offer access to socio-psychological, economic, and technical resources that the older workers find more attractive to be engaged in than those made available in the leisure contexts. The type of work that is attracting

most post-retirement re-employment is characterized by high levels of skills and qualifications, autonomy, and reasonable decision latitudes, thus largely in concert with the self-determination theory of human behavior. This concept of access to workplace resources is a finding largely overlooked by previous research, thus constituting a contribution to knowledge. It is partly supporting role theory of retirement as abrupt and unpleasant change of roles that are central to one's identity and consequently to be avoided, but different from this in the sense that not all types of work are equally attractive. The same arguments apply to continuity theory, while the focus on resources inherent to the work itself may be consistent with goal-oriented theories.

## Cross-References

- ▶ [Affect and Emotion Regulation in Aging Workers](#)
- ▶ [Age and the Psychological Contract](#)
- ▶ [Age Discrimination](#)
- ▶ [Age Diversity at Work](#)
- ▶ [Age Stereotyping and Discrimination](#)
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- ▶ [Selection, Optimization, and Compensation at Work in Relation to Age](#)
- ▶ [Stereotype Threat and Aging in the Workplace](#)
- ▶ [Timing of Retirement](#)
- ▶ [Volunteering in Older Adults in Retirement](#)
- ▶ [Work Motivation and Aging](#)
- ▶ [Workplace Creativity, Innovation, and Age](#)

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## Motivational Theory of Lifespan Development

Joseph S. Kay and Jutta Heckhausen  
 Department of Psychology and Social Behavior,  
 School of Social Ecology, University of  
 California, Irvine, CA, USA

### Definition

The Motivational Theory of Lifespan Development (MTD) explains the processes by which humans optimally pursue their developmental goals. Development is most successful when humans pursue appropriate goals, engage in goal-directed efforts to pursue their goals, and disengage when goals have been achieved or are no longer attainable. MTD has implications for goal attainment, health, and well-being across the lifespan.

## Synonyms

Lifespan theory of control; Optimization in primary and secondary control

## Motivational Theory of Lifespan Development

Humans operate in a complex environment in which prospects for achieving meaningful life goals wax and wane according to biological and social opportunities and constraints. The Motivational Theory of Lifespan Development (MTD) (Heckhausen and Schulz 1993; Heckhausen et al. 2010) expands on the lifespan theory of control (Heckhausen and Schulz 1995; Schulz and Heckhausen 1996) and describes the processes by which humans operate within their environment in order to optimally pursue developmental goals. According to MTD (Heckhausen and Schulz 1993; Heckhausen et al. 2010), development occurs throughout the lifespan and is successful when individuals are able to match their goal-directed efforts with the opportunities available to them and select behavior that is beneficial across multiple life domains and in the long run while maintaining a diversity of goals. MTD views humans as active agents in shaping their own development throughout their lives. This entry presents a brief history of the origins of MTD and expands on key concepts, applications, and empirical findings supporting the importance of viewing development throughout the lifespan from the MTD perspective.

## MTD and Lifespan Developmental Psychology

MTD is a theory of lifespan developmental psychology. Baltes (1987) identified several key propositions that characterized research and theories on lifespan development generally and which are applied in MTD. Lifespan developmental psychology stresses that development is a lifelong process. Development can be continuous across life stages and includes gains and losses that can

occur simultaneously or sequentially, either across life domains or within a single domain. Finally, the developmental course is determined by a person by context interaction such that outcomes are the result of social and biological constraints as well as individual experiences and efforts.

The Motivational Theory of Lifespan Development defines successful development as the development and maintenance of task mastery across a range of domains throughout the lifespan (Heckhausen et al. 2010). The optimal developmental strategy requires active regulation to allow individuals to select their goals in such a way that they are tailored to the opportunities available to them, respond to failure by increasing efforts, engagement, and use of other motivational strategies if the goal is attainable or disengage and redirect efforts if the goal is unattainable (Heckhausen and Schulz 1993; Heckhausen 1997). Matching goals and motivational control strategies to opportunities have beneficial implications for mental health and objective success in achieving developmental goals when healthy (Heckhausen et al. 2010) as well as when facing life stressors or illness (Hall et al. 2010; Wrosch et al. 2000). Furthermore, believing that one has control over one's environment and goal achievement is related to more effective use of goal engagement strategies and ultimately greater success in attaining one's goals (Shane et al. 2012; Heckhausen et al. 2012).

Heckhausen et al. (1998) identified and measured three categories of goal striving and control strategies: *optimization*, *primary*, and *secondary control* (OPS). Optimization measures an individual's tendency to select goals that are appropriate given the opportunities available, produce positive and not negative outcomes across multiple life domains at the same time, and are beneficial for long-term development. Optimized goals accurately reflect opportunities for control (Chang et al. 2006; Haynes et al. 2009), consider how that goal will affect goals related to other domains of life (Riediger et al. 2005), and maintain or build competence across multiple domains of life (Heckhausen and Schulz 1993). Selecting an appropriately attainable goal is important, as it

leads to increased goal engagement (Wrosch and Schulz 2008).

Once a goal has been selected, individuals use primary control strategies (i.e., those aimed at effecting change in the world in order to achieve a goal) and secondary control strategies (i.e., those used to influence one's own motivation) to pursue that goal (Rothbaum et al. 1982). Over the course of the lifespan, primary control capacity follows an upside down U shape, with a peak in adulthood and declines in old age, while secondary control capacity continues to rise throughout the lifespan (Wrosch et al. 2000; Heckhausen 1999). People seek to maximize primary control over their environment throughout their lives (Heckhausen and Schulz 1995, 1999a), although they recognize that primary control declines in old age (Lachman and Firth 2004) and therefore must adjust goals accordingly.

Primary control can be differentiated as selective primary control (SPC) or compensatory primary control (CPC) (Heckhausen and Schulz 1993, 1999b; Baltes and Baltes 1990). SPC refers to an individual's ability and tendency to invest time and effort into a goal, develop skills to help pursue that goal, and persevere despite difficulties. CPC, on the other hand, refers to an individual's use of external supports to help achieve a goal, whether that be through enlisting other's help or guidance or seeking new or different ways to achieve that goal. For example, when seeking a promotion with higher pay, a worker's SPC strategies would involve the investment of time and effort into his or her job and development of leadership skills that would help attain that promotion. If that promotion were more difficult to attain, the worker could enlist CPC strategies by contacting his or her network of colleagues for advice about how to approach the manager to request a promotion (i.e., enlisting others' help) or search for a different job that meets his or her desired salary goals (i.e., seeking alternate ways to achieve a goal). Primary control striving is associated with improved likelihood of achieving a goal (Shane et al. 2012; Fiksenbaum et al. 2006) as well as with better psychological health throughout the lifespan (Wrosch et al. 2002, 2005).

If primary control strategies are insufficient to achieve a desired goal, individuals must also use secondary control strategies. First, individuals can use selective secondary control (SSC) strategies, which consist of motivational strategies to aid in goal pursuit, such as enhancing the value, expected benefit, or perceptions of control related to that goal or devaluing other goals. These strategies boost the effectiveness of primary control strategies and ultimately help goal attainment across a range of life domains (Hamm et al. 2013; McQuillen et al. 2003). The worker, for example, can increase motivation by focusing on the importance of getting a better job in order to support a family or focus on the benefits the additional money will bring.

If that goal remains unattainable, compensatory secondary control strategies (CSC), which consist of disengagement from the goal and of self-protective strategies to change goal-related cognitions in order to minimize the negative impact of failure (Mendola et al. 1990; Gollwitzer 1990), become necessary. Disengagement in this situation can be adaptive when the individual withdraws both effort and commitment to a goal in order to pursue a more attainable goal (Wrosch et al. 2003a). Furthermore, specific self-protective cognitions can help to reduce the negative psychological consequences that come from failing to attain a goal (Wrosch et al. 2005, 2003b). If, for example, the worker realizes a promotion or better job is unattainable, the worker can disengage from his/her career goal, remember that money is not the only thing in life that matters (i.e., devalue the prior goal), and increase focus on family (i.e., reengage in a different goal). For self-protection, he can remind himself that it was not his/her fault that he did not get the promotion and that some colleagues are worse off.

### MTD in Relation to Other Developmental Theories

In addition to MTD, two other major developmental theories of regulation were developed. The dual-process model of assimilative and accommodative coping (Brandstädter 1989; Brandstädter and Rothermund 2002) highlights the importance of perceptions of control over a given goal in

determining whether an individual actively strives to achieve the goal (when it is perceived to be controllable) or reevaluates the goal (when it is not). When goals are perceived to be controllable, individuals enter into an *assimilative* mode, in which intentional effort is put forth in an attempt to regulate the environment to achieve goals. On the other hand, when goals are perceived to be unattainable, individuals enter into an *accommodative* mode which helps to adjust goals according to the constraints present and redirects efforts to more attainable goals. Second, the theory of selective optimization with compensation (SOC) (Baltes and Baltes 1990; Baltes 1997) describes three components to adaptive development. Individuals must make a *selection* between different possible goals in order to pursue one to master. Selecting an appropriate goal to pursue allows one to *optimize* adaptive capacity and increase overall functioning, while *compensation* is necessary when suffering functional losses or when goals become unattainable.

Although the details may differ, these theories, as well as MTD, share a common theme that successful lifespan development requires that individuals be actively engaged in goals they have selected when these goals are attainable. When goals are no longer attainable, all three theories explain that individuals must take steps to change their efforts and cognitions to avoid pursuing impossible goals. However, in addition to goal engagement and disengagement, MTD highlights the importance of meta-regulation (Haase et al. 2013). Individuals must actively regulate their goals to ensure that their engagement and disengagement efforts are aligned with the opportunities available to them and to position themselves so that they are able to succeed across multiple domains throughout their lives. MTD also specifies that goal pursuit occurs in distinct and sequential action phases, which involve biased cognitive processing in order to optimize goal engagement.

### Action Phases and the Decisional Rubicon

The Motivational Theory of Lifespan Development adopts a phase-sequential model from motivational action theory (Gollwitzer 1990;

Achtziger and Gollwitzer 2010; Heckhausen 2007). MTD describes three discrete stages of goal pursuit, the transitions between which should be discrete and non-gradual. Each stage of the goal pursuit process is characterized by a unique set of strategies that can be used for optimizing development and distinct types of cognitive processing.

**Pre-decisional phase.** The first stage takes place before the individual has selected a goal to pursue. At this time, the ideal strategy is to be deliberative in order to select the most appropriate goal based on biological and cultural opportunities and constraints and developmental norms (Gollwitzer 1990; Gollwitzer et al. 1990). This is the phase for optimization; ideally during this phase, the individual attempts an unbiased and realistic analysis of the situation, including of one's abilities and constraints, and the likelihood of attaining different goals as well as the benefits that would result from those goals (Beckman and Gollwitzer 1987).

**Goal engagement phase.** The selection of a goal to pursue is considered a decisional Rubicon, referring to Julius Caesar's irreversible decision to move his legions across the Rubicon, which set him on a path that could not be altered. Crossing the decisional Rubicon marks a distinct shift from deliberation to active goal pursuit. After the decisional Rubicon has been crossed, the individual must focus on strategies to achieve the selected goal. Depending on the ease of attaining the goal and the urgency with which it must be attained, differing levels of the control strategies may be used as described above, with SPC and SSC increasing with the urgency of the goal and CPC being used when the goal is urgent (Heckhausen 1999). During this goal pursuit stage, rather than considering alternatives goals, the individual focuses almost exclusively on attaining the selected goal. At this time, perceptions of control increase, and more generally, processing shifts toward implemental mindsets (Achtziger and Gollwitzer 2010).

**Goal disengagement phase.** A second shift in goal engagement occurs when control opportunities have diminished or when other goals take priority, that is, after the deadline for that goal

has passed. A goal deadline has passed when the goal has been completed or when the opportunity for its completion has passed unsuccessfully. Engagement in a goal whose deadline has passed becomes maladaptive and so should drop precipitously (Heckhausen 2000). When a goal has been completed successfully, the cycle begins anew, with the individual building on his or her successes and reentering the pre-decisional phase characterized by optimization. If, on the other hand, a deadline has passed without the successful completion of that goal, CSC strategies must be used in a self-protective manner, since remaining fully engaged with an unattainable goal would be harmful (Heckhausen 1999; Heckhausen et al. 2001). Disengagement from one goal allows for reengagement in a more attainable goal.

Importantly, shifting between goal engagement and disengagement requires an active monitoring process in order to identify when it is no longer adaptive to pursue a chosen goal either because it has already been attained or because it is no longer attainable and to ensure that primary and secondary control strategies match each other (Hamm et al. 2014). Active regulation occurs during each stage: first to identify a goal to pursue, second to tailor goal engagement strategies to the opportunities, and finally to monitor goal progress within the changing landscape of opportunities and constraints in order to identify when it is no longer adaptive to continue pursuing the chosen goal.

### **Application of MTD to Successful Aging**

Evaluating successful aging, from the perspective of lifespan developmental psychology, must account for individual difference in abilities and constraints and must consider indicators that are relative to those individual abilities and constraints (Baltes and Baltes 1990). This differs from a medical perspective of aging, according to which success is viewed more objectively, as high-functioning and free from disease. Within the lifespan developmental approach, the Motivational Theory of Lifespan Development defines successful aging as maximizing control across

multiple domains of life and for a longer period of time in spite of biological constraints (Schulz and Heckhausen 1996). Throughout life, individuals must use both primary and secondary control in order to achieve their goals. Toward old age, primary control declines as biological and social constraints limit the opportunities to successfully attain goals in different life domains. At the same time, secondary control use continues to increase throughout old age (Heckhausen 1997; Lachman and Firth 2004) allowing individuals to compensate for declining skills and increasingly disengage from goals that become unattainable.

Appropriate optimization of goals, engagement, and disengagement has significant implications for health, well-being, and mortality among both healthy and ill older adults. Accurate perceptions of control are critical for well-being and long-term mortality. Among older adults, shifting goals toward preventing loss becomes adaptive as opposed to being detrimental among younger adults (Ebner et al. 2006). Typically, aging adults experience a significant decline in well-being just prior to death, which can be buffered by perceptions of control (Gerstorf et al. 2014). Gerstorf and colleagues (2014) found that over a 25-year period, perceptions of control over one's environment were associated with higher well-being late in life, and both reduced and later declines in well-being prior to death. Higher levels of perceived control may indicate that those older adults are better prepared to face declines in functioning, since those who feel that they have more control over their environment and health goals remain more engaged in health and lifestyle demands related to aging (Tomasik and Silbereisen 2013). Those who are more engaged in health behavior and those who focus their efforts on primary control strategies more effectively cope with their challenges and report better psychological and physical well-being (Haynes et al. 2009; Wrosch and Schulz 2008).

Among older adults with illnesses, the match between engagement or disengagement and the opportunities for illness management is critical, since it allows individuals to focus their efforts on goals that are attainable and avoid engaging with unattainable goals. Older adults facing

progressive and irreversible illnesses such as progressive vision impairments (Boerner et al. 2010; Wahl et al. 2007), multiple sclerosis (Pakenham 1999), or Parkinson's disease (McQuillen et al. 2003) report using a variety of control strategies to help cope functionally and psychologically. Indeed, both engagement and disengagement can be adaptive, depending on the opportunities and constraints present. Among older adults with acute health problems, for whom goal engagement can lead to effective management and reduction of symptoms or severity, goal engagement predicts greater health and longevity, and disengagement predicts worse health and shorter longevity; in contrast, among those with chronic health problems, for which improvement is not a realistic goal, disengagement was predictive of better health and engagement with worse health (Hall et al. 2010). Thus, neither engagement nor disengagement can be considered inherently adaptive or maladaptive; they must be considered in the context of the opportunities present.

### **Aging and Lines of Defense**

In aging adults facing increasing disability and progressive declines in functioning, the primary goal should be to maintain functioning and control while avoiding futile battles. Goal selection and the use of primary and secondary control strategies to engage in attainable goals and disengage from unattainable goals are critical (Heckhausen et al. 2013). When facing progressive declines, individuals should organize their goals into "lines of defense" according to their attainability so that motivational resources are not wasted in battles that will inevitably be lost. Aging individuals should use primary and secondary control strategies to fully engage in goals that are attainable and meaningful, while disengaging and withdrawing efforts from those goals that are unattainable (Heckhausen et al. 2013; Heckhausen 2005). Given that diseases may progress, the adaptiveness of the lines of defense must be monitored; if a functional goal becomes unattainable, efforts should be withdrawn and a new line of defense organized.

Heckhausen et al. (2013) suggest aging or ill adults organize goals into one of four main lines of defense, depending on their functioning. Among healthy aging adults with few limitations, goals should focus on preserving functioning and disease-free status. Engaging in preventative-health and health-promoting behaviors is most adaptive. Among individuals with subclinical disease, a second line of defense should be drawn such that the functional goal is to prevent any disease progression. These individuals must acknowledge that they are not entirely disease free and should strive to maintain full functioning and prevent any declines.

Should an illness progress to chronic disease status, health goals should focus on preventing disease progression or reverting to subclinical disease status. At this stage, individuals must disengage from the goal of remaining disease free and reengage in goals related to preventing decline. In doing so, they may be more readily able to use health control strategies which lead to better psychological health and improved well-being and reduce the negative impact of health problems (Wrosch et al. 2002). Health goals may begin to include those related to daily functioning to maintain independence, first by altering the environment or using technical aids (Becker et al. 2005), then by recruiting help (Berg and Upchurch 2007), and finally by focusing on only most important elements of independence and maintaining flexibility in order to better cope with reduced functioning (Zimmer et al. 1997). Use of control strategies should be cyclical, characterized by engagement in an appropriate line of defense, disengagement when that is no longer feasibly maintained, and then reengagement in a next line of defense. Finally, when facing a terminal illness, functional goals should be to reduce to psychological and physical suffering and to promote acceptance by disengaging from health goals in order to focus on coming to terms with their death (Gerstorff et al. 2010); failing to do so may lead to increased psychological distress prior to death.

These lines of defense can also be organized in reverse when individuals are aiming to expand their functioning and rehabilitate capabilities

when recovering from an illness or injury. For example, when recovering from radical prostatectomy, patients organized their functioning goals based on their health (i.e., degree of incontinence) such that those who were least incontinent were engaged in goals related to self-reliance, and those most incontinent focused on disengagement and using aids to support their functioning (Knoll et al. 2014). As predicted by the lines of defense model (Heckhausen et al. 2013; Heckhausen 2005), as patients' health improved, they reengaged in higher functional goals (Knoll et al. 2014) indicating that goals are not static but can (and should) be organized and adjusted according to one's capacity.

## Summary

The Motivational Theory of Lifespan Development (Heckhausen and Schulz 1993; Schulz and Heckhausen 1996; Heckhausen 1997; Heckhausen et al. 1998) proposes that people select goals based on the opportunities and constraints present in such a way as to promote development across multiple domains and preserve a diversity of goals. Once goals have been selected, primary and secondary control strategies are activated to maintain engagement. When opportunities decline to a critical extent, individuals need to disengage from that goal in order to free up motivational resources to reengage in a newly selected goal. Research has consistently demonstrated that the ability to select the optimal goal and to tailor the engagement and disengagement strategies used has significant implications for goal attainment, health, and well-being among a range of populations across the lifespan. Still, there is work yet to be done. For example, it is not always clear why some individuals are better able to optimize their goals and engagement strategies than others or whether interventions to help individuals better optimize their goals, engagement, and disengagement would be effective. Additionally, most research related to MTD across the lifespan uses self-report measurements. Given that self-reports may reflect biases in recall or information processing, other measurement

types should be considered, including those of nonconscious processes and behavioral sampling via ambulant devices, assessments which do not share the biases inherent in self-reports. Although more work is needed, it is clear that across many contexts and throughout the lifespan, research on MTD has demonstrated the adaptive capacity of individuals and contributes to our understanding of the optimal motivational strategies to develop and maintain that capacity.

## Cross-References

- ▶ [Aging and Psychological Well-Being](#)
- ▶ [Life Span Developmental Psychology](#)
- ▶ [Psychological Theories of Successful Aging](#)
- ▶ [Psychological Theories on Health and Aging](#)
- ▶ [Selection, Optimization, and Compensation at Work in Relation to Age](#)

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## Motive Congruency and Person–Environment Fit of Aging Workers

Guido Hertel  
Department of Psychology, University of  
Münster, Münster, Germany

### Synonyms

Equilibrium; Motivational balance; Need–supply fit; Self-knowledge

### Definitions

According to the theory of dual motive systems (e.g., McClelland et al. 1989), two independent motive systems exist within humans: *Implicit motives* which are usually unconscious and directed toward intrinsic incentives of activities (e.g., task enjoyment, being together with others) and self-attributed *explicit motives* directed toward extrinsic incentives of activities (e.g., monetary benefits, acknowledgment from others). *Motive congruency* is considered in this entry as positive correlation between implicit and explicit motives within a person. Whereas high motive congruency is assumed to be connected with positive experiences, low motive congruency should be connected with negative experiences due to motive conflicts (e.g., Kehr 2004).

*Person–environment fit at work* is defined as compatibility between characteristics of an individual worker and the work environment (Kristof-Brown et al. 2005). This entry focuses on the compatibility between individuals' needs at work and the perceived opportunities to fulfill these values in the current work environment, which is a specific subtype of person–environment fit and described as *need–supply fit* (e.g., Kristof-Brown et al. 2005; Krumm et al. 2013).

### Achieving Balance Across the Lifetime

Achieving and maintaining a good balance between different needs and desires, as well as

between individual needs and the surrounding environment, is a general theme in many philosophical and religious traditions. For instance, “know thyself” has been an aphorism for self-reflection, learning, and acceptance of limited capabilities (among other meanings) in Ancient Greek and Latin philosophies. Moreover, achieving balance both within the personal mind as well as in the interaction with others and with the environment is a basic maxim of many religious frameworks. In essence, these traditions might suggest that a good balance of needs and desires is a major goal and an indicator of a successful human life to be achieved across the lifespan (see also Baltes and Baltes 1990; Higgins et al. [in press](#)).

In psychology, the idea of balance and equilibrium of needs and desires can be found in various concepts of congruency between different motive systems and of “fit” between personal motives and supplies of the environment. Consistent with the more general approaches described above, the experience of such congruency and fit is thought to be associated with higher satisfaction and well-being and with more energy and motivation, for instance, during flow experiences at work (e.g., Csikszentmihalyi 1990) or self-regulatory fit (e.g., Higgins 2009). However, although initial concepts exist on how motive congruency and person–environment fit might develop over time, few empirical studies have yet addressed the relationship between individuals' age and such concepts of balance.

The general research questions reviewed in this entry are twofold. First, it is examined whether motive congruency and person–environment fit are more likely with higher chronological age of a person, as might be suggested by ideas from philosophy and religious traditions that achieving balance is a major goal in human life. Second, it is explored whether *low levels* of motive congruency and person–environment fit are connected with more negative experiences for older as compared to younger persons, which should be the case if a good motivational balance is perceived as a general goal in life. In doing so, the entry focuses on occupational work settings as a major domain in human life with important implications

on persons' self-perception and well-being. However, it might well be that the principles discussed in this entry can also be found in other life domains.

## Overview of this Entry

In the following sections, the two research questions are first examined in the context of motive congruency within a person. Then, the two research questions are explored in the context of need–supply fit as a subtype of person–environment fit focusing on motivational processes. In both cases, specific assumptions on age contingencies are derived and discussed in light of available empirical studies. Finally, a preliminary summary on this emerging research is provided, followed by a discussion of open questions and directions for future research.

## Congruency Between Implicit and Explicit Motives

Human *motives* can be understood as networks connected with specific cognitions about goal states or incentives that have implications for the selection of behavior and the devotion of time and energy (e.g., Schultheiss 2008). For instance, a person with a strong affiliation motive actively seeks opportunities to build social relationships and spend time with others. Such motives can be both consciously available as self-directed attributions, or rather unconsciously as impulses, needs, or desires. A prominent approach that considers these different forms as independent motive systems is the theory of dual motive systems (McClelland et al. 1989). According to this theory, explicit motives are understood as self-attributed needs and wishes that are openly acknowledged by a person and initiate controlled behavior toward extrinsic incentives (e.g., monetary benefits, acknowledgment from others). Such explicit motives can be measured with self-report questionnaires (e.g., Jackson 1984). Implicit motives, on the other hand, are usually not conscious and initiate spontaneous behavior toward

intrinsic incentives of the behavior itself (e.g., task enjoyment, connecting with others; McClelland et al. 1989; Schultheiss 2008). Implicit motives can be measured with projective tests (e.g., Pang and Schultheiss 2005) or semi-projective measures (e.g., Sokolowski et al. 2000).

Although implicit and explicit motives refer to similar goal domains (e.g., affiliation, achievement, or power), the independence of the two motive systems can lead to different congruency patterns within an individual (Köllner and Schultheiss 2014; McClelland et al. 1989). For example, a person can have either (a) both a high explicit and a high implicit motive for affiliation or (b) both a low explicit and a low implicit motive for affiliation or (c) a high explicit and a low implicit motive for affiliation or (d) a low explicit and a high implicit motive for affiliation. Whereas the first two cases reflect high motive congruency (i.e., high correlation between implicit and explicit motives), the latter two are examples for low motive congruency or motive conflicts (i.e., low or negative correlation between implicit and explicit motives). Notably, the relative degree of motive congruency can vary for different motives (e.g., affiliation, achievement, or power) within a person.

The consequences of high and low motive congruency are manifold and can predict motivation, well-being, and behavior beyond the predictability of either explicit or implicit motives alone (e.g., Brunstein 2010; Lang et al. 2012). For instance, Lang and colleagues (2012) have demonstrated significant effects of motive congruency on job performance up and beyond the effects of the single motives alone. An interesting question, however, is whether motive congruency and its consequences are qualified by a person's chronological age.

## Age and Congruency Between Implicit and Explicit Motives

Following the basic idea that balance of individual motives might be a major goal in human life, it might be assumed that motive congruency increases during persons' lifetime. Such increase

might be explained by intraindividual as well as external processes. Among the intraindividual processes are learning, self-reflection, and accumulated experiences, which might lead to a constantly improved self-knowledge of individuals. Over time, persons might realize what their “true” needs and desires are based on experiences that have led to enduring and deep satisfaction and enjoyment. Such increasing self-knowledge might not occur automatically; however, “through self-observation and analysis, greater congruence between the two types of motives can be achieved” (McClelland et al. 1989, p. 700). Indeed, whereas implicit motives are considered as stable dispositions, explicit motives are considered to be adjustable by individuals due to self-observations and inferences about motivational processes (e.g., Thrash et al. 2010).

This is particularly relevant in the work domain where discrepancies between explicit motives (e.g., a person considering her-/himself as being a tough manager) and implicit motives (e.g., having a high affiliation desire) might lead to strain and unsuccessful work behavior (e.g., avoiding necessary decisions because these might be not popular and risk the sympathy from others; see also McClelland et al. 1989). Learning repeatedly that necessary job behavior is difficult or even aversive for an individual might eventually lead to changes in her/his self-perception (Thielgen et al. 2015b). Over time, such iterative learning and adjustments of explicit motives should lead to higher motive congruency for older as compared to younger workers. This assumption is congruent with findings indicating an increasing self-reflection and integration of affect and cognition during adulthood (e.g., Labouvie-Vief 2003). Notably, older workers might also have more opportunities for adjustments of explicit motives because they often have higher autonomy and control at work (e.g., Ng and Feldman 2010).

In addition to learning and accumulation of experiences, older as compared to younger persons might also be more *motivated* to achieve motive congruency. Socioemotional selectivity theory (e.g., Carstensen 2006) suggests that preferences of goals are affected by perceived temporal boundaries. In particular, the perception of

time being limited should prioritize goals related to regulation of emotional states and well-being. This general principle not only holds for preferences across the whole life-span but also for goals related to more specific time frames, such as the occupational career of a person from entering the job life until retirement age (e.g., Zacher and Frese 2009). Based on socioemotional selectivity theory, older as compared to younger workers might be more motivated to successfully regulate their emotional states and well-being, including their motive congruency. Indeed, low motive congruency can be frustrating and function as a “hidden stressor” when explicit motives are in conflict with the fulfillment of implicit needs and desires (Baumann et al. 2005) or when striving for explicit motives is not fueled by enjoyment and pleasure (Kazén and Kuhl 2011).

Empirical research on the interplay between motive congruency and age is scarce, particularly in connection with work-related experiences. However, initial data have confirmed the assumed higher motive congruency of older workers for affiliation motives. In two studies using different measures of implicit motives (i.e., the Picture Story Exercise, Pang and Schultheiss 2005, and the Multi-Motive-Grid, Sokolowski et al. 2000), Thielgen et al. (2015b) found a higher congruency between implicit and explicit affiliation motives for older as compared to younger workers. In this motive domain, workers seem to adjust their explicit motives over the life-span considering experiences such as success or failure at work or more explicit feedback from supervisors, colleagues, or HR representatives (e.g., coaching or counseling).

However, it should be noted that age differences in motive congruency were not observed for power or achievement motives in these initial studies. In addition, a recent meta-analysis based on 47 empirical papers (mostly with university students, though) found also no significant age moderation of motive congruency. Thus, high motive congruency seems to be determined by many other influences, among them both person factors (e.g., self-monitoring) as well as environmental influences (e.g., feedback culture, autonomy; see Thrash et al. 2010, for a review). As a

consequence, low motive congruency and related motive conflicts might be found not only among younger workers but also among older workers. An interesting question, then, is whether the consequences of (low) motive congruency at work are different depending of workers' age.

### **Age-Contingent Consequences of Motive Congruency at Work**

Although older workers might be more likely and motivated to achieve motive congruency, not all older workers might do so. Interestingly, the basic rationale for the assumed positive relationship between persons' age and motive congruency has also implications for the experienced contingencies of motive congruency for different age groups. Indeed, the popular assumption that older persons are more balanced and well adjusted than younger persons might create corresponding expectations and norms that, in turn, might influence both social and self-perceptions of individuals. Moreover, low motive congruency is likely to be connected with difficulties in emotion regulation and frustration of implicit motives (e.g., Kehr 2004), which should be experienced as particularly fatal if persons have only a limited future time perspective (see Carstensen 2006), for instance, because they are close to retirement. Thus, experienced consequences of low motive congruency might be more negative for older as compared to younger persons (Thielgen et al. 2015b). In the work domain, a central indicator for such experienced consequences is job satisfaction.

In general, empirical studies have demonstrated motive congruency to be related to well-being and motivation (e.g., Brunstein 2010). For the work domain, an initial study (Thielgen et al. 2015b) has shown that congruency of affiliation motives is positively related with workers' job satisfaction, particularly when both implicit and explicit affiliation motives are strong. Moreover, these contingencies of motive congruency were moderated by workers' age such that low congruency of affiliation motives was connected with lower job satisfaction for older as compared to younger workers.

However, age did not moderate congruency effects of achievement or power motives on job satisfaction in this study (Thielgen et al. 2015b).

These selective effects might be partly explained with differences in the motives' sensitivity for different outcome measures. Indeed, a main strategy to maintain positive well-being is to connect with others and seek social support. Thus, congruency and the fulfillment of affiliation motive might be highly relevant for job satisfaction (Thielgen et al. 2015b), whereas congruency of achievement or power motives might be more relevant for work motivation, strain, or self-esteem (e.g., Kazén and Kuhl 2011; Thielgen et al. 2015a). Indeed, Thielgen et al. (2015a) using a longitudinal design documented that both congruency of affiliation motives and congruency of achievement motives were positively related to work motivation, consistent with the assumption that motive congruency increases the likelihood that workers pursue goals at work that are congruent with their implicit motive structure (Kehr 2004). In fact, low congruency of achievement motives can be seen as persistent handicap for individuals' work motivation that might often be overlooked by both workers themselves as well as by supervisors or career counselors due to the unconscious nature of implicit motives (Baumann et al. 2005).

Moreover, the consequences of low congruency of achievement motives were again moderated by workers' age. Interestingly, however, low congruency of achievement motives was more strongly related to demotivation for younger as compared to older workers. Older workers, in contrast, were found to have higher self-regulation strengths than their younger colleagues and seemed to be better able to compensate low congruency of achievement motives (Thielgen et al. 2015a). This finding is in line with life-span theories of human motivation suggesting that persons develop self-control strategies over time to master challenges and obstacles (Charles 2010; Heckhausen et al. 2010). While the fulfillment of affiliation motives can be experienced immediately, fulfillment of achievement motives is rather a prospect for the future. Thus, the different directions of the observed age moderation

of congruency consequences seem plausible given the different time horizons of motive fulfillment (Thielgen et al. 2015a).

In general, motive congruency seems to correspond to different experiences within each of the motive domains, an idea that is well in line with the theory of dual motive systems (McClelland et al. 1989). Whereas motive congruency in the affiliation domain was associated with job satisfaction (Thielgen et al. 2015b), motive congruency in the achievement domain seems to be more strongly associated with motivation and engagement at work (Thielgen et al. 2015a). Finally, motive congruency in the power domain has been found to be associated with stress and well-being for managers (Kazén and Kuhl 2011). The observed age moderation effects show that chronological age cannot only correlate with motive congruency per se but also qualify the experienced contingencies of motive congruency, for instance, at work. These results confirm the second research question of this entry.

### Person–Environment Fit

In addition to intraindividual balance of motives, compatibility between individuals' motives and the surrounding environment is another aspect of achieving a good balance in life. Such person–environment fit is particularly important for the work domain. In particular, subjective need–supply fit as a motivation-specific form of person–environment fit (Kristof-Brown et al. 2005) covers the compatibility between workers' motives and perceived opportunities to fulfill these motives at work (e.g., Krumm et al. 2013). While workers' needs can include both implicit and explicit motives, empirical research on need–supply fit has usually considered explicit motives so far (i.e., work values; see Thielgen et al. 2015a, for discussing also implicit motives as component of need–supply fit).

In general, need–supply fit has been assumed and shown to have positive consequences on major outcomes in the work domain, such as work motivation, performance, and job satisfaction (e.g., Cable and DeRue 2002; Kristof-Brown

and Guay 2011). In particular, if workers perceive their current job to be highly compatible with their work values, job satisfaction is assumed to be high (Krumm et al. 2013). On the other hand, if workers perceive only few opportunities to fulfill their work values, job satisfaction should be rather low. Again, an interesting question is whether these effects are different as a function of workers' age.

### Age and Person–Environment Fit at Work

Following the general rationale introduced in the beginning of this entry, age might not only be positively related with indicators of motive congruency but also with making adjustments to the external environment as a major developmental goal. This is particularly relevant for the work domain, where career advancement often enables to increase the match between individual motives and work conditions. Indeed, personal development and promotion are often based on seniority principles, providing more leeway, flexibility, and financial security for older workers. In addition, given an increasing priority on emotion regulation with higher age (Carstensen 2006), older workers might also be more motivated to achieve high job satisfaction and therefore might even adjust their expectations to the job supplies available (Zacher et al. 2014). This reasoning would predict an increasing perceived person–environment fit and, more specifically, an increasing perceived need–supply fit with higher age at work.

However, admittedly, there are also considerable difficulties to achieve and maintain a high need–supply fit over time. First, the job environment today is often changing due to career progression or market changes, requiring frequent adaptations to challenges and opportunities at work. This might also include changes in management policies or in the recognition from supervisors or colleagues (e.g., increasing age discrimination; Feldman and Vogel 2009; see also Zacher et al. 2014). Second, persons' work values itself often shift as a function of individual age (e.g., Hertel et al. 2013; Kooij et al. 2011;

Ng and Feldman 2010; Stamo $\ddot{u}$ v-Ro $\beta$ snagel and Hertel 2010), and these shifts might not always concur with ongoing changes in the job environment. Thus, maintaining a high compatibility between individual needs and job supplies seems to be a constant challenge requiring adjustments not only in the beginning of a career but also later on.

As an initial empirical exploration, Krumm et al. (2013) examined the possible contingencies between workers' age and perceived need–supply fit in a cross-sectional study with 471 workers from various working fields. In line with the latter reasoning, the authors observed no significant correlation between age and perceived need–supply fit, neither for specific work value clusters nor for an overall measure of need–supply fit. Thus, (current) work environments as well as age differences in work values seem to pose constant challenges on the maintenance of high need–supply fit even though, and this has been also found in the study of Krumm et al. (2013), a significant correlation between need–supply fit and job satisfaction suggests that high need–supply fit is a desirable state both from a worker's and an employer's perspective. However, what about potential age effects on these consequences of need–supply fit?

### **Age-Contingent Consequences of Person–Environment Fit at Work**

Parallel to the reasoning related to motive congruency, it can be assumed that the relation between need–supply fit and job satisfaction is qualified by workers' age. More specifically, experiencing high need–supply fit might be particularly important for older workers (Krumm et al. 2013). This prediction rests again on the more general assumption from socioemotional selectivity theory (Carstensen 2006) that emotional self-regulation becomes more important when future time perspective decreases. At work, workers should place higher value on need–supply fit the less time they perceive to be remaining for achieving such fit. In addition, social norms might pose higher expectations on older workers to experience high need–supply fit. Therefore, older

workers might be more sensitive to discrepancies or incompatibilities between their work values and current opportunities at work and react more negatively (e.g., in their job satisfaction) when their perceived need–supply fit is low.

Indeed, Krumm et al. (2013) found that the relationship between perceived need–supply and job satisfaction was moderated by workers age, showing a stronger relationship for older as compared to younger workers. This pattern was consistently observed for four out of five clusters of need–supply fit, i.e., extrinsic growth values (e.g., advancement, status), generativity values (e.g., meaningful work, helping others), affective values (e.g., enjoyment, social contacts), and context-related values (e.g., job security, health). Consistent with the socioemotional selectivity theory (Carstensen 2006), workers seemed to be more sensitive to incompatibilities between their needs and the respective job supplies when their future time perspective at work is more limited. Apart from direct implications for age-differentiated human resource management (e.g., Hertel et al. 2013; Hertel and Zacher *in press*), these findings might contribute to a more differentiated understanding of the overall relation between workers' chronological age and job satisfaction (e.g., Ng and Feldman 2010). Workers' age seems to moderate not only the relative importance of different work values (e.g., Kooij et al. 2011) but also the impact of different facets of perceived need–supply fit as contribution to overall job satisfaction. Future research is desirable to examine such age-specific antecedents of job satisfaction in more detail.

### **Summary and Future Research Direction**

Based on ancient wisdom, classic philosophy, and religious traditions, achieving balance within oneself and in interaction with the environment might be seen as a major goal in human life. This is reflected in social expectations about older persons and might put pressure on individuals to concur with such normative beliefs. However, in addition of such external norms, the experience of subjective states of balance is motivating in itself,

including feelings of happiness and high motivation as described in research of flow experiences (Csikszentmihalyi 1990) or self-regulatory fit (e.g., Higgins 2009; Higgins et al. in press). Older persons might not only have more opportunities to achieve such balance through learning, accumulated experiences, and self-reflection, but older persons might also be more motivated to achieve such balance because limited time perspectives increase the priorities of emotional self-regulation (Carstensen 2006). This entry sets out to review the existing empirical evidence for a connection between persons' chronological age and motive congruency as well as perceived person–environment fit. In doing so, the entry focuses on the work context as a major life domain of adults with important implications for self-definition, growth, and well-being. Two main assumptions were central in this review: First, is there evidence for a positive relation between workers' age and their within-person motive congruency or their perceived person–environment fit? Second, are the consequences of not experiencing a good motivational balance, i.e., motive congruency and/or perceived person–environment fit, moderated by workers' age?

With respect to the first question, this review has revealed only scarce evidence for a positive connection between workers' age and states of balance. Workers' age was not related to perceived need–supply fit at work. Moreover, workers' age was also not related with the congruency between implicit and explicit motives for achievement and power motives. The only evidence for a positive link between workers' age and motive congruency was found for affiliation motives (Thielgen et al. 2015b). However, given that aging per se is connected with increasing priorities on emotional self-regulation and nurturing social connections (e.g., Carstensen 2006; Kooij et al. 2011), the higher motive congruency in the affiliation domain might be due to a general age shift in the strength of explicit affiliation motives rather than to an increased self-reflection of older workers. Thus, consistent with a more skeptical stance of other researchers (e.g., Köllner and Schultheiss (2014), higher age seems to be not automatically connected with higher motive

congruency, even though older persons should have more learning opportunities and a higher motivation to achieve high motive congruency.

With respect to the second question, the review has revealed considerable evidence that contingencies of motivational balance at work are indeed moderated by workers' age. Older as compared to younger workers showed more negative job satisfaction when perceived need–supply was low (Krumm et al. 2013). Moreover, older as compared to younger workers showed more negative job satisfaction when motive congruency was low (Thielgen et al. 2015b). Interestingly, however, when considering work motivation as outcome variable, older as compared to younger workers reacted less negatively to low motive congruency. In fact, younger workers reported more demotivation than their older colleagues (Thielgen et al. 2015a). In contrast, older as compared to younger workers were found to possess more volitional strength that seemed to enable them to better compensate low motive congruency with self-management strategies (cf. Kehr 2004). Thus, the implications of higher age for the experience and motivational or behavioral consequences of balance states seem to be more complex and additionally qualified by the type of outcome measure as well as alternative coping resources (see also Hertel et al. 2015).

Of course, these are only initial empirical results of an emerging research theme that have to be replicated and extended, including critically scrutinizing alternative explanations. For instance, more general age differences such as shifts in goal priorities (e.g., Kooij et al. 2011) or decision-making strategies (e.g., Schwarz and Knäuper 2000) should be considered when examining the relation between age and measures of motivational balance at work. Moreover, moderating conditions should be considered that might integrate partly opposing predictions on the relation between age and motive congruency or need–supply fit. For instance, Zacher and colleagues (2014) have argued that person–environment fit might sometimes be *lower* for older workers because they are more likely to remain in jobs with poor fit due to fewer perspectives to find a new job. Thus, the direction of the age-fit link

might well be moderated by industry sector, required competencies, or other job-related aspects. Moreover, person characteristics such as dispositional affectivity, self-efficacy, or proactivity are important. These different factors are best integrated into an interactionist framework.

As a final group of moderators, differences in the conceptualizations and methodologies of balance-related measures are to be considered. Whereas the current entry has focused on subjective measures of need–supply fit, more objective measures of person–environment fit might yield different results (see Zacher et al. 2014, for a discussion of different foci of person–environment fit construals) and help to disentangle adjustments in the perception of individual motives from existing individual needs. Moreover, research on the two concepts of motivational balance considered in this entry, i.e., motive congruency and person–environment fit, has rarely been connected in the literature so far, even though the constructs are closely related. Indeed, considering only explicit motives when measuring need–supply fit is neglecting a major part of an individuals' motivation (see Thielgen et al. 2015a, for initial data integrating motive congruency and task characteristics). Thus, a more integrative consideration of person–environment fit for both explicit and implicit motives might yield a more complete picture of motivational processes and changes across age.

Given that chronological age is often a standard variable reported in empirical research, meta-analyses on the connection between age and different measures of motive congruency, person–environment fit (considering both subjective and objective fit), and related measures (e.g., flow, self-regulatory fit) might be feasible (e.g., Köllner and Schultheiss (2014). Of course, such analyses require a sufficient age range to examine age contingencies reliably.

To provide insights on causal processes, longitudinal designs are inevitable, both for age effects on motive congruency and on person–environment fit. For instance, given the available cross-sectional research, it is still unclear whether high perceived need–supply fit affects job satisfaction, or vice versa. In particular, this issue needs further exploration in light of findings that older adults seem to

be more likely to use heuristics (e.g., mood as information) when answering self-report questionnaires (e.g., Schwarz and Knäuper 2000).

Last but not least, although being in its infancy, this research offers various practical implications. Given the positive implications of balance both within person (e.g., motive congruency) and in interaction with the environment (e.g., need–supply fit), it might be worthy to consider strategies that increase such congruency and fit, for instance, age-differentiated human resource management and work design that include autonomy and resources for job crafting. Moreover, coaching interventions might not only counsel workers with regard to problems with the external environment (e.g., supervisors, colleagues, customers) but also with regard to more hidden stressors due to motivational conflicts between the way they perceive themselves (explicit motives) and the way they experience enjoyment and pleasure with what they are doing (implicit motives). While such interventions are certainly beneficial in occupational contexts both from a workers' and an employers' perspective, similar interventions are also conceivable in nonwork contexts in order to support individuals on their quest toward achieving a good balance of their needs, motives, and environmental supplies across their life.

## Cross-References

- ▶ [Affect and Emotion Regulation in Aging Workers](#)
- ▶ [Age Stereotypes in the Workplace](#)
- ▶ [Job Crafting in Aging Employees](#)
- ▶ [Work Design and Aging](#)
- ▶ [Work Motivation and Aging](#)

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## Music Therapy, Applications in Geropsychology

Jessica V. Strong  
Geriatric Mental Health, VA Boston Healthcare System, Boston, MA, USA

*“I regard music therapy as a tool of great power in many neurological disorders – Parkinson’s and Alzheimer’s – because of its unique capacity to organize or reorganize cerebral function when it has been damaged.” – Oliver Sacks*

### Synonyms

Music healing; Music-facilitated psychoeducational strategy

### Definition

“Music therapy is the clinical and evidence-based use of music interventions to accomplish individualized goals within a therapeutic relationship” – American Music Therapy Association.

The population of adults in the USA is aging quickly, led by the baby boomer generation who began turning 65 in 2011. Average life span strongly influences the number of older adults in

the country, and it has risen by almost 30 years in the last century (Center for Disease Control and Prevention 2013). The CDC and US Department of Health estimated that the number of older adults in the USA will be 89 million by 2050, which is double the number of older adults in 2010 (Center for Disease Control and Prevention 2013). Although Americans are living longer, they are also coping with more chronic health conditions, including heart disease, cancer, stroke, neurocognitive disorder (i.e., dementia), and Parkinson’s disease. It is imperative that interventions are developed and practiced to address not only the underlying biology and physiology of these chronic medical conditions but also their comorbid quality of life and psychiatric features.

Music therapy is one such intervention that has become more widespread in recent years for treating a variety of populations and conditions, including children with autism, adults with serious mental illness, and older adults with neurocognitive disorders or other health conditions. Music therapy is a versatile intervention that can be implemented in a variety of settings, including hospice and palliative care, long-term care and rehabilitation facilities, and the home. The benefits of music therapy in treating different conditions and improving overall quality of life can be pronounced. The goals of this chapter are to help the reader better understand what music therapy is and how music therapy developed as a field. In addition, it will discuss current evidence for the effectiveness of music therapy and, finally, provide practical applications for the use of music therapy with older adults across a range of functional levels.

### Music Therapy Defined

Music therapy can take many different forms, depending on the patient’s abilities and goals. For the purpose of this chapter, clinical music therapy (as described below), as well as music used therapeutically outside of the licensed clinical profession, will be discussed. The American Music Therapy Association defines music therapy as “the clinical and evidence-based use of music

interventions to accomplish individualized goals within a therapeutic relationship by a credentialed professional who has completed an approved music therapy program” (American Music Therapy Association 2015).

Music therapy can be implemented with an individual or in a group setting and can be receptive or active. Receptive music therapy involves the implementation of music listening (i.e., live or recorded) for the patient by the therapist, whereas active music therapy involves therapist and patient equally in the session. A session can include singing or playing along to popular or preferred songs, listening to songs for later discussion, improvisation, song writing, or the use of drumming and rhythms. In some settings, caregivers or family members can be included in session to explore meaningful communication. Group music therapy can encourage social interactions among group members and increase positive interaction with the environment. In either group or individual sessions, music therapists often employ techniques such as music listening, music reminiscence, or music play along.

The form of a music therapy session often depends on the setting and the population; there is no “typical” music therapy session. Music therapy with individuals who have more severe disabilities may be dictated primarily by the individual and his or her needs on the day of session, rather than by an external structure imposed by the therapist. Music therapy sessions with higher functioning individuals may be more organized and include more complex activities or even manualized treatments (i.e., working through planned, specific activities over the course of the session). The frequency and length of sessions depend on the individual’s need. Sessions can range anywhere from 15 minutes up to an hour or longer. Some individuals meet with a music therapist daily, others weekly or biweekly.

### History of Music in Medicine

Music is a universal activity that has spanned much of human history and has been used as a form of intervention for centuries (Bradt 2006). Prehistoric tribes are thought to have used rhythms, drumming, and chanting as a way of

warding off illnesses and evils. Priests in ancient Egypt were required to be proficient at music and healing, evidence that music played a role in medicine even as far back as 5000 BC. Hippocrates believed that music had the power to bring equilibrium to those who had an imbalance in their physical or psychological being. Aristotle and Plato wrote about the effect music had on behavior and health (Bradt 2006).

The first known English publication discussing music as medicine was published in 1729 by Richard Browne (*Medicina Musica*) (Bradt 2006). In the early 1800s, two medical students of Dr. Benjamin Rush, one of the fathers of modern-day psychiatry, published their dissertations on how music influenced the course of treatment for a disease. Later that same century, a study was published on the effect of music on sleep, emotional state, and health.

Music therapy as licensed clinicians practice today began to develop after World War I (American Music Therapy Association 2015). Physicians and nurses treating veterans all over the country documented significant improvements in the veterans’ physical and emotional healing following interactions with musicians visiting and playing in the hospitals. The first music therapy textbook was published in 1936 (*Music in Institutions*), and the first formal degree in music therapy was founded at Michigan State University in 1944. Early societies, like the National Society of Music Therapeutics (founded in 1903), did not last. However, the National Association for Music Therapy (founded in 1950) and the American Association for Music Therapy (founded in 1971) combined in 1998 to form the American Music Therapy Association. International associations have also been formed, including the Canadian Association for Music Therapy, the Japanese Music Therapy Association, and the World Federation of Music Therapy.

### Music Therapy: Efficacy and Application

#### Study Designs

Many music therapy studies employ a randomized controlled design. Typically, participants in these studies are randomly assigned to one of two

interventions: music therapy or standard care (e.g., medication management or physical therapy). Randomized controlled trials (RCTs) are the gold standard for intervention research. However, the quality of extant music therapy studies is variable. Some common issues have been described in the literature (Nilsson 2008). Generally the symptom raters are not blinded to the conditions of the intervention, leaving open the possibility for experimenter bias. In addition, studies often use convenience samples of older adults (e.g., from a single nursing home), leading to only semi-secure randomization. Other issues include lack of explicit description regarding validity of measures used to assess symptoms, using non-validated questionnaires to assess impact of music therapy intervention, or not calculating estimated power and sample sizes.

### Normal Aging

Certain forms of music therapy can be implemented with normal aging older adults to address psychosocial aspects of the aging process. Contrary to Freud's belief that individuals do not learn or change after mid-life, it is well supported that changes occur in aging, including changes to a person's social network and social role. Retirement, decreased mobility, increased isolation, and other disabilities can contribute to changes in mood and social support in late life. A review of 16 individual studies found that music participation in normal aging older adults who sang in choirs added value to the aging experience, for example, increase social networks or subjective quality-of-life ratings (Skingley and Vella-Burrows 2010). In one study (Skingley and Vella-Burrows 2010), older adults were assigned to a chorale (i.e., weekly singing for 30 weeks with several performances) or usual activity (e.g., no changes to their daily routines and activities). After 1 year, the older adults who were in the choir had lower depression and loneliness ratings and fewer reported health problems compared to the older adults who did not sing in the chorus. The singing group also became more socially active in other areas of their lives across the year. For older adults, involvement in a choir can provide a sense of purpose and encourage

interactions with peers to increase social support. Choirs that can accommodate older adults including those who do not know how to read music (e.g., by providing recordings of new songs or singing repertoire that is largely known by the group), or those with transportation difficulties (e.g., by providing transportation to and from rehearsals or performances), may be even more successful.

### Sleep

The architecture of sleep has been found to alter with age, due to changes to the circadian rhythm that may contribute to insomnia, daytime sleepiness, and the onset of disorders, such as obstructive sleep apnea. Many well-controlled studies have addressed the use of receptive music therapy to treat sleep disorders with mixed results. Most studies randomly assign older adults to listen to slow and soft music before bed. Multiple studies have failed to support changes on objective polysomnography tests (Chang et al. 2012; Lazic and Ogilvie 2007) that record brain waves and oxygen levels during sleep. Often participants are tested in the sleep lab of a hospital. In one study of older adults with chronic insomnia, listening to music had a significant effect on some stages of sleep, including stage 2 (shorter) and REM (prolonged). However, the music had no effect on overall sleep quality as measured by the polysomnography test and self-report questionnaires (Chang et al. 2012). When music conditions are compared to silence or to simple tones, music does not seem to improve the quality of sleep as measured by formal, objective sleep measures. However, participants without insomnia who are assigned to listen to music often report higher levels of relaxation before falling asleep compared to participants listening to nothing or to tones (Lazic and Ogilvie 2007). They may also perceive that they fall asleep more quickly when listening to music, but polysomnography results show that this is not the case.

A systematic review of non-pharmacological interventions found "adequate evidence of a moderate effect" of music-assisted relaxation on sleep. The evidence was stronger for music-assisted relaxation than other widely used sleep

interventions, including cognitive behavioral therapy for insomnia (CBT-I), progressive muscle relaxation (PMR), and stimulus control (e.g., sleep hygiene, including no naps during the day, limiting alcohol and caffeine intake within hours of bedtime, and implementing a bedtime routine to cue the body that it is time for sleep), though the effects were slightly smaller (De Niet et al. 2009). Music-assisted relaxation combines relaxation techniques (deep breathing and PMR) with music that is chosen for its slower rhythm and relaxing quality.

### Psychiatric Conditions in Late Life

Studies have examined the effects of receptive music therapy on common psychiatric conditions in late life, including depression, anxiety, and pain. Results have generally been promising and consistently show a positive effect on these conditions, sometimes above and beyond other well-established interventions. Many of the studies also have low dropout rates, suggesting that individuals who participate in music therapy are engaged and invested in treatment.

**Depression and Anxiety.** Depression in late life has been linked to increases in other health problems, including cardiovascular risk and cognitive decline, making it a significant public health issue. Most published music therapy interventions to treat depression employ receptive music listening, rather than active music therapy participation. The dose of intervention is often 30–60 min of listening to preferred music daily to weekly over the course of a few days to a few months. In general, receptive music listening over time has been found to decrease scores on common depression measures for older adults (Chan et al. 2011). One study found large effect sizes for both depression (0.65) and anxiety (0.49); however, no significant differences at 6-month follow-up were seen although graph analyses suggested that the effect persisted (Erkkila et al. 2011).

Listening to relaxing music can reduce both physiological and subjective ratings of anxiety. One study found that individuals listening to music had decreases in heart rate, systolic blood pressure, and subjective ratings of anxiety across a variety of hospital and community settings

(Wang et al. 2014). In one study of older adults (65+yo) undergoing cardiovascular surgery, the experimental music group listened to preferred music during and after surgery, whereas the control group received care as usual. The results found that the older adults who listened to music experienced significantly lower subjective symptoms of anxiety (Twiss et al. 2006). However, to contrast these single studies, one review paper of subjective anxiety ratings reported that only half of the studies reviewed (12 of 24) found significant decreases in anxiety ratings (Nilsson 2008). It is possible that even when physiological measures (e.g., blood pressure, heart rate) show effects of music, the subjective experience takes longer to respond and is not captured on these questionnaires.

**Chronic and Operative Pain.** Pain can be a difficult syndrome to treat. Concerns about proper pain management coupled with concerns about prescribing pain medications that may have an effect on cognition in older adults necessitate alternative interventions for pain. Receptive music therapy has shown promising results in the treatment of chronic pain in adults. In one RCT of adults (reviewed in Chan et al. (2011) participants 21–65 yo) with chronic pain were randomly assigned to standard music (choice of recordings), patterning music (chose music to match or reverse their mood or muscle tension), or control groups who did not listen to music. Music groups reported less pain than control groups after 1 week (20% reduction in pain in both music groups, 2% decrease in control). Music groups showed a decrease in depression scores as well (23% and 15%).

Review papers have documented an effect of music on recovery time and pain ratings before and after surgery. One study found that individuals randomly assigned to the receptive music group had significantly less pain, as measured by the number of pain medications requested and received by the patient the day after surgery. Qualitatively, of the participants who had at least one episode of confusion as documented by nursing notes, 95% of these were in the control group (5% in the experimental music group). This study also measured distance of ambulation (in feet) that

each participant completed in rehabilitation. The experimental group ambulated a significantly longer distance compared to the control group on all 3 days postoperative (McCaffrey and Locsin 2006). A particularly comprehensive review included the results on 42 studies on the effect of receptive music on pain across operative settings (preoperative, postoperative, and intraoperative, not necessarily mutually exclusive). Just over half of these studies found that music had a significant effect on reducing pain ratings.

### Neurocognitive Disorders

A majority of music therapy studies have focused on the treatment of neurocognitive disorders (NCDs) to increase mood, social interactions, and quality of life for individuals with this disease. Receptive and active music therapies are used with equal frequency in this population. Music may allow those with an NCD to continue to express and experience their personhood, which can allow for meaningful exchange between individuals with an NCD and family or friends. Because music can be nonverbal, it provides the perfect medium for individuals whose verbal abilities are compromised to continue to express emotions. Studies have found that music and music therapy may improve food intake and reduce behavioral and psychological symptoms of NCDs (agitation, aggression, wandering, restlessness, irritability, social and emotional difficulties); however, studies in this area generally have a weak study design and small sample sizes.

The most frequently published subset of literature examining music therapy as an intervention for NCDs is for aggressive behavior and agitation. Two review papers reported that all (Skingley and Vella-Burrows 2010) or the vast majority (Wall and Duffy 2013) of studies reviewed showed a significant effect of music therapy on agitated behavior in NCDs. Results have consistently supported short-term decreases in agitation and aggression and increases in social engagement and reciprocity after a music therapy intervention. Although patients are often less agitated during and immediately following music therapy sessions, most studies showed no long-term effects on agitation levels across time. One study

within this review found that even though there were no long-term behavioral differences (1 month after music therapy), saliva samples revealed that patients who received music therapy continued to have reduced levels of a psychological stress indicator.

Multiple studies of caregiver interaction with music therapy suggested an even stronger effect in decreasing agitation and increasing socialization when the caregiver sings or leads the musical experience (Skingley and Vella-Burrows 2010). When caregivers sang to their family member as they were performing care, agitation and aggression were lower, and individuals with NCD showed more environmental awareness (e.g., frequency of social interactions, eye contact, smiling). This effect was stronger than listening to background music during care rituals. Multiple studies cited in this review also found that caregivers provided enhanced care if they were singing through improving nonverbal communication. It is unclear if the effect of music on the caregivers is independent from the care recipient or if decreases in the care recipient's agitation, aggression, or irritability are the driving force of this effect. One study reviewed in this paper found that listening to a loved one recalling a story decreased verbal agitation whereas listening to music decreased physical agitation.

Some studies have also addressed music therapy as an intervention for individuals who have an NCD and comorbid depression. One review found a short-term improvement in mood but again no evidence for long-term changes (McDermott et al. 2013). Most studies were not determined to be "high quality" for reasons discussed previously. One RCT of older adults with NCD living in a long-term care nursing facility compared music therapy (live musician led singing and active listening) to reading therapy (social and reading activities, including local news stories, short stories, and telling jokes), which was conducted three times weekly for 2 months. Participants had a 5-week "washout" period and then attended the other group (e.g., residents in the music group for the first 8 weeks attended the reading group). They found a main effect for group belonging – participants who were in the

reading group reported higher levels of belonging. Participants who attended at least half of the music therapy sessions showed significant improvement on quality-of-life self-esteem scores over time. Participants who screened positive for depression showed decreases in these symptoms over time that were stronger in the music group than in the reading group (Cooke et al. 2010).

### Parkinson's Disease

Many studies have examined the effects of active music involvement in patients with Parkinson's disease. RCTs have found that patients who are assigned to receive music therapy sessions in groups show improvements in vocal strength, verbal and nonverbal expression (Elefant et al. 2012), and gait (e.g., using music as an external auditory cue; de Bruin et al. 2010). Singing within active music therapy sessions has shown to improve vocal strength and volume as well as strengthen facial muscles, which may lead to more expressive facial expressions. In addition, studies examining the effect of music therapy with individuals with Parkinson's disease have large effect sizes (0.8 and higher).

### Stroke

Similar to gait training in Parkinson's disease, stroke patients whose gait has been affected can also benefit from gait training in music therapy (Bernatsky et al. 2004). Two single studies (reviewed in Chan et al. 2011; Nayak et al. 2000) randomly assigned participants poststroke to standard rehabilitation or standard treatment plus music therapy. The studies found that the individuals who received music therapy in addition to their standard rehabilitation therapies were rated by family and staff to have improved mood, have more social interactions, and be more cooperative in other therapies (physical and occupational) and show greater gains in cognitive domains of verbal memory and attention when compared to individuals who were not receiving music therapy. These studies provide some preliminary support for music therapy in the early recovery stages from stroke for improvement in mood and possibly cognition.

### Future Directions

Future research in this field should focus on improving the quality of the available intervention studies. Factors like calculating effect sizes, using well-established and validated measures to assess for change, and designs that include random assignment and blinded raters are important to help establish music therapy as an efficacious and standard intervention. Additionally, research on the mechanisms of change related to music therapy as an intervention would be helpful to understand what it is about music that leads to changes and improvements in the short term. A better understanding of these mechanisms will increase the field's ability to apply these interventions to older adults across the spectrum – from flourishing older adults adjusting to normal changes in late life to those in long-term care who struggle with psychiatric and/or medical conditions.

### Cross-References

- ▶ [Anxiety Disorders in Later Life](#)
- ▶ [Behavioral and Psychological Symptoms of Dementia](#)
- ▶ [Caregiving and Carer Stress](#)
- ▶ [Challenging Behavior](#)
- ▶ [Depression in Later Life](#)
- ▶ [Insomnia and Clinical Sleep Disturbance](#)
- ▶ [Pain and Pain Management](#)
- ▶ [Palliative Care](#)

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## Narrative Approaches with Older Adults

Sunil S. Bhar  
Department of Psychological Sciences,  
Swinburne University of Technology,  
Hawthorn, VIC, Australia

### Synonyms

Account; Chronicle; Description; History; Portrait; Portrayal; Recital; Record; Rehearsal; Report; Rendering; Sketch; Statement; Story; Tale

### Definition

Narrative = a spoken or written account of connected events; a story.

People are storytellers. From fireplaces to crowded cinemas, humans are immersed in the telling, sharing, and receiving of stories. Stories are exchanged to entertain, to express values, to form social connections, to make sense of experiences, and to teach. People understand their current experiences, anticipate the future, and reflect on the past, through stories (McAdams and McLean 2013). As social beings, individuals construct their sense of who they are – their identity – through the telling of stories. The telling of stories, or the narrative, offers a reconstruction of memories of past events and expectations of the

future, in such a way that the story no longer simply is a disjointed and factual account of one's experiences, but rather a simplified and organized rendition of one's view (Neimeyer et al. 2008). As people tell stories about their experiences, these narratives begin to define their sense of identity (Singer 2004). As cogently expressed, "selves create stories, which in turn over time create selves" (McAdams and McLean 2013, p. 235). Through such stories, people convey "who they are now, how they came to be and where they think their lives may be going in the future" (McAdams and McLean 2013, p. 233). From this perspective, identity can be viewed as "a narrative achievement. . .achieved through the stories that we tell about ourselves, the stories that relevant others tell about us, and the stories we enact in their presence" (Neimeyer et al. 2008, p. 270).

In analyses of narratives about suffering, studies have shown that adults who grow from, or feel happy following, negative life experiences make narrative sense of such experiences in a positive manner that emphasizes their agency (autonomy), communion (social connections), and redemption (reaching a valued outcome) (Adler et al. 2015). Narrators who derive such meanings from negative experiences and who emphasize the learning, agency, growth, and personal positive transformations related to those events tend to demonstrate psychological well-being, generativity, and other indices of successful adaptation to life. For example, in speaking about the death of a relative, the

narrator may emphasize a redemptive story of how the death reinvigorated a reconceptualization of one's priorities. Such observations have suggested that the way in which an individual constructs personal narratives may impact the trajectory of their mental health over time (Adler et al. 2015; McAdams and McLean 2013).

Such observations have also spurred a burgeoning interest in narrative approaches with older adults. During late life, adults may experience a number of changes and transitions that require reorganization of relationships and roles, a reconstruction of assumptions and expectations, as well as validation of existing self-views. The death of a spouse or life partner, functional and health-related difficulties, and reduced autonomy can destabilize the meanings that individuals have constructed about themselves and their world. The narrative of such events from the perspective of the older person can have significant effects on the trajectory of their growth, emotional reactions, and well-being.

### What Are Narrative Approaches?

Narrative approaches in psychotherapy are those that assist individuals tell their story to validate or “re-story” their lives (McAdams and McLean 2013) – that is, to explore stories that are self-empowering. To a large extent, all psychotherapies reconstruct or validate meanings individuals hold about themselves, others, and their lives, even if such focus is not explicitly declared. For example, person-centered therapies allow the client to express their views and reflections and discover personal resources and strengths (Rogers 1951). Cognitive and behavioral therapies focus on assisting clients challenge their dysfunctional cognitions (Beck et al. 1979). Solution-focused therapies allow for the expression of personal goals and wishes (De Jong and Berg 2012). Psychodynamic therapies allow for an exploration of understandings about early and midlife experiences (Garner and Evans 2010); and interpersonal therapies draw out the attachment-based perceptions of self in context to others (Hinrichsen 2006). Despite the differences in language or

terms, the client's narrative is addressed within such therapies.

However, some therapeutic approaches are arguably more explicit in their focus on the client narratives and consider these narratives as central mechanisms of therapeutic change. These include narrative therapy, reminiscence therapy, dignity therapy, expressive writing, and constructivist approaches. Common to these approaches is the view that stories are transformative – that is, by developing alternative or empowering stories of self, the individuals can feel, act, and think in more helpful ways, resulting in improved emotional, social, and physical well-being. This entry outlines four of these approaches and the research on their efficacy when used with older adults. Reminiscence therapy is addressed in another entry.

### Narrative Therapy

Narrative therapy is a postmodern approach to the practice and theory of psychotherapy, which is based on the belief that identity is formed in social, cultural, and political contexts and illuminated through stories and narratives (White and Epston 1990). The underlying principle of narrative therapy is that the world is socially constructed, that is, it is created and grounded in multiple narratives or stories told by the self or others (Gergen 1994). The therapy involves uncovering the client's dominant or problem stories, understanding them, and retelling or “re-authoring” them in alternative and more empowering ways. The therapy is focused on guiding the clients toward crafting life stories that can be used throughout therapy to support therapeutic change.

Narrative therapy involves two major stages. First, the focus in therapy is on understanding and deconstructing the dominant unhelpful story of the individual. In this phase, the individual is encouraged to externalize, objectify, or personify the problem and talk about it as a “thing.” The problem is externalized which makes the situation more manageable, and thus the problem, not the person, becomes the target for change. In the

second stage, the individuals are encouraged to reconstruct an alternative story, where alternative meaning systems are embellished through the incorporation of unique outcomes and divergent perspectives. In this phase, props (e.g., letters, certificates, self-declarations), or other people, are drawn upon to reinforce these alternative stories (Morgan et al. 2011). For example, an older individual may communicate to the therapist the dominant view of their life as involving sickness, degeneration, and frailty. Through working in therapy, this story is embellished to include the notion of the client as being a survivor to have endured beyond these physical and health challenges. The individual may then be presented with a “certificate of endurance” by the therapist, to acknowledge this new account of the client’s identity.

Narrative therapy originated in work with children and family therapy; hence, little is known about the use or efficacy of narrative therapy with older adults. Some authors, however, argue that the therapy is applicable to older adults (Morgan et al. 2011). Using a case study approach with an older woman experiencing depression, Kropf and Tandy (1998) described how narrative therapy provided the client with an opportunity to examine her life from a “survivor” perspective. The therapy was described as empowering as it allowed the older woman to cast herself in an alternative and more positive role. Gardner and Poole (2009) used an ethnographic study design involving participant observation and semi-structured interviews to investigate the experience of older adults (aged 55–70 years of age) with addiction attending an eight-session narrative therapy group. The findings from the study suggest that narrative therapy was helpful for older adults with addictions. All participants described group experiences as positive and reported the helpfulness of various aspects of the group – such as the externalization of the problem (“I’m not a bad person; I’m just a person with a problem”; p. 611) and the creation of an alternative story (“we are challenged by narrative therapy to...become aware of the story we’re telling ourselves and make choices of what short story we want to tell ourselves...”; pp. 611–612).

The researchers suggest that the approach suits older adults, because older adults have many stories to recall and to employ as alternatives to the dominant negative discourse. The researchers state that the therapy “provides the space and time for narratives that surprise, delight, or that that have been long buried and tucked away as “irrelevant” to the problem” (p. 615).

## Dignity Therapy

People receiving palliative care can experience substantial physical, emotional, and existential distress, which leads to a reduced quality of life. For over a decade, dignity-conserving care has been recognized as one of the most important therapeutic considerations in palliative care (Chochinov 2002). Dignity therapy is an intervention designed to reduce existential suffering for patients approaching the terminal phase of illness. The therapy was developed from the premise that the dignity and generativity of the dying patient; that their sense of being worthy of honor, respect, or esteem; and that their sense of having an influence across time in the service of others could be validated. Patients participating in dignity therapy are invited to discuss issues that matter most and are asked to reflect on how they wish to be remembered (Chochinov 2012). The patient is asked questions such as “Tell me a little about your life history; particularly the parts that you either remember most or think are most important; When did you feel most alive?; What are the most important roles you have played in your life? And what have you learned about your life that you would like to pass along to others” (Chochinov 2012, p. 71). These questions serve to address issues that are closely related to the patient’s sense of personhood and hence to allow patients to feel that their valued narrative of self is acknowledged and validated.

The therapist assumes a facilitative role to guide the flow of the interview based on the patient’s interests and responses. The therapist pays close attention to what is said and how it is said and to modify, embellish, or add questions based on patient cues. The therapist serves as a

caring active listener who operates from a dignity-conserving stance, conveying respects for the patient, their thoughts, and their feelings. The aim of the interview is not to record the patient's complete biography, or simply "happy stories," but rather the patient's story, as defined by the patient.

Usually, the therapist meets with the patient for 1–2 sessions for a total of 1–2 h, in order to record the interview. These recordings are then transcribed and edited. The editing of the transcription involves rephrasing parts of the transcription so that it reads more like prose than a recorded conversation, is coherent, is correct in terms of time sequence, and has a dignified ending. The edited transcript is then returned to the patient for a final review. The patient has the opportunity to amend the transcript, add to it, or delete parts of the transcript. In a final meeting with the patient, the patient is presented with the final edited and reviewed generativity document (Chochinov 2012). The narrative of the individual's story is hence translated into a concrete document, which serves not only as a reminder to the individual of their core self but also as a means for leaving behind a legacy or message for others.

Evidence for the benefits of the therapy has been demonstrated through research with hundreds of patients (Chochinov et al. 2005). In 2011, a randomized controlled trial involving 441 patients found that, compared to usual care or client-centered care, dignity therapy was rated by patients as significantly more likely to have been helpful, in terms of improving quality of life and increasing a sense of dignity (Chochinov et al. 2011). Dignity therapy was also reported to be significantly better than standard palliative care in reducing sadness or depression.

In a novel application of dignity therapy to older adults living in residential care, Hall and colleagues (Hall et al. 2012) randomized 60 residents to an intervention (dignity therapy) or control (standard care) condition in 15 residential facilities in South East London. The aims of the study were to assess the feasibility, acceptability, and potential effectiveness of dignity therapy to reduce psychological and spiritual distress in such

populations. There was an overall significant reduction in dignity-related distress, although no significant differences in reduction were found between the conditions. The study authors suggested that such results may have been due to low levels of distress at baseline and hence the little room for improvement. However, compared with the control group, residents who received dignity therapy reported feeling more positive about their participation in the study and more strongly agreed that their participation heightened their sense of meaning, purpose, and hope. Although dignity therapy did not influence distress per se, it seemed to enrich the end-of-life experience for residents who received the intervention. Although more research is warranted, this study suggests that the application of dignity therapy may be beneficial to older adults, beyond the confines of palliative or hospice settings.

## Expressive Writing

In all therapies, disclosure may be a powerful therapeutic agent. The act of disclosure alone – apart from any feedback received by the therapist – may be the basis of much of the healing process that takes place in therapy. Over the last few decades, this speculation has been examined through simple verbal self-disclosure through expressive writing (Jones and Pennebaker 2008). In the expressive writing paradigm, a person typically writes about emotional, traumatic, or distressing experiences (Pennebaker 1997). The person does not talk with another person, disclose information to another person, or receive feedback. The basic expressive writing paradigm involves writing about assigned topics for 10–30 min per day for one to five consecutive days. Usually, even with assigned topics, individuals write about a broad range of experiences and either choose their own topic or individualize an assigned topic.

Research has found that such writing has been associated with physical and psychological benefits. Across studies, when people are randomly assigned to write about emotional upheavals,

they show improved health outcomes relative to controls who write about superficial topics (Esterling et al. 1999; Jones and Pennebaker 2008; Pennebaker and Seagal 1999). For example, students who write about emotional topics show improvement in grades in months following the writing; senior professionals laid off from their jobs get new jobs more quickly after writing and report using less alcohol. In a meta-analysis of 13 randomized controlled trials examining the mental and physical health benefits of expressive writing, Smyth (1998) found an overall Cohen's  $d$  of 0.47 across outcomes, representing a 23% improvement among intervention participants, compared to control participants.

In what way might such writing constitute a narrative approach? Writing about trauma in multiple writings has been considered as a means for individuals to reframe or make sense of trauma, so that memory of the trauma no longer causes physiological arousal. For example, writing may help individuals link their trauma to later benefits, or to the development of wisdom, and hence develop greater meaningfulness in life. As people inhibit thoughts or feelings, they may be deprived of opportunities to assimilate, accept, or feel a sense of control over such experiences and may paradoxically spend excessive amounts of time ruminating about them. Therefore, expressive writing may assist individuals to think through these emotions and thoughts and thus bypass inhibition. In support of this speculation, some research suggests that individuals who have difficulties with, ambivalence about, or few opportunities for disclosing feelings may benefit more than those who tend to discuss their emotions more deeply (Esterling et al. 1999).

Despite the proclivity for older adults to reminisce and tell stories of their past, there is a surprising lack of studies that have examined the outcomes of expressive writing in such populations. Expressive writing has been evaluated primarily in young people (e.g., college students). Existing studies of the effects of expressive writing on mental health and physical outcomes for older adults have produced equivocal findings. In one study on the effects of expressive

writing on physical and emotional well-being in older adults (Klapow et al. 2001), 45 patients aged 66 years or older who attended a university-based geriatric primary care clinic in Alabama were randomized to an intervention or control condition. Patients assigned to the treatment condition were asked to write about thoughts and feelings associated with the most distressing event of their lives. Those allocated to the control condition were asked to write about what they did to stay healthy. Participants in both conditions were asked to write for 20 min, three times over a 2-week period. The decrease in somatic and distress symptoms and reduction in the of outpatient services were observed to be greater in the treatment group than in the control group, although these effects were not statistically significant.

Smyth et al. (1999) randomized 112 patients aged between 41 and 51 to an intervention or control condition. Participants in the intervention condition were asked to write about the most stressful experience they had ever undergone, while those in the control condition were asked to write a description of their plans for the day. Participants suffered from mild to moderately severe asthma or rheumatoid arthritis. Those who wrote about stressful life experiences had clinically relevant changes in physician-rated and objective indicators of health status and disease activity at 4 months, compared to those in the control group. The researchers explain that such improvements may have been triggered by altered representation of past traumas facilitating improvements in coping with stressful events. However, in a partial replication and extension of this study to 270 community-based patients with rheumatoid arthritis (average age = 55–60), no effects were found for the expressive writing intervention (Broderick et al. 2004).

Finally, Mackenzie et al. (2007) compared the effects of expressive writing to time management and history writing on caregiver stress levels in a sample of 40 older caregivers (mean age = 61.53 years). Participants were asked to write for 20 min on four occasions over a 2-week period. Those in the expressive writing condition were asked

to write about current stressors; those in the time management condition wrote about how they spent their time; and those in the history writing condition wrote about twentieth-century Canadian or world events that were not personally impactful. Expressive writing and history writing were not associated with significant improvements in caregiver stress. Conversely, caregivers in the time management condition experienced significant mental and physical improvements after writing. As discussed by the researchers, these results suggest that expressive writing focused on negative experiences may be less effective for older than younger adults. They also suggest that expressive writing that is focused on positive aspects of caregiving may be more effective, than writing about stressful experiences. In support of this suggestion, a reanalysis of the data by the researchers (Mackenzie et al. 2008) found that those who wrote about their current stressors in a positive, optimistic, and future-oriented tone had improved outcomes on anxiety and insomnia.

### **Constructivist Approach to Grief Therapy**

The loss of a loved one can represent a profound life transition that disrupts the survivor's self-narrative, mood, social and occupational functioning, and fundamental assumptions of predictability, fairness, and control (Janoff 1992). For some survivors, the loss leads to a significant sense of purposelessness and futility about the future, while for others, a major reorganization of family roles, traditions, and interdependencies (Neimeyer et al. 2008). The loss of siblings, spouse, health, and home can result in the loss of validation of identity and security for older adults.

Post-loss resilience has been understood as a process of meaningful reconstruction marked by successful assimilation of losses into a positive pre-loss narrative structure and/or the accommodation of these losses into an expansive post-loss narrative (Neimeyer et al. 2008). For example, an

individual may view the death of an older sibling in late life as a sad but anticipated expression of natural order. Alternatively, individuals may reorganize, deepen, or expand their self-narratives to accommodate the changed life of the survivor. For example, an individual may consider the loss as a trigger for self-reliance and an opportunity to affirm existing resources and supports.

From a constructivist standpoint, grief can be viewed as "a struggle to reaffirm or reconstruct a world of meaning that has been challenged by loss" (Neimeyer et al. 2008, p. 270). Converging evidence from several investigators links an inability to do so with intense and protracted grieving, and that making sense of adversity significantly mediates the relationship between the impact of unexpected deaths from suicide, homicide, and accidents and grief symptomatology of the survivor (Currier et al. 2006). Other studies, however, have been somewhat less clear about the role of sensemaking in reducing grief-related symptoms (Coleman and Neimeyer 2010).

How can the therapist operate from a constructivist perspective to assist the survivor reestablish continuity and meaning in a life story that has been challenged by loss? A variety of biographical methods, metaphoric and poetic techniques, and narrative procedures have been described in the literature (Neimeyer 1999). For example, Neimeyer (1999) describes the techniques such as (a) writing an epitaph that affirms the meaning of the deceased to the survivor, (b) maintaining written or audio-recorded journal of one's experience and reaction to the loss, (c) acknowledging the imprint or legacy of the deceased on the life of the survivor, (d) deliberately choosing to maintain a connection with the deceased through integrating objects or life projects associated with the deceased into the life of the survivor, and (e) using metaphors and poetry to express one's unique experience of loss.

In a study on the effects of a 5-week Internet-based intervention to complicated grief, (Wagner et al. 2006) offered clients (average age = 37 years old) carefully tailored writing assignments, with therapist feedback to assist them to embellish

a self-narrative that assimilated and accommodated loss. The assignments consisted of recalling and recording the story of the loss as vividly as possible; drafting a letter to an imaginal friend with a similar loss to foster perspective, compassion, and meaningful attribution; integrating positive memories of the loved one into ongoing life; defining identity; sharing the story of loss with a sympathetic other; and projecting new goals. At posttreatment, clients receiving this intervention demonstrated significantly greater reduction in grief symptoms than wait list control group.

## Summary

Therapists adopting a narrative approach to working with older adults share in common a careful attention to stories of their clients, as well as to the way in which the stories are narrated. Such approaches allow for the telling of stories of one's life and self, and if indicated, to assist in the embellishment and expression of more positive stories. As seen, some approaches such as dignity therapy do not require the positive embellishment of stories, while others, such as narrative and constructivist approaches, are attentive to the development of alternative and more empowering meanings that can be drawn from adversity and losses.

The field of narrative approaches can be described as theory rich, but lacking in rigorous empirical research on its efficacy particularly with older adults. Many of the approaches have been developed with younger adults or family units, rather than for older adults. For example, expressive writing paradigms have mostly been researched using student-based samples. An exception to the youth-focused research may be found in dignity therapy, where the focus of the treatment is on the revisiting of one's life and the expression of wisdom, which is arguably most suited to individuals in later life stages. However, even in this therapy, most research is focused on adults in palliative care, rather than on older adults per se.

The dominant assumption of narrative approaches is that those stories represent a powerful frame in which to reinterpret or re-author our lives. Despite the absence of research, such an assumption provides a useful heuristic for therapists working with older adults. The essence of such treatments is to discover the story of the individual and to assist the individual to recast themselves or their situations in a way that offers purpose and validation and prompts the acknowledgement of strengths and resources. Given the abundance of experiences in late life, narrative approaches may offer older adults a means to integrate such experiences and to draw from these positive and purposeful themes.

## Cross-References

- ▶ [Clinical Issues in Working with Older Adults](#)
- ▶ [Cognitive Behavioural Therapy](#)
- ▶ [Depression in Later Life](#)
- ▶ [Interpersonal Psychotherapy](#)
- ▶ [Palliative Care](#)
- ▶ [Problem-Solving Therapy](#)
- ▶ [Psychodynamic and Humanistic Approaches](#)

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## Neurocognitive Markers of Aging

Tanya Dash<sup>1,2</sup> and Yves Joanette<sup>1</sup>

<sup>1</sup>Centre de recherche, Institut universitaire de gériatrie de Montréal, Montréal, QC, Canada

<sup>2</sup>École d'orthophonie et d'audiologie, Faculté de médecine, Université de Montréal, QC, Canada

### Synonyms

Cognitive markers; Neurobiological markers; Neurofunctional markers

### Definition

Neurocognitive markers correspond to the components of cognition, along with their neurobiological and neurofunctional bases, that exhibit changes along the trajectory of normal aging.

### Introduction

The aging of societies and globalization of activities both characterize the twenty-first century. Sustaining active aging, and particularly cognitive health, is one of the leading global public health priorities (WHO 2015). Aging is a dynamic process that spans across the entire life course. In order to distinguish between the normal evolution of cognition across the lifespan and cognitive impairments due to neurodegenerative diseases, it is critical to recognize the different neurocognitive markers in aging. This entry provides a description of those markers at both the functional and structural level, while also addressing the neurofunctional reorganization that occurs and is responsible for the relative preservation of cognitive abilities in normal aging.

Hedden and Gabrieli (2004) describe the age-related cognitive changes in three broad categories – *lifelong decline*, *late-life decline*, and *lifelong stability* – thus indicating that not every cognitive function follows a similar trajectory during the aging process. According to their

view, a number of cognitive components are characterized by a process of *lifelong decline*, including general speed of processing, working memory (the transient holding of new and already stored information), divided attention (the ability to execute more than one action at a time), executive function (the management of cognitive processes), and encoding of information in episodic memory (memory of events). These components of cognition show a gradual change from early adulthood and continue throughout one's life. On the other hand, components of cognition that are well practiced on a day-to-day basis appear to be affected only in the later decades of life and are thus included in the *late-life decline* category. Examples of such components are short-term memory (the capacity to hold information for a short amount of time) and semantic memory (general world knowledge accumulated over one's lifetime). Finally, some components of cognition are comparatively less affected, or show no changes in aging, suggesting that these cognitive skills exhibit *lifelong stability*. Examples of the latter category include autobiographical memory, emotional processing, word knowledge, and automatic memory processes (Hedden and Gabrieli 2004). These three different trajectories of cognitive changes may themselves differ in their lifelong deployment, from a steady decline over the years to a sudden, steeper deterioration at one point during the life course.

Regardless of the lifelong pattern, these age-related changes in cognition result from the complex influence of genetic determinants, which are further shaped by lifelong cognitive experiences such as those involving novel items and skills. At the same time, structural changes in the brain may begin to occur as early as the second decade of life. These changes are a product of some level of genetic, lifelong wear and tear mechanism that is part of the adaptive process. Aging is no exception to the general rule, where systems try to maintain a balance within its sub-components to give rise to optimal performance. These structural changes are not uniform across aging individuals, or within cognitive functions. In order to recognize the neurocognitive markers in aging, it is pivotal to understand both the

neurobiological changes that arise and the neurofunctional adjustments that occur in response to these changes and lifelong experiences. On one hand, the neurobiological changes that affect cognition include the loss of synaptic connections, significant neural loss in different parts of the brain, and synaptic alterations in distinctive cerebral circuits. On the other hand, lifelong changes in the neurofunctional organization of the brain are a product of adaptation to the neurobiological process and fine-tuning through life experiences. These life experiences are a crucial determinant in building what is referred to as *cognitive reserve*, or the ability to perform tasks as efficiently as possible with the use of available resources (Stern 2002). Experiences such as engaging in leisure activities, educational or occupational attainment, learning multiple languages, or skill building all contribute to the cognitive reserve mechanism (Scarmeas and Stern 2003).

Given the importance of ensuring quality of life in old age, there is a need to better understand both the natural course and the determinants of healthy cognitive aging. Understanding the typical neurocognitive changes in aging is essential in order to be able to distinguish between the effects of aging and those of neurological diseases that may occur in aging. Factors affecting these neurocognitive processes can help spread awareness and provide support for active lifestyle changes. The knowledge presently available regarding these questions comes from converging methodologies including psychophysics, behavioral studies, neuroimaging, and electrophysiological studies in the aging population. But prior to studying this question, it is important to discuss what is currently known about cognition and aging.

## Cognition and Aging

Age-related changes in the different cognitive domains are relatively heterogeneous throughout the lifespan. Such heterogeneity can be found among different cognitive domains, as well as between individuals (Salthouse 2004). Memory, attention, executive function, visual perception, and language abilities are discussed in this order

of priority in the literature related to aging. Different components of cognition show age-related changes that can differ in quality and quantity. Factors such as motivation, adaptation, or persistence can influence the detrimental consequences of cognitive decline due to aging. Furthermore, the magnitude of decline seen in older adults due to anatomical brain changes can be compensated through environmental factors and lifestyle choices. The following sections will discuss the age-related changes in memory, attention, executive functions, visual perception, and language abilities.

### Memory

Age-related decline in memory processes can take many trajectories, from linear to curvilinear. Among the different memory processes, episodic memory and working memory are the most affected by aging (Brickman and Stern 2009).

Working memory enables the processing of information from the current environment and of already stored information within a transient period of time. It is sensitive to age-related changes in executive control processes, speed of processing, and memory load. Distinct areas in the prefrontal cortex are activated in young and older adults, suggesting differences in the execution of working memory tasks (Park and Reuter-Lorenz 2009).

Episodic memory enables the registration of an event in space and time and its key feature lies in its ability to bind different fragments of the event together into a cohesive unit. This process can range from perceptual feature binding to the binding of higher-order memory process, namely, executive functions (Shing et al. 2010). There is an age-related linear and continuous decline in episodic memory from 20 to 60 years of age, followed by a steep deterioration (Brickman and Stern 2009). This decline is not influenced by the stimuli type or modality in which episodic memory is assessed (e.g., face vs. word recall; verbal vs. nonverbal task).

Implicit memory is generally preserved in older adults. Thus, the deficits in implicit memory performance, when present, mostly reflect a decline in processing speed and processing of stimuli. In the aging literature, it is usually assessed with priming

tasks (mediated through frontal and occipital regions in aging) and sequence and categorical learning tasks (mediated through frontostriatal regions in aging). However, when implicit memory deficits are present, they appear to be linked with changes in the frontostriatal circuitry (Dennis and Cabeza 2008).

Semantic memory and procedural memory are comparatively spared during the aging process and can even show some improvement with aging (Brickman and Stern 2009). This suggests that decline in semantic memory is relatively slow. Also, its decline is seen only after the seventh decade of life (Brickman and Stern 2009). The tip-of-the-tongue phenomenon is associated with the subjective accounts of memory decline by older adults (Brickman and Stern 2009). In terms of how the brain supports these types of memories, procedural memory depends on the basal ganglia and the cerebellar structures, while semantic memory is related to the posterior neocortex.

Multiple neuroimaging studies report changes in brain activation as a function of aging in areas related to memory (Grady 2008). The literature reports both positive and negative changes in neural activities depending on the task, the type of memory process, and the type of training induced. Grady (2008) highlights the existence of a distributed pattern of brain activation in older adults compared to young adults. Greater activation was reported in the ventral and dorsal prefrontal cortex in older adults during the memory task, and frontal and parietal activation was detected during the attention task. Furthermore, the medial temporal area, and more specifically the hippocampus, showed a reduced activation in memory encoding and retrieval (Grady 2008).

Episodic memory and working memory are the subcomponents of memory that are the most affected in aging. The age-related changes seen in other memory processes are mainly due to general decline in processing speed (Brickman and Stern 2009). In addition to memory, other cognitive domains are affected by aging. Attention and executive functions, which are discussed in the next section, are closely related to memory processes.

### Attention and Executive Functions in Aging

Attention is usually conceived under three broad headings: selective attention, divided attention, and sustained attention. In the older population, attentional deficits are more evident in highly demanding situations. Minimal deficits are seen in selecting relevant information (selective attention) and maintaining attention for an extended period of time (sustained attention). In general, divided attention, inhibitory control, and executive attention are three processes that are influenced by aging. Inhibitory processes, which correspond to the ability to ignore irrelevant information in the environment, experience a decline with aging. These attentional processes are influenced by memory load and executive attention (Ansado et al. 2013). Executive attention is usually discussed with both attentional and memory processes and plays a crucial function in higher-order planning and programming in day-to-day activities. Verhaeghen and Cerella (2002) report higher costs in response time for older adults but only in divided attention tasks (dual-task performance and global task switching cost) with minimal signs of deficits in selective attention. The performance deficits seen in divided attention tasks are not only caused by the effect of general slowing down but are also associated with memory load. Another approach in studying executive attention is by looking at the role of error monitoring in older adults. The anterior cingulate cortex is usually associated with error monitoring in both young and older adults, with increased activation in older adults (Dennis and Cabeza 2008). Paxton et al. (2008) report a shift in performance in older adults from a proactive (more automatic) to a more reactive (stimuli-driven) strategy of cognitive control for effective performance in any task. This is described by multiple neuroimaging studies suggesting compensatory strategies at the neural level. Grady (2008) stresses the importance of frontoparietal regions for attentional processes.

Regarding executive functions, most studies suggest an enhanced activation in different brain areas as a function of age. Enhanced activation is frequently seen in the frontal and parietal areas when performing nonverbal executive function

tasks (Madden 2007). Providing a different perspective, Jonides et al. (2000) reported less activation in the prefrontal cortex in older adults. Reduced executive function is mostly influenced by changes in frontostriatal circuits in older adults (Park and Reuter-Lorenz 2009). In addition to greater neural activation in the prefrontal cortex, a decrease in occipital neural activation in older adults during tasks requiring the participant to ignore irrelevant information is also reported (Madden 2007). In contrast to this frontal increase in brain activation, Madden (2007) reports no changes in the activation of frontal regions in older adults in an oddball paradigm; in this particular study, more activation was reported in the striatum, the thalamus, and the insula in a task involving processing of irrelevant stimuli. Similar reduced activation was reported in the left dorsal prefrontal cortex in auditory attention induced by a dichotic listening task (Thomsen et al. 2004). Selective attention, which was measured by a visual search task as well as a Stroop task, was found to be less affected in aging, suggesting an overall decline in the processing of information rather than in selective attention per se. Moreover, Persson et al. (2007) reported an increased degree of deactivation with the increase in selection demand in the default mode network, which was suspended when engaged in a verb generation task.

In summary, the execution of any goal-directed behavior changes with aging. The prefrontal cortex and the anterior cingulate cortex, which show alterations in activation, are considered to be the key areas associated with these changes. One of the major steps in allocating attention stems from the perceptual analysis of internal and external stimuli, which will be the focus of the next section.

### **Visual Perception and Visual Cognition in Aging**

Visual perception comprises visual cognition, perception, and visually guided behavior. The perceptual deficits seen in aging are associated with attentional demands (e.g., load and complexity), semantic memory, and sensory acuity. The trajectory of visual working memory performance peaks in the early twenties and exhibits thereafter a linear decline with age. Studies on the

age-related changes in regional cerebral blood flow report an increase in the prefrontal cortex activation coupled with a decrease in occipital activation. This is predominantly seen in ventral visual pathways that are involved in word and face processing (Grady 2008; Madden 2007). Age-related variations are also seen in motion perception in older adults when compared to young adults. This change is more prominent in second-order motion perception (e.g., changes in contrast, flicker, and spatial frequency). The perception of luminance changes, corresponding to first-order motion perception, shows limited age-related differences. Thus, the increase in the level of complexity in motion perception is a key factor for age-related changes in older adults. In a virtual reality environment, dynamic variations in tracking speed were seen in older adults, a phenomenon that was attributed to capacity limitation. Some neurofunctional studies report changes in the visual cortex as a function of aging during various cognitive tasks. For visually oriented cognitive tasks, enhanced activation was seen in the frontal and occipital regions, whereas the medial temporal lobes (parahippocampal gyrus) showed reduced activation (Greenlee and Sekuler 2014).

In summary, the limitation in attentional resources and the decline in processing speed can partially account for the visual perceptual deficits reported in the literature. However, positive perceptual changes do occur in aging, particularly for more complex visual stimuli.

### **Language and Aging**

Language abilities are considered to be generally stable in aging compared to other cognitive domains. Although, there are considerable reports of decline in language in older adults, comprehension largely shows an unimpaired performance compared to language production. In general, comprehension deficits in older adults are reported in studies carried out in noisy environments, which rather suggests challenges in auditory perception. It is usually supposed that language deficits are due to impairment in central cognitive processes (Shafto and Tyler 2014). Semantic processing is usually preserved at both the sentential and word level. In fact, word

knowledge continues to improve with age. Among the brain areas involved in syntactic processing tasks in older adults, the left frontotemporal network shows changes with age in the form of an increase in frontal activities in the right hemisphere, which is even detected in low-load tasks (Shafto and Tyler 2014). On the other hand, there seems to be less of a compensatory increase in prefrontal activities during semantic and phonological tasks, a phenomenon also reported in the attention and memory domains of cognitive processes. Some of the changes seen in language abilities can be considered as resulting from the impact of deficits in working memory, executive attention, and visual/auditory sensory perceptual skills (evident as a modality-specific effect: spoken/written and reading/writing). Thus, language is the cognitive domain that is the least affected in aging. As mentioned previously, some of its components (e.g., word knowledge, discourse skills) may even show improvement with age.

In sum, the different components of cognition are differentially affected by aging within and across cognitive domains. Working memory, episodic memory, divided attention, and executive functions are more susceptible to changes related to aging. These cognitive changes are usually linked to alterations in the frontal regions of the brain. The underlying cognitive and neural architecture of the system and the interrelationship between different cognitive domains are key to understand cognitive aging. The following section addresses the neuroanatomical and neurofunctional bases of aging as a function of these cognitive domains.

## Neural Bases of Cognitive Aging

The age-related changes in the neural bases of cognition occur at both the neurobiological and neurofunctional level.

### Neurobiological Modifications in Aging

The main neurobiological changes in aging consist of structural and functional changes that largely occur in the medial temporal lobe, the

prefrontal cortex, and the white matter tracts. The rate of atrophy varies within and between the lobes of the brain. The frontal, parietal, and temporal lobes show more atrophy compared to the occipital lobe. Within the frontal and parietal cortices, there is a steeper decline in gray matter in the inferior subregions of the lobes (Dennis and Cabeza 2008). Compared to other lobes, the frontal region of the brain shows a faster rate of decline, with an average decline rate of 0.9–1.5% per annum (Raz et al. 2005). On the other hand, the occipital lobe shows minimal or no significant age-related atrophy (Dennis and Cabeza 2008). There is a 0.12% rate of decline per year in the cerebral cortex in young adults, whereas older adults show a 0.35% decline per year as of 52 years of age (Dennis and Cabeza 2008; Raz et al. 2005). Due to the importance of these structures in memory, specific regions of the temporal lobes are extensively studied such as the entorhinal cortex, the hippocampus, and the parahippocampal gyrus. Raz et al. (2005) carried out a longitudinal study and found considerable atrophy in the hippocampus compared to the entorhinal cortex in healthy adults, a change that is common in Alzheimer's disease. In normal aging, hippocampal atrophy ranges from 1.18% to 1.85% per annum after the age of 50 (Raz et al. 2005). In addition to cortical atrophy, there are reports of shrinkage of subcortical (Dennis and Cabeza 2008; Raz et al. 2005) and cerebellar structures (Raz et al. 2005), and of the corpus callosum (Sullivan and Pfefferbaum 2006). In terms of neuronal loss, subcortical structures show maximum change in the caudate nucleus, followed by the putamen and the globus pallidus. Similarly, the cerebellar cortex showed more shrinkage compared to the pons and the vermis. The anterior part of the corpus callosum is more susceptible to change compared to its posterior part (Sullivan and Pfefferbaum 2006). As a result of white and gray matter loss, the rate of expansion of the ventricles increases from 0.43% in young adults up to 4.25% in older adults after the age of 70 (Dennis and Cabeza 2008; Raz et al. 2005).

The rate of decline in white matter volume is also said to accelerate after the age of 50 and is characterized by a loss of synaptic connections.

Many studies have reported a greater loss of white matter compared to gray matter with increasing age, particularly after the age of 50 (Dennis and Cabeza 2008). Furthermore, atrophy is more important in the anterior regions than in the posterior regions (Sullivan and Pfefferbaum 2006). A loss of white matter and associative track integrity is believed to be associated with the age-related decrease in processing speed (Penke et al. 2010). In fact, the diminished processing speed may be responsible for the age-related deficits in executive attention, episodic memory (Penke et al. 2010), and in the general slowing of performance.

Regarding the regional cerebral metabolic rate of glucose and oxygen, the results reported in the literature are more diverse. Through the use of different methodologies, it has been established that cerebral blood flow is altered as a function of age. Similar results were found for regional cerebral metabolic rate of oxygen (Dennis and Cabeza 2008). More recently, positron emission tomography (PET) and functional magnetic resonance imaging (fMRI) studies using blood-oxygen-level dependent (BOLD) and hemodynamic response amplitude (HDR) measures have shown that there is more decline in the activation of the visual cortex and less so in the motor cortex. Some studies report stability in hemodynamic responses in face processing up to the ninth decade of life. Changes in the dopaminergic system have also been extensively studied as examples of the age-related modifications in neurotransmitters. The changes in the dopaminergic system seem to be mostly associated with the decline in episodic memory, executive function, and motor performance, and the related deficits appear to be at the level of the striatum. Extrastriatal decline is also evident in the frontal, temporal, and occipital lobes, as well as in the hippocampus and the thalamus (Dennis and Cabeza 2008).

In summary, the anatomical alterations in the form of gray and white matter decline and of changes in cerebral blood flow, neurotransmitters, and hemodynamic responses represent most of the age-related decrement at the structural level.

However, cognitive abilities along the age continuum do not appear to change proportionately to the extent of these structural and physiological changes. It is thus important to understand the neurofunctional reorganization that occurs in aging and that is thought to be responsible for this phenomenon.

### Neurofunctional Modifications in Aging: Brain-Behavior Interface

Numerous studies using neuroimaging techniques (e.g., PET and fMRI) offer critical information on the neurobiological reorganization in aging reported in visual perception, memory, attention, and executive function. As summarized in the previous section, the evolution of cognitive performance with age includes a number of cognitive markers such as speed of performance, available resources, recollection of information, processing of sensory information, and inhibition. However, these cognitive changes are in many cases less important than what could be expected given the age-related structural and physiological decline. Such a difference stems from the existence of a neurofunctional reorganization that occurs with age as an expression of constant adaptations. The fact that the brain is capable of a neurofunctional reorganization that limits the decrease in cognitive abilities has introduced the concept of cognitive reserve. The neurofunctional reorganization in brain activation with age has been captured within two observed phenomena and two frameworks. The phenomena described correspond to: (a) the existence of a hemispheric asymmetry reduction in older adults (HAROLD) and (b) the presence of a posterior to anterior shift in activation (PASA). On the other hand, the two frameworks related to the age-related neurofunctional reorganization are the *compensation-related utilization of neural circuit hypothesis* (CRUNCH) and the *scaffolding theory of aging and cognition* (STAC) (Park and Reuter-Lorenz 2009; Dennis and Cabeza 2008).

The HAROLD and PASA phenomena have been introduced to describe the adaptive nature

of the aging brain by providing some explanation concerning the localized account of neurofunctional changes.

The PASA phenomenon has been identified in studies showing an anterior shift in brain activation in older adults who maintained an adequate performance in tasks involving attention, working memory, and executive functioning.

The HAROLD phenomenon refers to a decrease in the interhemispheric differences of brain activation in older adults in memory and attentional tasks.

The CRUNCH and STAC frameworks seek to provide some insight on the causes of the neurofunctional reorganization.

The CRUNCH framework suggests that the age-related neurofunctional reorganization in aging occurs as a response to demanding situations when there are cognitive limitations such as deficient memory load or capacity limitation. The CRUNCH principle has been reported in several studies using different cognitive functions and describes a saturation of the system at higher load levels. In the CRUNCH framework, it is suggested that older adults require more resources to process the same amount of information as young adults. CRUNCH complements the STAC framework well, suggesting that a sort of scaffolding process could account for the compensation in cognitive aging. The STAC is thus presented as a recruitment principle of additional areas or networks when the primary areas are less efficient or need assistance. It provides a holistic account of neuronal plasticity in older adults as a response to the neurobiological changes. According to this framework, an alternative network is recruited, which is less focal than in young adults. Thus, the CRUNCH and STAC explain the nature of interaction between “demand” and “supply” in a particular system, aging being only one of the examples.

In sum, the aging brain undergoes significant neurobiological changes. At the same time, there is evidence suggesting that a number of neurofunctional reorganization processes occur during the same period. The question, however, remains in our ability to reconcile the presence

of such neurobiological changes with the relatively preserved cognitive abilities in aging and to link them with the ongoing neurofunctional reorganization. This reconciliation requires the introduction of a new concept: cognitive reserve.

### **Reconciling Structure and Function: Cognitive Reserve**

The notion of cognitive reserve has been introduced to explain the existence of functionally appropriate cognitive performance in older individuals, in spite of the known anatomical and physiological changes. The reason for such a mismatch is thought to relate to the existence of adaptive changes in the brain, also referred to as cognitive reserve, that protect the individual from the adverse effects of aging. According to Stern (2002), the notion of *reserve* can be conceived from either a structural or functional standpoint. As previously discussed, there are many structural differences in the aging brain, such as brain volume, brain size, and decline in synaptic count. However, there is clear evidence of a functional reorganization that allows for the aging brain to perform in an optimal manner. These functional changes, which are considered to *sustain the existence of a cognitive reserve*, include the recourse to neural networks that are less susceptible to disruption and the involvement of previously unused networks or components of networks (Stern 2002). Cognitive reserve is now a widely used concept in the aging literature and has a vital role in contributing to the understanding of some of the determinants of the trajectory of cognitive changes as a function of age. Cognitive reserve can be useful in discussing the reduced effect of age on cognition as a function of life exposure. Life exposure includes education, occupational attainment, and engagement in leisure as well as social activities. At the same time, there are factors that can adversely affect cognitive aging. The resilience to the neurobiological changes and neuropathological damage stems from different adaptive

processes essentially corresponding to either a change (1) in cognitive strategies (which include speed of processing, resource allocation, etc.) or (2) in the recruitment of brain networks.

### Factors Affecting Cognitive Reserve

Various factors are now known as having a differential impact on the nature and extent of cognitive aging.

**Education and occupation** – Individuals with higher levels of educational and occupational attainment show less age-related cognitive decline. It is the lifelong process of skill building that results in the development of cognitive reserve (Stern 2002), possibly leading to the selection of more efficient strategies for optimal functioning in old age.

**Multilingualism** – Multilingual environments also play a crucial role in building a strong cognitive reserve. Cognitive advantages in bilingual and multilingual individuals have been well documented in various studies conducted over the last 10 years (Bialystok et al. 2007). In its simplest term, it is the lifelong ability to cognitively juggle two or more languages that appears to lead to better cognitive flexibility/cognitive control. However, this advantage is not only linked to the knowledge of languages but also to the proficiency level of a particular language, thus adding to the level of cognitive flexibility.

**Cognitive training** – Another determinant of cognitive reserve consists of the lifelong exposure to cognitive training. Erickson et al. (2007) reported training-induced changes in the dorsal and ventral prefrontal cortex on a dual-task training program in older adults. This could be considered as a way to reduce the age-related cognitive and neural decline. In fact, improvement in older adults has been found with perceptual-cognitive training in motion discrimination and tracking speed thresholds (Legault et al. 2013).

### Heterogeneity in Cognitive Aging

Our understanding of the patterns of cognitive aging has evolved over the last decades. Initially,

cognitive domains were thought of as modular systems, and thus the influence of one domain on another was rarely addressed. However, it is now known that different cognitive domains can share some basic processes, which explains why changes in some cognitive processes may affect multiple domains (Hedden and Gabrieli 2004; Brickman and Stern 2009; Grady 2008). At the same time, other cognitive processes contribute in a more restricted manner to a specific cognitive domain. With this in mind, it is crucial to describe not only within but also across domain variability. Heterogeneity in the changes occurring between cognitive domains and between individuals can provide information on individual differences in the normal aging process or on differences in various cognitive domains. Heterogeneity is also present in the way a given individual's cognitive pattern evolves over time (Salthouse 2004). As discussed in earlier sections of this entry, there are cognitive domains that are more affected than others (executive function, episodic memory, working memory > visual perception, language, semantic memory) (Grady 2008). However, beyond the existence of actual differences in the age-related changes between cognitive domains, and within these domains along the age continuum, there are also many possible sources of variability among studies reporting changes in the different components of cognition in aging that have to be taken into consideration. These sources include: (1) different types of variables measured, (2) different sample sizes, (3) longitudinal vs. cross-sectional studies, (4) differences in the amount of cognitive demand required per task, and (5) lack of control over extraneous variables (e.g., education, occupation, skill-set learning, cardiovascular disorders, diabetes, etc.) (Valdois et al. 1990).

### Conclusion and Future Directions

Aging is undeniably associated with changes in cognition. However, not all cognitive abilities are changing in the same way during the aging process. In some cases such as language, some

skills are nearly unaffected by aging, while other aspects of cognition show significant decline. However, in general, the magnitude of the changes in cognitive abilities in aging is not as important as it could be predicted by the extent of the changes in the brain. The disparity between the neurobiological and cognitive dimensions of aging is reassuring as it expresses the existence of neurofunctional processes that allow the aging brain to benefit from its lifelong learning and experiences and to engage in such a way that it can achieve similar or even superior cognitive performance compared to young adults, with an apparently diminished neurobiological basis. Some of the obvious determinants of this remarkable evolution are beginning to emerge such as education, bilingualism/multilingualism, and cognitive training, which are collectively referred to as contributing to cognitive reserve. It will become important to better understand these determinants of cognitive reserve and the exact link between such lifelong activities and their impact on cognitive abilities. It will also be important to enhance the efficiency of such measures in order to counteract the impact of the aging brain for as long as possible. The neurocognitive markers of aging are starting to be better known – research should now turn its focus toward understanding the underlying determinants of age-related changes in cognition and empowering individuals to curb the impact of aging and brain diseases in aging as much as possible.

## Cross-References

- ▶ [Aging and Inhibition](#)
- ▶ [Aging and Quality of Life](#)
- ▶ [Aging and Semantic Memory](#)
- ▶ [Cognitive and Brain Plasticity in Old Age](#)
- ▶ [Executive Functions](#)
- ▶ [Memory Training Methods and Benefits](#)
- ▶ [Memory, Autobiographical](#)
- ▶ [Memory, Episodic](#)
- ▶ [Memory, Implicit](#)
- ▶ [Working Memory in Older Age](#)

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## Neuropsychological Consequences of Chronic Disease in Older Persons

Romola S. Bucks and Michelle Olaithe  
School of Psychology, University of Western  
Australia, Crawley, WA, Australia

### Synonyms

Aging; Cognition; Cognitive decline; Non-communicable diseases

## What Is Chronic Disease?

The World Health Organization defines chronic disease as noncommunicable diseases (diseases not passed from person to person) that generally progress slowly and are of long duration (WHO 2014a). They are commonly divided into four types: cardiovascular diseases (such as hypertension, heart attack, or stroke), cancers, chronic respiratory diseases (such as asthma, obstructive sleep apnea, or chronic obstructive pulmonary disease), and diabetes (see Fig. 1), all of which are more common as we age.

Chronic diseases have multiple and complex causes and often occur together. That is, a single individual may be diagnosed with more than one chronic disease, since they act as risk factors for each other. When an individual is diagnosed with more than one chronic disease, it is called multimorbidity.

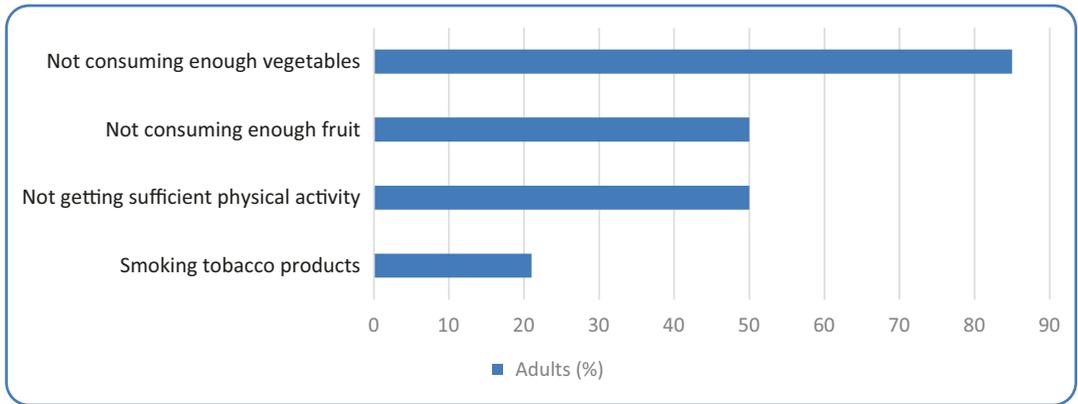
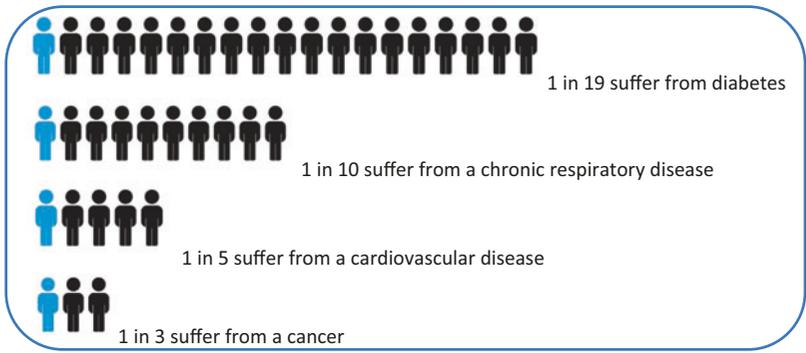
Chronic diseases are common (77% of people in high-income nations have had at least one during their lifetime) and can affect people at any stage of life. However, an individual is more likely to be affected by a chronic disease in older age. Nearly 40% of individuals aged 45 years and older have two, or more, comorbid chronic diseases. Whereas, by aged 65 years, around 50% of individuals will have 5 or more chronic diseases, reaching 70% by the time we are 85 years or older (AIHW 2015).

Chronic disease is the leading contributor to the fatal burden of disease (the total loss of life due to early death) in high-income nations. However, not all individuals are affected equally. Those in geographically isolated regions, people from indigenous populations, people in low socioeconomic areas, and people of older age have a higher incidence of, and higher death rate from, chronic diseases. The economic burden of chronic disease is estimated at \$30 trillion between 2011 and 2031. This cost represents an approximate 48% of global domestic product in the United States (Bloom et al. 2011).

While many chronic diseases carry a genetic loading, lifestyle factors contribute to their development and progression, including poor diet, inactivity, and smoking. Unfortunately, these

**Neuropsychological Consequences of Chronic Disease in Older Persons,**

**Fig. 1** Chronic diseases are common; four of the most common are cardiovascular diseases, cancers, chronic respiratory diseases, and diabetes



**Neuropsychological Consequences of Chronic Disease in Older Persons, Fig. 2** Percentage of adults engaging in risk factors associated with the development and progression of chronic diseases (AIHW 2015)

N

factors are common in low-, middle-, and high-income nations (see Fig. 2).

**Three Common Chronic Diseases: Introduction and Prevalence**

Three common, and highly comorbid, chronic diseases are cardiovascular disease, diabetes, and obstructive sleep apnea.

**Cardiovascular Disease (CVD)**

CVD describes a group of disorders affecting the heart and blood vessels, including coronary heart disease (in which the blood vessels supplying the heart muscle are affected), cerebrovascular disease (in which the blood vessels supplying the brain are affected, such as in stroke), and

peripheral arterial disease (which affects the blood vessels supplying the arms and legs).

CVD is the leading cause of death, globally. In 2012, 31% of all deaths, worldwide, were due to CVD, of which 75% were in low- or middle-income countries (WHO 2014a). Furthermore, CVD is the most expensive disease group, costing \$863 billion in the United States, annually. It is estimated that this health and financial cost could be reduced by 75% for a cost of \$0.43–\$2.93 per head, per annum (Lim et al. 2007).

**Diabetes**

Insulin is a hormone that helps us to regulate blood sugar. Diabetes is a metabolic disorder that occurs either when the pancreas does not produce sufficient insulin or when the body is unable to use the insulin it produces, resulting in

elevated levels of glucose in the blood (hyperglycemia) (Palta et al. 2014). Hyperglycemia is a common consequence of poorly controlled diabetes and, over time, it can cause marked damage to the nerves and blood vessels.

According to the World Health Organization, in 2014, approximately 9% of adults aged 18+ years had diabetes (WHO 2014a), which causes around 1.5 million deaths per year (WHO 2014a), more of which occur in low- and middle-income countries (WHO 2014b). Critically, diabetes is a growing chronic disease. According to WHO, diabetes will be the 7th leading cause of death by 2030 (WHO 1999).

Diabetes has two forms: type 1 and type 2. Type 2 diabetes (which used to be called noninsulin-dependent diabetes) is due to the body's ineffective use of insulin. Worldwide, more than 90% of people with diabetes have type 2 (Strauss et al. 2006): largely a consequence of obesity and physical inactivity. Type 2 diabetes, once a disorder of adulthood, is now increasingly being diagnosed in children.

Diabetes is not only common but costly to individual health, well-being, and quality of life. Costs to the individual include a higher rate of divorce and poorer psychological and social health when blood glucose levels are poorly controlled. When treated, diabetes costs an individual an average of \$1,700–\$2,100 in combined drug treatments, hospital care, and other medical services. Finally, diabetes is known to cause further disease and disability including eye and kidney disease and limb amputations (AIHW 2015).

### **Obstructive Sleep Apnoea (OSA)**

OSA is a nighttime, respiratory disorder in which the throat collapses, partially (hypopneic event) or fully (apneic event), stopping the individual from breathing. Hypopneic and apneic events cause repeated, loud snoring, intermittent hypoxia (episodes of low blood oxygen each time breathing stops or is partially blocked), intermittent hypercarbia (episodes of high blood carbon dioxide because blockages in the throat prevent carbon dioxide being breathed out), and poor sleep architecture. In order to restart breathing, the individual either wakes from sleep or rises up from deeper

into shallower stages of sleep, known as physiological arousal. These arousals disrupt the normal pattern of sleep in which we cycle through lighter into deeper sleep stages around once per 90 min.

OSA is common and costly to the individual and to society, occurring in 9% of middle-aged women and 24% of middle-aged men. Furthermore, prevalence rates increase with increasing age. Costs include a two to threefold risk of motor vehicle accidents, disruptions to mood, increases in irritability, sexual dysfunction, occupational injuries and increased work absenteeism, relationship discord, and reduced quality of life. Finally, as OSA is a nocturnal disorder, it often remains undiagnosed and untreated.

### **CVD, Diabetes, and OSA Increase Risk of Each Other**

To compound the problems experienced by individuals with these chronic diseases, they each increase risk of developing the others. A common form of CVD is hypertension (high blood pressure) and this is a known risk factor for type 2 diabetes. Diabetes is a risk factor both for OSA and for stroke and heart disease (also types of CVD). OSA appears to be a cause of CVD, including hypertension, heart disease, and stroke, and is also a risk factor for hyperglycemia and diabetes.

In addition, diabetes, CVD, and OSA are also causes of impairments in neuropsychological function, likely induced by similar mechanisms of harm. Before describing the nature of the neuropsychological impairments of each disorder, this entry first explains what neuropsychological function is, then lists the types of functions known to be impaired in CVD, diabetes, and OSA, and then considers the ways in which it is thought that each disorder causes those neuropsychological deficits.

### **Definition of Neuropsychological Function**

The term “neuropsychological function” captures all cognitive functions that enable awareness, perception, comprehension, thinking, and reasoning and are associated with an underlying brain region

or neural network. Neuropsychological tasks are used to measure cognitive functions and make assessments about the function of the underlying brain region or network. Such tasks, when used by a trained clinician, allow for assessment of cognitive deficits, diagnosis of disease, and tracking cognitive decline.

Broadly, neuropsychological function can be divided into the overarching domains of attention, memory, executive function, visuospatial/constructional abilities, psychomotor ability, and language function. What follows is a brief explanation of these domains, associated brain regions or networks, and a typical task used to assess this domain. A full explanation of domains, facets of each domain, and assessments is beyond the scope of this entry. For readers interested in neuropsychological function, anatomical correlates, and assessment, we recommend Strauss, Sherman, and Spreen (2006); Lezak, Howieson, and Loring (2004); and Schoenberg and Scott (2011).

### Attention

Attention refers to several capacities that enable and direct perception, orientation, and concentration of selected stimuli and inhibition of processing unwanted stimuli. Broadly speaking, attention involves many regions of the brain. Some key networks include sensory input and motor output systems, the dorsolateral and midlateral prefrontal cortex, the temporoparietal junction, and the intraparietal sulcus (Gobel et al. 2011). Complete assessment will examine simple attention, selective attention (focused attention), sustained attention (vigilance), divided attention, and rapid alternating attention (see Table 1 for definitions and typical tasks assessing each function).

### Memory

Memory broadly refers to one's capacity to encode new information, consolidate this information, and retrieve it when needed. Key brain regions involved in memory include the hippocampus, amygdala, diencephalic structures, medial temporal lobes, entorhinal cortex, and basal forebrain (Gobel et al. 2011).

Memory can be described in many different ways, but is generally divided into explicit

(declarative memory or information you can intentionally and consciously recollect) and implicit memory (nondeclarative or procedural memory or information you know without conscious awareness of the formative experiences). Declarative memory can be further divided into episodic (personal experiences and information) and semantic memory (factual knowledge). Memory is typically thought to be processed as verbal (memory involving language) and visual/spatial (memory involving pictorial or spatial representations) content and is held in short- and long-term memory stores.

Short-term memory refers to the ability to recall a small amount of information (typically 7 +/- 2 pieces of information) within about 30 s. Sometimes, short-term memory is referred to in conjunction with working memory (see section "Executive Function," below). Working memory requires holding information in short-term memory stores while dynamically manipulating this information. Long-term memory refers to the acquisition and consolidation of new information into long term, relatively permanent stores, or learning. In neuropsychological assessment, this typically means information that is retained after at least a 20–30 min delay.

Complete assessment of memory will sample short- and long-term memory abilities, learning (acquiring knowledge with repeated presentations of stimuli), encoding (conversion of information to a form usable by the brain), consolidation (stabilization of a memory trace), retrieval (the process of pulling information from memory store), primacy and recency effects (the effect on memory of the position of items in a list), free (remembering items without cues) and cued (memory with cues) recall, recognition (identifying a known item from a list or story), and proactive (older information interferes with the recall of newly learned information) and retroactive (newly learned information hinders the recall of older information) interference.

Memory problems are the most frequent presenting neuropsychological complaint: however, what people view as a memory complaint and/or the underlying reason can be quite varied.

**Neuropsychological Consequences of Chronic Disease in Older Persons, Table 1** Key neuropsychological domains and tasks that assess these domains

Domain	Facet	Description	Example task
Attention	Simple attention	Ability to perceive and concentrate on key stimuli	Cogstate detection test
	Selective attention	Attend to key stimuli while ignoring competing stimuli	WAIS Cancellation Task
	Sustained attention	Maintain attention over a set time period	Conner's continuous performance task
	Divided attention	Processing multiple stimuli at the same time	Test of everyday attention (telephone directory test)
	Rapid alternating attention	Shift attention rapidly between stimuli	Test of everyday attention (elevator counting)
Memory	Short-term memory	Holding information in mind for ~30 s	Verbal example: Digit span forward Visual example: Spatial span forward
	Long-term memory	Encoding and consolidating memory into relatively permanent stores	Verbal example: California Verbal Learning Test Visual example: Location Learning Test
Executive function	Updating	Updating and monitoring of working memory representations	Letter number sequencing
	Inhibition	Inhibition of dominant or prepotent responses	NIH Examiner – inhibition test
	Set shifting	Shifting between tasks and mental sets	NIH Examiner – set shifting test
	Generativity (fluency)	Efficiency of access to long-term memory	Controlled Oral Word Association task
	Fluid reasoning	Reasoning and problem solving, involving complex, higher-order abstraction, problem solving, and concept formation	6 Elements task
Psychomotor function		Physical movements/actions associated with conscious cognitive control	Grooved pegboard
Visuospatial/ constructional ability		Processes involved in processing visual and spatial information	Clock drawing task
Language function		The ability to produce language (expression, either oral or written) and to understand language (reception, either oral or written)	Boston diagnostic aphasia examination

Note: The example tasks in this table are designed for testing adults, although there may be child versions of some of these tasks

Full neuropsychological testing is commonly required to uncover the underlying issue.

### Executive Function

Executive functions describe a set of cognitive processes responsible for volition, planning,

purposeful action, and monitoring of performance. These processes collectively manage other cognitive processes, including memory and attention. Broadly speaking the frontal cortices are chiefly involved in executive functions (Schoenberg and Scott 2011). Like other

cognitive domains, executive function is multidimensional and has been divided into shifting between tasks and mental sets (shifting), updating and monitoring of working memory representations (updating), inhibition of dominant or prepotent responses (inhibition), and efficiency of access to long-term memory (generativity). In addition, an overarching system of fluid reasoning, involving complex, higher-order abstraction, problem solving, and concept formation, is also considered an aspect of executive function.

Executive function difficulties may not be apparent in a highly structured environment. As such, complete assessment of executive function will evaluate the facets mentioned above and may include subjective or informant report of an individual's executive functioning within their environment. Subjective details about an individual's environment and their functioning within it assist clinicians with understanding the level of dysfunction and with providing appropriate recommendations.

### **Psychomotor Function**

Psychomotor functions relate to the ability to coordinate thinking and physical movement. Psychomotor skills are demonstrated in fine and gross motor coordination, including hand-eye coordination, balance, and reaction times. Crucial neural correlates include sensory, premotor and motor cortical regions, and extrastriatal regions of the occipital and parietal cortices (Starkstein and Kremer 2001). Generally, psychomotor function is measured using physical tasks, such as tapping a finger as fast as possible, in terms of speed (reaction time) and accuracy.

### **Visuospatial/Constructional Abilities**

Visuospatial and visuoconstructional abilities are largely automated functions, but can be consciously directed and controlled. Visuospatial abilities enable the perception and processing of complex visual stimuli, involving information about color, line, and orientation. The sensory and motor systems in the occipital and parietal lobes are crucially involved in visuospatial functions (Gobel et al. 2011).

### **Language Function**

Language function is the capacity to learn, understand, and produce complex symbolic systems for communication, for example, spoken and written language or sign language. Brain regions intimately involved in language processing involve sensory and motor systems, the left posterior frontal cortex, and the left posterior temporal-parietal areas.

### **Neuropsychological Function and Aging**

Neuropsychological function declines in healthy aging. Cognitive domains that show change in typical aging include expressive language, visuospatial/constructional abilities, most executive functions, and long-term and working memory (Starkstein and Kremer 2001). However, that neuropsychological decline is an inevitable consequence of normal aging is debatable. Instead, there seems to be an intricate interplay of risk and protective factors, including diet, lifestyle, cognitive and brain reserve, and disease.

Cognitive and brain reserve are thought to explain why some individuals show decline with age or disease, whereas others do not (Stern 2012). Brain reserve describes differences in the structure of individuals' brains (the number of neurons and the strength of connections between them). Cognitive reserve, by contrast, refers to individual differences in how we use our brains to perform neuropsychological tasks, which help to make us more or less susceptible to the impact of aging or disease (such as skill, expertise, or practice). Despite differences in the degree to which each individual is affected, however, it is clear that chronic disease negatively impacts on neuropsychological functioning, and this can be compounded by usual aging.

### **The Nature of the Neuropsychological Deficit in CVD, Diabetes, and OSA**

Neuropsychological function is adversely affected by chronic disease. The three classes of chronic disease that are the focus of this entry produce a profile of neuropsychological harm with striking similarities and some differences.

**Neuropsychological Consequences of Chronic Disease in Older Persons, Table 2** The neuropsychological consequences of diabetes, CVD, and OSA

Domain	Diabetes <sup>2,3</sup>	OSA	CVD <sup>4,5</sup>
Attention	D <sup>2,3</sup> Sustained: D <sup>3</sup> Divided: N <sup>3</sup> Selective: N <sup>3</sup>	D <sup>1</sup>	D <sup>4</sup> , N <sup>5</sup>
Memory	Verbal: D <sup>2,3</sup> Visual: D <sup>2,3</sup> Short-term: D <sup>3</sup> Long-term: D <sup>3</sup>	Short-term: E <sup>1</sup> Long-term (episodic) verbal (short, long, learning, and recognition): D <sup>1,7</sup> Long-term (episodic) visual (short and long): D <sup>1,7</sup>	D <sup>4,5</sup>
Executive function	D <sup>2</sup>	D <sup>1</sup> Shifting: D <sup>6</sup> Inhibition: D <sup>6</sup> Updating: D <sup>6</sup> Generativity: D <sup>6</sup> Fluid Reasoning: D <sup>6</sup>	D <sup>4</sup> , N <sup>5</sup>
Visuospatial/constructional abilities	D <sup>3</sup>	D <sup>1</sup>	N <sup>4,5</sup>
Psychomotor function	D <sup>2</sup>	N <sup>1</sup>	
Language	N <sup>3</sup>	N <sup>1</sup>	N <sup>5</sup>

*Note:* *N* evidence suggests no effect of this chronic disease, *E* equivocal findings (some evidence for deficits; some for preservation); *D* poorer performance reported in those with this chronic disease, relative to those without; *blank* no systematic review evidence available; 1, Bucks et al. (2013); 2, Brands et al. (2005); 3, Palta et al. (2014); 4, DeRight et al. (2015); 5, Gifford et al. (2013); 6, Olathe and Bucks (2013); 7, Wallace and Bucks (2013)

Table 2 summarizes systematic review evidence describing the nature of the neuropsychological deficit in each chronic disease. Where available, cognitive domains have been broken into facets of a domain.

Across OSA, diabetes, and CVD, there appears to be no marked harm to language functions and differential profiles of harm across visuospatial/constructional abilities and psychomotor function. All three of these chronic diseases show neuropsychological dysfunction, greater than would be expected for patients' age, within the broad domains of attention, memory, and executive function. However, when the overarching domains are broken into facets, such as has been conducted for memory function in CVD and OSA, harm is not ubiquitously displayed across the entire domain. For example, short-term memory has been shown to be impacted by diabetes, but does not appear to be compromised in OSA, while long-term memory, particularly for new, episodic memory, is markedly impaired both in CVD and in OSA for both visual and verbal material. Within executive function, all five

domains are affected by OSA, while for CVD there is evidence that executive function (as a whole) is impacted, and the evidence for diabetes is contradictory. It may be that facets of executive function are impaired, while others are preserved in CVD and in diabetes, explaining the contradictory review findings for the latter. Systematic reviews aimed at delineating harm within facets of a domain, for these disorders, would enable a more intricate understanding of the neuropsychological profile of harm, outline the possible functional declines, and aid with understanding the mechanisms of harm.

### CVD

CVD is associated with deficits in attention, memory, and executive functions, whereas visuospatial/constructional abilities and language remain intact. In the second review (Gifford et al. 2013) for CVD, which summarized neuropsychological function in hypertension, attention and executive function remained intact, while memory function was compromised. As yet, there are no reviews into the effect of CVD on psychomotor function.

Imaging studies suggest that this pattern of deficits relates to the profuse changes to white and grey matter found in CVD.

### **Diabetes**

Within the domain of attention, people with diabetes demonstrate impaired performance on sustained attention tasks, but not on divided or selective attention. People with diabetes show impairment across many facets of memory (verbal and visual, short and long term), and executive functions, visuospatial constructional abilities, and psychomotor function are also compromised. Language remains intact in diabetes. Imaging studies have localized damage to fronto-temporal regions (regions heavily involved in executive functions) and the periventricular nucleus (associated with memory).

### **OSA**

Individuals with OSA experience impaired function in attention, memory (long-term verbal and visual), executive skills, and visuospatial/constructional abilities. There appears to be no harm to psychomotor functions or language abilities. Evidence in relation to short-term memory deficits is unclear, with studies reporting both preservation and impairment. Associated with these neuropsychological difficulties is neuroanatomical degeneration in brain regions implicated in these functions, including the thalamus, involved in relaying sensory and motor signals and regulating sleep and alertness; the hippocampus, involved in memory; and the amygdala, which assists with regulating emotion.

## **Mechanisms by Which These Three Chronic Diseases Impact on Neuropsychological Function**

The striking similarities in the nature of the neuropsychological impairments seen in these three chronic diseases suggest that there may be overlap in the mechanisms of harm by which each disease impacts on neuropsychological function. However, although there is ample evidence that each of these chronic diseases is an independent risk factor for cognitive decline and dementia in older

people, the mechanisms by which diabetes, CVD, and OSA impact on neuropsychological performance are not well understood (McCrimmon et al. 2012). Candidate mechanisms include the impact of each chronic disease on blood supply to the brain, reductions in blood gas/nutrients to the brain, reductions in removing waste from the brain, deposition of harmful chemicals, and reduced brain white matter.

### **Impact on Blood Supply**

Diabetes, CVD, and OSA compromise the blood supply to the brain. The cardiovascular system (the heart and blood vessels) is essential for supplying the brain and other cells of the body with oxygen, glucose (blood sugar), and other nutrients. Interruptions to this supply deprive the brain of vital nutrients and decrease the removal of toxic metabolites.

Additionally, diseases like diabetes, OSA, and CVD affect the small cerebral (brain) blood vessels (microvasculature) of the brain, the tiny blood vessels that are critical for carrying blood, and therefore oxygen and nutrients to the whole brain. These diseases are associated with proliferation of lesions in small cerebral blood vessels which reduce the flow of blood to the brain.

### **Blood Gas/Nutrient Abnormalities**

The brain is particularly vulnerable to reductions in the supply of such nutrients, because it has very limited capacity to store them. Even very brief or subtle interruptions of supply can be damaging. Due to reduced blood supply, changes in small cerebral blood vessels, and changes in levels of blood gasses and nutrients, the brain receives less of the necessary “food” required by biological processes, which is likely to impact on neuropsychological functions.

### **Reduced Capacity to Remove Waste, Protect the Brain from Toxic Substances, and Buildup of Toxic Substances**

OSA, CVD, and diabetes lead to an increase in brain metabolites (including free radicals and beta-amyloid) and impair protective brain structures (including the blood-brain barrier), and recent animal studies suggest they may also reduce the

brain's ability to remove toxic waste products. Reduced capacity to remove waste emerges due to interruptions in filtration due to changes in small cerebral blood vessels and/or to broken sleep.

Changes in small cerebral blood vessels and the proliferation of lesions alter the blood-brain barrier (BBB). The BBB separates the blood circulating around the brain in the cerebral blood vessels from the fluid circulating around our brain cells (brain extracellular fluid). Glucose and nutrients are allowed across the BBB, while bacteria are kept out. CVD, OSA, and diabetes are associated with an increase in the permeability of the blood-brain barrier (BBB). A more permeable BBB may allow bacteria, and other toxins, to pass into the brain tissue, causing harm. Similarly, increased permeability has been demonstrated in Alzheimer's disease and in vascular dementia.

While OSA is clearly a sleep disorder, CVD and diabetes also appear to be causes of poor sleep. CVD, OSA, and diabetes may result in neuropsychological impairments due to a reduced capacity to filter and remove waste from the brain due to the changes to small cerebral blood vessels noted above, in combination with poor sleep. The lymphatic system is a system of tubes and tissues throughout the body that is integral to the immune system, bathes bodily tissues in fluid, and acts to filter toxic substances from tissues by passing them into the blood stream, from where they can be excreted. The brain has no lymphatic vessels, but new research suggests a brain-specific filtration system termed the "glymphatic system" performs the same function. Animal studies have shown that this system becomes most active and efficient during sleep, with capillaries within this network opening up by more than 60% (Xie et al. 2013). Changes to small cerebral blood vessels and broken sleep deplete the efficiency with which this system can remove waste from the brain. This, potentially, leads to the buildup of toxic substances such as beta-amyloid.

Beta-amyloid is fragments of protein broken off from an amyloid precursor protein (a larger protein found in the membrane which surrounds all nerve cells), which, under normal circumstances, would be broken down by the body and eliminated from the brain. The latest thinking is that sleep disruption

impairs the brain's ability to rid itself of these fragments of protein. Because they are "sticky," they clump together, building up into plaques. These clumps of beta-amyloid are toxic to nerve cells: indeed, even very small clumps may reduce communication between nerve cells and produce inflammation. Beta-amyloid plaques are one of the hallmarks of Alzheimer's disease.

### **Reduced White Matter Integrity**

White matter is the term used to describe the bundles of nerve fibers that connect the grey matter (the lobes of the brain) together. These nerve fibers are "insulated" with myelin, which sheathes the nerve fibers, speeding the transmission of signals. CVD, OSA, and diabetes all damage white matter, producing lesions (also called white matter hyperintensities for the way they show up in brain imaging). White matter lesions are small areas of dead cells that are thought to be due to loss of blood supply to the nerve fibers leading to damage to the myelin sheath (ischemic demyelination) or due to occlusion of small arteries resulting in nerve fiber death. White matter lesions slow and/or stop neural signals from passing back and forth in a fast and efficient manner. While some white matter changes are a normal part of the aging process, white matter lesions are associated with increased risk of stroke, cognitive decline and dementia, greater deposition of beta-amyloid, and faster decline in global cognitive performance, executive functions, and processing speed (DeBette and Markus 2010).

### **Future Directions**

A search of the literature reveals a wealth of information describing single, chronic diseases, their prevention, and care. It also reveals an understanding of the broad neuropsychological domains affected in each chronic condition alone. What is missing is a more intimate investigation of facets within domains, within each chronic disease. In addition, the nature and extent of multi-morbidity is not well understood, nor do we have a good understanding of the impact of multi-morbidity of chronic diseases on neuropsychological function. Finally, longitudinal studies

that track changes in neuropsychological function have also focused on single, chronic diseases. Few prospective or longitudinal studies are available tracking combinations of chronic diseases in order to understand how trajectories of change in neuropsychological function may be similar or different in different combinations. This is critical. We do not know if the neuropsychological impacts are simply additive or multiply in some way. We do not know if particular combinations of chronic diseases produce greater risk for neuropsychological dysfunction or faster rates of decline.

Thus, further research is required to delineate the cognitive profiles and mechanisms of harm in chronic diseases and in their combinations. Such detail would support clinicians better to recommend ways to compensate for or rehabilitate neuropsychological impairment. Such compensation may include the use of diaries for individuals with memory impairment or problem solving techniques for those with executive functioning difficulties. Critically, a better understanding of the mechanisms of harm of each disorder, and their comorbidities, will allow for the development of treatments targeting the mechanisms that cause damage and tailored to the combination of chronic diseases experienced by each individual.

## Clinical Implications

Whether or not we experience chronic disease in older age is, in large part, a consequence of the cumulative effects of lifestyle; behavior and behavior change; social mobility; physical growth in the womb, in infancy, and through childhood into adulthood; and history of infection and of reproduction. Increasingly inactive childhoods (due to extended screen time) and adulthoods (due to sedentary occupations), consumption of high-fat/high-sugar foods leading to obesity, coupled with marked healthcare successes, mean that we now live longer, with the greater associated risk of living longer with one or more chronic diseases (WHO 2014a).

Clinicians from many healthcare fields can have a significant impact on people's quality of life and life expectancy by screening for these

contributors early and educating their patients as to the positive benefits of a healthy diet and lifestyle. Other sectors of society can ensure procedures and policies for effective food labeling and education about tobacco smoking and access to environments that ensure active lifestyles and to fresh foods.

## Summary

Chronic diseases are noncommunicable diseases with a slow progression and long duration. Cardiovascular diseases, cancers, chronic respiratory diseases, and diabetes are common; increase in prevalence as we age; occur more commonly in geographically isolated regions, in indigenous populations, and in individuals from low socioeconomic areas; and are the leading contributors to the fatal burden of disease. Lifestyle factors such as tobacco smoking, diet, and exercise contribute to the development and progression of chronic disease.

Of these, cardiovascular disease (CVD), diabetes, and obstructive sleep apnea (OSA) are often comorbid. Diabetes, CVD, and OSA are each associated with impairments in neuropsychological function. While language functions appear to be spared, visuospatial/constructional abilities are affected in both CVD and OSA, and psychomotor functions are impaired in CVD. Consistent across all three of these chronic diseases is decreased attention, memory, and executive abilities. The striking similarities in the nature of the neuropsychological impairments seen in these three chronic diseases suggest overlapping mechanisms of harm, including reductions in blood supply to the brain, which lead to blood gas/nutrient abnormalities, to increased deposition of harmful substances compounded by a reduced capacity to remove waste products, and to reduced white matter integrity.

Further research is required to delineate differences in the neuropsychological profiles of chronic diseases and their combinations and the mechanisms of harm. Clinicians from a variety of health fields can impact the development and progression of chronic disease with early screening and education.

## Cross-References

### ► Psychological Aspects of Diabetes

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## Neurotrophic Factors in Aging

Natália Pessoa Rocha and Antônio Lúcio Teixeira  
Laboratório Interdisciplinar de Investigação Médica, Faculdade de Medicina, Universidade Federal de Minas Gerais, Belo Horizonte, MG, Brazil

## Definition

Neurotrophic factors (NFs) are polypeptides involved in the maintenance and adequate

function of neurons and neuron-supporting cells. Mechanisms underlying NFs signaling may fail during neuronal repair and aging, resulting in neurodegenerative diseases, such as Alzheimer's disease (AD) and Parkinson's disease (PD) (Lanni et al. 2010).

## Introduction

Neurotrophic factors (NFs) are a group of soluble polypeptides with a range of functions in nervous system development and maintenance, and survival of neurons and neuron-supporting cells.

NFs are divided into different families according to structure and function: (i) neurotrophins (NTs): nerve growth factor (NGF), brain-derived neurotrophic factor (BDNF), NT-3, and NT-4; (ii) transforming growth factor (TGF)- $\beta$  superfamily which includes the glial-cell-line-derived neurotrophic factor (GDNF); (iii) neurokinin superfamily comprising ciliary neurotrophic factor (CNTF), interleukin (IL)-6, and IL-11, among others; and (iv) nonneuronal factors, for instance, insulin-like growth factor (IGF)-1 and epidermal growth factor (EGF) (Lanni et al. 2010).

Each of these NFs exerts its biological activities through receptors with intrinsic tyrosine kinase activity. Consequently, there is activation of transcription factors, and the expression of determined genes is induced. These genes encode proteins involved in regulating neuronal survival, differentiation, and plasticity (Lanni et al. 2010).

NFs are not always essential for neuronal survival, but they are at least involved in maintenance and adequate function of neurons. For instance, in the absence of NGF and BDNF, there is no loss of cholinergic neurons in young rats but reduction of cholinergic markers in aged ones. *In vitro* experiments have showed that when neurons initially grown with NGF stimulus are deprived of this NT, there is no death of old cholinergic neurons. However, NGF withdrawal resulted in downregulation of neurotransmitter-associated enzymes, cholinergic cell shrinkage, and reduction of fiber density (Svendsen et al. 1991).

Mechanisms underlying NFs signaling may fail during neuronal repair and aging, resulting in neurodegenerative diseases, such as Alzheimer's disease (AD) and Parkinson's disease (PD). This entry will focus on the neurotrophins, NGF and BDNF, and the NFs, GDNF and CNTF, given their clinical significance in aging and neurodegenerative age-related disorders.

## Neurotrophins (NTs): An Overview

NTs were first identified as promoters of neuronal survival. Currently they are also known to regulate many aspects of neural development, function, and plasticity (Reichardt 2006; Huang and Reichardt 2001). NTs act mainly through tropomyosin-related kinase (Trk) receptors. NTs directly bind and dimerize these receptors, which results in activation of the Trk present in their cytoplasmic domains.

NGF binds selectively to the TrkA receptor, while BDNF and NT-4 are selective for TrkB. NT-3 activates TrkC, although it is also able to activate less efficiently other Trk receptors. There is another NT receptor, the p75NTR, to which all NTs can bind at low affinity (Lanni et al. 2010; Reichardt 2006; Huang and Reichardt 2001). p75NTR is a member of the tumor necrosis factor receptor family. The role of p75NTR in NTs signaling was unclear, being debatable whether this receptor transmitted any signal or was merely a binding protein. Studies have shown that p75NTR indeed transmits signals important for determining which neurons survive during development (Huang and Reichardt 2001). Figure 1 shows NTs actions on their respective receptors.

NTs are synthesized as precursors, i.e., larger proteins cleaved to produce mature NTs. The mature cleaved forms of NTs, then, selectively bind NT receptors. Activation of Trk receptors pathways results in neuron survival signaling. When NTs bind p75NTR, signaling events promote cell death due to apoptosis (Lanni et al. 2010; Huang and Reichardt 2001). Uncleaved proNGF is also able to bind the



and NFs may be important in controlling neuronal death or survival and ultimately the clinical outcome of brain aging (healthy vs. pathological aging) (Yankner et al. 2008).

### **Nerve Growth Factor (NGF)**

NGF, the first discovered NT, is essential for neuronal survival during CNS development and influences neuronal functioning throughout life. NGF is a highly conserved molecule, sharing considerable homology among species (Aloe et al. 2012).

When NGF binds the receptor TrkA, the main activated pathways are Ras-mitogen-activated protein kinase (MAPK), extracellular signal-regulated kinase (ERK), phosphatidylinositol 3-kinase (PI3K)-Akt, and phospholipase C (PLC). When NGF binds the p75NTR, c-Jun-N-terminal kinase-p53-Bax (JNK) and nuclear factor kappa B (NF- $\kappa$ B) signaling pathways are activated, which may determine cell death via apoptosis in the absence of coexpressed TrkA (Aloe et al. 2012; Fig. 1).

In the brain, the highest NGF levels are found in the hippocampus and cortical regions. Experiments using animal models showed that NGF is mainly produced by neurons in the hippocampus and cortex and retrogradely transported to cell bodies of basal forebrain cholinergic neurons (BFCN). BFCN express both TrkA and p75NTR receptors, and NGF acts regulating survival and maintenance of these cells. BFCN and their projections to hippocampus and cortex are involved in learning and memory functions. Alterations in NGF levels have been associated with cognitive changes during normal (or physiological) aging and cognitive impairment in neurodegenerative diseases such as AD.

Using a vector-based RNAi approach, the blockade of TrkA receptor expression resulted in worsening attentional performance in aged but not young adult rats. In animals with preserved TrkA levels, attentional performance correlated positively with TrkA levels. Among aged rats, poorer attentional performance was associated with lower TrkA levels expressed in cholinergic neurons in the nucleus basalis of Meynert and substantia innominate. Aging and TrkA

suppression increased cortical proNGF levels. Aging also increased cortical p75NTR densities in the cortex (Parikh et al. 2013). These results highlight the role of NGF/TrkA/p75NTR signaling in cognition, one of the most affected functions in aging. In fact, a range of evidence has indicated a link between NGF and cognitive function. For instance, levels of the membrane-associated p75NTR are higher in the hippocampal formation of human AD brains than in age-matched controls (Chakravarthy et al. 2012). Amyloid-beta also binds p75NTR in neurons *in vitro*, leading to apoptosis (Yaar et al. 1997).

Changes in NGF levels in age-related disorders have also been demonstrated. Late-life depression (LLD) is one of the most common neuropsychiatric disorders in the elderly population and is a risk factor for neurodegenerative diseases, mainly AD. Serum NGF levels were reduced in elderly patients with LLD in comparison with nondepressed elderly controls. Elderly subjects with previous depressive episodes also showed a significant reduction in serum NGF levels compared to controls. These results support the hypothesis of a reduced neurotrophic support in LLD (Diniz et al. 2013).

### **Brain-Derived Neurotrophic Factor (BDNF)**

BDNF is the most widely distributed NT in the CNS, occurring mainly in the hippocampal formation, cerebral cortex, and amygdaloid complex. BDNF expression rises during brain development, reaching the highest level after birth. BDNF levels do not decay with aging, which is suggestive of its important role in the adult brain. Like NGF/TrkA signaling, MAPK, PI3K/Akt, and PLC signaling cascades are activated when BDNF binds the TrkB receptor. Also similar to NGF, when BDNF binds p75NTR, NF- $\kappa$ B and JNK signaling are activated. BDNF binds the TrkB receptor with high affinity, playing a role in neuronal survival and maintenance. BDNF is also important for neurogenesis, since it promotes neural progenitor cells differentiation into neurons and the subsequent survival of these new neurons. Interestingly, processes that stimulate neurogenesis such as exercise, dietary energy

restriction, and cognitive stimulation are associated with an increase in hippocampal BDNF levels (Lanni et al. 2010).

Despite the well-established role of BDNF in neuron development and survival and neurogenesis, its profile in the aging brain is still a matter of debate. While some studies have found a decrease in BDNF levels in aged brains, others have failed to show any alteration in BDNF concentration during aging process (Lanni et al. 2010).

Increased BDNF/TrkB signaling might prevent cognitive impairment in the early stages of AD, accompanying brain reserve. However, high levels of TrkB might not be sufficient to prevent cognitive decline with further amyloid beta deposition and AD progression. There is increased neuronal TrkB expression in CA1 region brain samples from cognitively intact individuals with AD pathology (Braak & Braak stages I–II) when compared to cognitively intact individuals with no AD pathology (Kao et al. 2012). A more feasible way for assessing CNS levels of NTs in humans is using cerebrospinal fluid (CSF) samples. Since LLD is an important condition among elderly subjects and is associated with cognitive impairment, the neurobiological links between LLD and MCI/AD have been studied. Age-matched healthy controls presented higher CSF BDNF levels when compared to individuals with LLD (with mild cognitive impairment (MCI) or with no cognitive impairment). In LLD group, patients with mild cognitive impairment (MCI) had lower CSF BDNF levels in comparison with patients without cognitive dysfunction. The reduction of the availability of BDNF in the CNS may indicate increased vulnerability to the development of age-related disorders such as LLD and MCI (Diniz et al. 2014).

In addition to brain and CSF samples, peripheral blood levels of BDNF have been investigated. Plasma BDNF levels were found altered (i.e., increased and decreased) in AD patients in comparison with age-matched controls (Faria et al. 2014; Forlenza et al. 2015). The increase in circulating levels of BDNF in AD might reflect an adaptive or compensatory mechanism for neuronal damage. This result does not corroborate the

hypothesis of a decreased NFs availability in AD. A possible explanation is that peripheral levels of BDNF would increase in the early stages of dementia and decrease according to the progression of neurodegenerative changes. Patients' disease status varies among different studies, explaining discrepant (increased vs. decreased levels) results.

Not only BDNF but also serum levels of NGF and GDNF were found reduced in cognitively impaired subjects, including MCI and AD patients, in comparison with controls. After controlling for age, gender, and cognitive performance, only BDNF and NGF levels remained statistically diminished in cognitively impaired group. Interestingly, the group of MCI patients who progressed to dementia upon follow-up presented lower BDNF and NGF levels (Forlenza et al. 2015). These findings reflect the importance of NTs, notably BDNF and NGF, in cognition and aging-associated cognitive diseases.

Studies have shown that physical exercises, notably muscle strength exercises, are able to increase BDNF levels. Particularly, one study found that after muscle strength exercises, elderly women presented improvement in depressive symptoms accompanied by increase in BDNF plasma levels. The increase in NFs levels, especially BDNF, has been indicated as one of the potential mechanisms of action of physical exercise in depression, mainly because of its effects on neuroplasticity (Pereira et al. 2013).

### **Glial-cell-line-Derived Neurotrophic Factor (GDNF)**

GDNF is the main NF of the GDNF family ligands, which are polypeptides belonging to the TGF $\beta$  superfamily. GDNF is relevant for embryonic dopamine neurons development and for survival of mesencephalic dopaminergic neurons. Both in vitro and in vivo studies have shown that BDNF is involved in neuritic outgrowth and survival of dopaminergic neurons in several areas, such as the substantia nigra, BFCN and brainstem, and noradrenergic neurons and Purkinje cells (Lanni et al. 2010). GDNF is also present in axons from peripheral nerves and

Schwann cells. GDNF and its receptors were found to be broadly expressed in the hippocampus. GDNF supports synaptic transmission and participates in learning and memory processes.

Even though its name indicates a glial source, GDNF is also produced by neurons, being present in abundance at striatal medium spiny neurons that receive dopaminergic projections from substantia nigra. Similar to NTs, GDNF is also retrogradely transported to cell bodies.

GDNF binds the receptor GFR $\alpha$ 1 resulting in tyrosine kinase Ret receptor activation, which starts several signaling transduction pathways, such as the MAPK, Erk-1 and Erk2, and the serine-threonine kinase Akt. Therefore, GDNF regulates neuronal differentiation and survival by controlling the expression of antiapoptotic genes, such as Bcl-2 (Lanni et al. 2010).

GDNF is mainly associated with motor function. Apart from cognitive deficits, aging is also characterized by impairment in motor functioning with slowness and coordination difficulties. Decreased dopaminergic transmission in the basal ganglia is one of the main mechanisms behind aging-related motor changes. GDNF has neurotrophic effects on dopaminergic neurons, and several aging and PD animal models have shown the beneficial effects of GDNF in dopaminergic system associated with motor improvement. For this reason, GDNF has been studied for PD treatment. Clinical trials testing GDNF-based therapies for PD treatment are shown in Table 1.

Although GDNF was originally identified as a specific trophic factor for dopaminergic neurons, it also supports survival of motoneurons. In vitro experiments have demonstrated that GDNF was much more potent than neurotrophins such as BDNF and neurokinins such as CNTF in supporting survival of purified embryonic rat motoneurons. In vivo, exogenously supplied GDNF was able to support the survival of all neonatal rat facial motoneurons that were deprived of target-derived factors by axotomy (Henderson et al. 1994). These findings highlight GDNF as a promising candidate to slow the loss of function, degeneration, and death of

motoneurons in diseases such as amyotrophic lateral sclerosis (ALS) and the spinal muscular atrophies (SMA).

### Ciliary Neurotrophic Factor (CNTF)

CNTF is the main member of the neurokinin family. It is synthesized by astrocytes, acting through autocrine and paracrine signals of astrocytic activation and hypertrophy in response to injury to the CNS. CNTF is also produced in the periphery, in muscle, released by motoneurons terminals and then retrogradely transported to cell bodies. CNTF also seems to be involved in peripheral nerve injury.

CNTF acts through the activation of the Janus kinase/signal transducer and activator of transcription (JAK/STAT) signaling pathway. When CNTF binds the alpha subunit of the CNTF receptor (CNTFR $\alpha$ ), it induces the recruitment of two transmembrane receptor proteins gp130 and LIFR $\beta$ , resulting in tyrosine phosphorylation and the downstream activation of the JAK/STAT pathway. Once the pathway is activated, STAT proteins translocate to the nucleus, bind gene promoters on the DNA, causing DNA transcription and activity in the cell.

CNTF is mainly expressed in glial cells, playing a role in glial differentiation and development. The collaborative effects of CNTF with NTs have been reported, with synergic effects on development and maintenance of distinct neuron types. For instance, when CNTF is administered together with BDNF in BFCN, a synergic effect on cell survival was observed (Lanni et al. 2010).

A range of evidence from experiments in vitro and in vivo animal models have shown a link between CNTF and neurogenesis dependent on dopamine D2-receptor in the subventricular zone and the dentate gyrus of the hippocampus (Mori et al. 2008). Since dopaminergic dysfunction is a hallmark of neurological disorders, such as ALS and PD, CNTF has been proposed as a putative strategy for treating these diseases. Nevertheless, some attempts to use CNTF as a therapeutic agent had unsatisfactory results, such as failure in achieving sufficient concentrations in the brain, poor efficacy, and adverse effects.

**Neurotrophic Factors in Aging, Table 1** Clinical trials performed for testing neurotrophic factors therapy in Alzheimer’s disease and Parkinson’s disease

Study	Drug	Trial design	Endpoint classification	Estimated enrollment	Follow-up period	Outcomes	Status
<i>Clinical trials involving neurotrophic factors in Alzheimer’s disease treatment</i>							
NCT00087789	CERE-110 (AAV2-NGF), intracerebral injection	Nonrandomized, follow-up, open-label phase 1 trial	Safety	10	24 months	Given the overall tolerability of the neurosurgical procedure under general anesthesia, they decided to start a phase 2 trial	Completed
NCT00876863	CERE-110 (AAV2-NGF), intracerebral injection	Multicenter, randomized, double-blind, follow-up phase 2 trial	Efficacy	50	24 months	No published results	Active, not recruiting patients. The study started in September 2009 and the estimated final data collection was completed by December 2014
NCT01163825	ECB-NGF, intracerebral implants	Nonrandomized, controlled, follow-up, open-label phase 1 trial	Safety and tolerability/efficacy study	6	12 months	Follow-up MRI at 3 and 12 months postimplantation showed no evidence of inflammation or device displacement. At 12 months, implants were successfully retrieved, and low but persistent NGF secretion was detected in half of the patients	Active, not recruiting patients. The study started in January 2008 and the estimated final data collection was completed by December 2011
NCT00017940	Ex vivo gene therapy (intracerebral injections of autologous fibroblasts genetically modified to express human NGF)	Uncontrolled, follow-up, open-label phase 1 trial	Safety	8	18 months	Stereotaxic injections were completed safely in six of eight subjects. After mean follow-up of 22 months in six subjects, they observed an improvement in the rate of cognitive decline and no long-term adverse effects of NGF occurred	Completed

NCT00000180	AIT-082 (potential action mechanism: stimulus of neurotrophic factors production), orally administered	Multicenter, randomized, double-blind phase 2 trial	Efficacy	36	5 weeks	There were no significant differences by treatment arm on the clinical or neuropsychological evaluations. AIT-082 was rapidly absorbed by the oral route with a half-life suitable for dosing once or twice daily. No problems with tolerability or safety were found	Completed
<i>Clinical trials involving neurotrophic factors in Parkinson's disease treatment</i>							
NCT00875316	Cogane™ (PYM50028, promote the release of both GDNF and BDNF), orally administered	Randomized, controlled, double-blind phase 1 trial	Safety	36	28 days	No published results	Completed
NCT01060878	Cogane™ (PYM50028, promote the release of both GDNF and BDNF), orally administered	Randomized, controlled, double-blind phase 2 trial	Efficacy	425	28 weeks	Failed to show any clinical benefits	Completed
NCT00985517	CERE-120 (AAV-nerturin), intracerebral injection	Randomized, double-blind phase 1/2 trial	Safety/ efficacy	60	36 months	Considered safe and well tolerated according to preliminary safety and tolerability results from six subjects with PD who received bilateral stereotactic injections of CERE-120 into the substantia nigra and putamen	Active, not recruiting patients. The study started in September 2009 and the estimated final data collection was completed by November 2014

(continued)

Neurotrophic Factors in Aging, Table 1 (continued)

Study	Drug	Trial design	Endpoint classification	Estimated enrollment	Follow-up period	Outcomes	Status
NCT00006488	Recombinant human GDNF, continuous, unilaterally infused administered through an implanted intraputaminial catheter and programmable pump	Phase 1 trial	Safety/efficacy	10	24 weeks of infusion	Improvement in the motor scores at 24 weeks compared with baseline scores. Improvements occurred bilaterally, as measured by balance and gait and increased speed of hand movements. All significant improvements of motor function continued through the washout period (5 weeks). The only observed side effects were transient Lhermitte symptoms in two patients	Completed
NCT01621581	AAV2-GDNF (convection enhanced delivery to bilateral putamen)	Nonrandomized, open-label phase 1 trial	Safety/efficacy	100	5 years	Not available yet	Recruiting

*AAV* adeno-associated virus, *AD* Alzheimer's disease, *BDNF* brain-derived neurotrophic factor, *ECB* encapsulated cell biodelivery, *GDNF* glial-cell-line-derived neurotrophic factor, *MRI* magnetic resonance imaging, *NGF* nerve growth factor, *PD* Parkinson's disease

## Neurotrophic Factors as Therapeutic Agents for Neurodegenerative Disorders

Aging is followed by several physiological changes, being the CNS one of the most affected. Abnormal NFs support during aging seems to play a major role in the pathophysiology of age-related neurodegenerative disorders, such as AD and PD. The major challenge in the treatment of neurodegenerative diseases is to identify a disease-modifying strategy able to slow or even to halt disease progression. Unfortunately, until now there is no such available therapy.

Since NFs are regarded as neuroprotective molecules, some attempts to use them in patients with neurodegenerative disorders have been made. There are some completed and ongoing clinical trials with this purpose, which are summarized in Table 1.

For AD treatment, the main tested NF was NGF. Based on the evidence of NGF positive effects on cholinergic neurons and cognition, NGF-based therapies have been proposed for AD treatment. One study showed that two from six patients enrolled in a clinical trial had positive results regarding cognition, electroencephalography, and nicotinic receptor binding after 12 months of encapsulated cell implants releasing NGF (EC-NGF) therapy. Of note, surgical implantation and removal of EC-NGF in the basal forebrain were safe and well tolerated (Eriksdotter-Jönhagen et al. 2012). After 12 months, there was an increase in both choline acetyltransferase (ChAT) and acetylcholinesterase activities. The activity of soluble ChAT correlated with cognition, CSF tau and amyloid-beta levels, in vivo cerebral glucose utilization and nicotinic binding sites, and morphometric and volumetric magnetic resonance imaging measures. In this study, three out of six enrolled patients had improvement in clinical outcomes (Karami et al. 2015). Table 1 shows clinical trials testing NGF-based therapies for AD treatment. Although trials have demonstrated safety and tolerability in NGF administration, studies failed to demonstrate the efficacy of NF-based strategies.

Regarding PD treatment, the most promising NFs are from the GDNF family, neurturin and

GDNF. Two open-label phase 1 studies involving PD patients investigated the delivery of neurturin using stereotactic injection of a viral vector (adeno-associated virus serotype 2, AAV2) in the putamen or both the putamen and the substantia nigra pars compacta. The procedure was safe and tolerable, with some clinical improvement. Unfortunately, when multicenter, double-blind, phase 2 randomized control trials were performed, no significant difference regarding motor symptoms between those who received AAV2-neurturin and the sham surgery group was observed up to 24 months of follow-up (Kalia et al. 2015). Old studies with GDNF in human PD also showed safety and tolerability. Currently, an open-label study is using a gene therapy approach with AAV2-GDNF and a convection enhanced delivery system for intraputamin GDNF in advanced PD (Table 1).

It is worth mentioning that some drugs clinically used to treat AD (memantine) and PD (levodopa, rasagiline, pramipexole, ropinirole, apomorphine) share the property of modulating NFs levels in the brain regions involved in the pathophysiology of the respective disease (Lanni et al. 2010).

## Conclusions

NFs are very important for neuronal development, survival, and maintenance. Aging is accompanied by several physiological changes, being the CNS one of the most affected. NFs imbalance is an important feature in age-related neurodegenerative disorders, being putative candidates to disease-modifying therapies.

## Cross-References

- ▶ [Alzheimer's Disease, Advances in Clinical Diagnosis and Treatment](#)
- ▶ [Common Cause Theory in Aging](#)
- ▶ [Cognitive Neuroscience of Aging](#)
- ▶ [Neurocognitive markers of aging](#)
- ▶ [Plasticity of Aging](#)
- ▶ [Parkinson's Disease](#)

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## New England Centenarian Study (NECS)

Mynhi Nguyen

School of Psychology, The University of Queensland, Brisbane, QLD, Australia

### Synonyms

Aging; Compression of morbidity; Genetic studies; Health span; Longevity; Survival analysis

### Definition

The New England Centenarian Study (NECS) currently investigates centenarians and their family members in order to identify determinants of healthy aging and exceptional longevity. Their findings contribute to medical and genetic topics related to extreme longevity.

### Background to the NECS

The New England Centenarian Study (NECS) (<http://www.bumc.bu.edu/centenarian/>) was founded in 1994 as a population-based study of all centenarians living within eight towns near Boston (Massachusetts, USA). The focus of the study was on the prevalence of Alzheimer's disease and other dementias in centenarians.

Gradually, the focus of the NECS transitioned from a population-based study focusing on medical issues into a study also inviting volunteers to investigate the characteristics of centenarians and their family members and identifying determinants of healthy aging and exceptional longevity (New England Centenarian Study Website: <http://www.bumc.bu.edu/centenarian/>; Sebastiani and Perls 2012). The NECS has recruited centenarians from throughout the United States as well as internationally (New England Centenarian Study Website: <http://www.bumc.bu.edu/centenarian/>).

The NECS has extended its recruitment to include siblings of centenarians and their

offspring in order to examine potential genes they may have in common and lifestyle factors that contribute to the ability to achieve extreme old age and live a healthy long life. Additionally, the NECS recruited younger referent subjects from families lacking longevity along with spouses of centenarians' offspring (Sebastiani and Perls 2012).

There has also been a specific endeavor to locate and recruit supercentenarians (persons aged a 110 or more) with the focus of discovering the genetic and environmental factors that facilitate living to extreme old age (New England Centenarian Study Website: <http://www.bumc.bu.edu/centenarian/>; Sebastiani and Perls 2012).

### Participants and Procedures

From 1994 to 2012, the NECS has recruited approximately 1,800 centenarians and 123 supercentenarians, approximately 600 centenarian offspring (in their 70s and 80s), and 437 controls (Sebastiani and Perls 2012).

The majority of centenarians in the study were born between 1880 and 1910, with a median age of 103 years. Of these centenarians, 85% are women and 15% are men. Among supercentenarians, the female prevalence is approximately 90% (New England Centenarian Study Website: <http://www.bumc.bu.edu/centenarian/>; Sebastiani and Perls 2012).

Potential subjects were detected via the town census, local obituary listings, councils on aging, local newspapers, and nursing homes (social workers, physicians, and visiting nurses). Also, voting records and media alerts were used (Sebastiani et al. 2012a; Perls et al. 2003). Today, eligible subjects can directly contact research staff to take part in the study. Details for participation are provided on the NECS website (<http://www.bumc.bu.edu/centenarian/>).

Subjects and their families were contacted by mail with a letter providing a description of the study and a postage-paid response card (Perls et al. 2003). The response card requested the subjects (or their proxy) to indicate that they are indeed a centenarian, whether or not they have a

living sibling, and whether they provide informed consent for recruitment for the study. If no response was received, a follow-up letter was sent. If attempts by mail were unsuccessful, attempts were made to contact the subject by phone. In some cases, neighbors were contacted to verify that the subjects are alive and visits were made to the subjects' home or residence.

Upon first contact, subjects were asked if they possess a birth certificate to validate their date of birth (Perls et al. 2003). If they do not, relevant information was obtained to locate the birth certificate. After all attempts were exhausted and the birth certificate was not obtained, then multiple corroborative pieces of evidence indicating the subject's age were requested. These may include: census data, military certificates, old passports, school report card, family bible, and baptismal or other church certificate. If the subject had children or siblings, their birth dates and birth order were noted to cross-refer their age in relation to the subject's age.

The only exclusion criteria for the NECS have been the inability to validate age (Andersen et al. 2012).

Once the subject's age was validated, they were asked to complete a series of questionnaires and provided a blood kit to obtain a small blood sample for the genetic aspects of the study (Perls et al. 2003).

## Measures

Questionnaires were used to assess a range of characteristics including: demographics, lifestyle choices, medical history, current medication, family pedigree, and physical (i.e., Barthel Index) (Andersen et al. 2012) and cognitive function (i.e., Blessed Information-Memory-Concentration [BIMC] Test) (Andersen et al. 2012).

Small blood samples were collected for the genetic aspect of the study (Sebastiani and Perls 2012). A dementia scale test was administered over the phone (Sebastiani and Perls 2012). Approximately 30% of the subjects provided consent to donate their brains for further study after they have passed away (New England

Centenarian Study Website: <http://www.bumc.bu.edu/centenarian/>).

## Funding

The National Institute on Aging (NIA), National Institute of Health (NIH), William Wood Foundation, and Martin Samowitz Foundation currently fund the study (New England Centenarian Study Website: <http://www.bumc.bu.edu/centenarian/>). Previously the study received funding from Alzheimer's Association, Ellison Medical Foundation, Alzheimer's Drug Discovery Foundation, American Federation Aging Research, and Glenn Foundation for Medical Research (New England Centenarian Study Website: <http://www.bumc.bu.edu/centenarian/>). All studies were approved and supervised by the Boston University Medical Campus Institutional Review Board (New England Centenarian Study Website: <http://www.bumc.bu.edu/centenarian/>).

## Findings from the NECS

The NECS has published in excess of 110 peer-reviewed papers (New England Centenarian Study Website: <http://www.bumc.bu.edu/centenarian/>). As it is beyond the scope of this entry to provide a broad review of the NECS findings, the following section focuses on four major areas of discovery and their associated publications.

### Genetic Signatures of Exceptional Longevity in Humans

Exceptional longevity is a complex phenomenon influenced by a combination of environmental and genetic factors (New England Centenarian Study Website: <http://www.bumc.bu.edu/centenarian/>). This study investigated the genetic contribution of exceptional longevity by conducting a genome-wide association study. It was hypothesized that the genetic contribution to exceptional longevity gets larger and larger with increasing age. The participants in this study included 801 centenarians (mean age at death 104 years) and 914 genetically matched healthy controls (i.e., spouses of

centenarian offspring, children of parents who died at age approximately 73, and from individuals from the Illumina control database).

Three steps were taken to build a genetic model of exceptional longevity: (1) Genetic marker analysis: to identify genetic markers that are significantly associated with exceptional longevity, (2) genetic risk modeling: to produce genetics risk profiles (based on nested Bayesian classifiers), and (3) cluster analysis of the profiles: to discover genetic signatures and correlate these to different survival patterns of exceptional longevity.

As hypothesized, results of the study found 281 genetic markers with 61% accuracy in predicting who is 100 years old, 71% accuracy in predicting who is 102 years old or older, and 85% accuracy in predicting who is 105 years old or older. That is, the prediction gets stronger with increasing ages greater than 100. These 281 genetic markers are associated with approximately 130 genes that may play a role in age-related diseases such as Alzheimer's disease, cancers, diabetes, heart disease, high blood pressure, and basic biological mechanisms of aging. Additionally, centenarians and younger people in the general population had the same amount of variants that were linked with increased risk for age-related diseases. Their exceptional survival advantage may therefore be due to the existence of longevity-associated genetic variants that are protective and counter the negative effects of such disease gene variants.

The 281 genetic markers can be used to create genetic profiles. A subgroup of subjects were found to have genetic profiles in common (genetic signatures). Ninety percent of the 801 centenarians were grouped into clusters characterized by one of 27 different genetic signatures of differing predictive values of exceptional longevity. These genetic signatures were also associated with varying predispositions to subgroups of centenarians such as those who completely escape Alzheimer's disease or those that delay heart disease until the final 5% of their lifetime.

The results of this study were replicated in other studies showing that many of the variants are associated with survival to extreme ages

(Sebastiani et al. 2013). A limitation of this study however was the use of Bayesian classifiers, which guarantees robustness although there are many alternative approaches to genetic risk modeling.

### **Health Span Approximates Life Span Among Supercentenarians: Compression of Morbidity at the Approximate Limit of Life Span**

Supercentenarians, individuals who are 110 years old and older are extremely rare, existing in industrialized nations at a rate of about one per five million people in the population (Andersen et al. 2012). James Fries (1980) proposed the compression of morbidity hypothesis, which states that as a person ages and reaches the limit of human life span, this would compress the time of developing diseases towards the very end of their life. This study investigated whether or not people who reach the limit of human life span actually compress their morbidity towards the end of their lives.

Participants of the study included: 104 Supercentenarians (aged 110–119 years, 13% men, 87% women), 430 Semi-Supercentenarians (aged 105–109 years, 20% men, 80% women), 884 Centenarians (aged 100–104 years, 25% men, 75% women), 343 Nonagenarians (aged 87–99 years, 38% men, 62% women), and 436 controls (different age groups corresponding to the ages of onset for diseases). These participants were followed for an average of 3 years (range 0–13 years). The age of onset of cognitive and physical disability, individual disease, and morbidity were examined using survival analysis.

Results of the study indicate that the older the age group, the later the onset of cognitive and functional impairment and age-related diseases such as cancer, cardiovascular disease, dementia, and stroke. Specifically, the hazard ratios for these diseases appeared progressively shorter with older and older age, and the amount of time spent with disease was shorter with older age group. In figures, there was a downward trend in the average percentage of years with disease, being 17.9% in control group, 9.4% in nonagenarians, 8.9% in centenarians, and 5.2% in supercentenarians.

Supercentenarians were very similar in terms of the exceptionally delayed age of onset of age-related diseases compared to centenarians. This shows that there may be some factors (presumably genetic) in common that enable them to be so similar. The overall morbidity was also progressively delayed with increasing age. Therefore, as hypothesized, as the limits of the human life span were effectively reached with supercentenarians, compression of morbidity was generally detected.

The study further discovered that for all the centenarian age groups, men were better off than women in terms of physical and cognitive status. Paradoxically, male centenarians are fitter than females but females have a much greater probability of surviving to extreme old age. This could be explained by women being better able to survive with age-related diseases and functional impairment compared to men, whereas mortality associated with these diseases are greater for men. Therefore there is a “select survivor effect” in which men who survive to extreme ages, compared to women, do not have the diseases and associated impairments that cause mortality at younger ages.

The advantage of this study was the large number of supercentenarian participants. There are a substantial number of prevalence studies of age-related diseases in the literature; however, participants of these other studies are mostly less than 105 years old.

The major limitation of this study was the healthy volunteer bias – that is, participants who are healthier were more likely to take part in the study. Additionally, the sample was enhanced with centenarians who have familial history of exceptional longevity. These participants were therefore more likely to achieve exceptional longevity than centenarians without such a familial history.

### **Whole Genome Sequence of Male and Female Supercentenarians, Both Ages >114 Years**

Human aging is affected by a combination of genetic, lifestyle, and environmental factors (Sebastiani et al. 2012b). The genetic element could explain approximately 20–25% of the

variability of human survival to the mid-eighties but may have a larger impact on survival to the nineties and beyond. Supercentenarians typically delay or escape disability and age-related diseases, and this exceptional survival is possibly determined by a genetic tendency that has both common and rare genetic variants. This study therefore investigated and described the complete genomic (DNA) sequence of two supercentenarians.

The study consisted of two subjects, one male and one female both born before 1897, and were more than 114 years old at the time of testing. Their actual age were confirmed by birth/baptism certificates and US census records. Both subjects were Caucasian and were selected for this study due to their exceptional life spans and health span. That is, the average Blessed Information-Memory-Concentration Test scores of both subjects were greater than average of the NECS supercentenarian sample until they died. Furthermore, both subjects exhibited delays in the ages of onset of disability. Peripheral blood was collected for each subject and used for DNA extraction. Illumina’s Clinical Laboratory Service subsequently sequenced the DNA samples using the Illumina Genome Analyzer II.

The results of the study showed that, first, the sequence variant spectrum of both subjects’ DNA sequence was predominately comparable to current non-supercentenarian genomes. In addition, both subjects did not carry most of the well-established human longevity enabling variants previously published in the literature. Both subjects had a comparable number of known disease-associated variants respective to most human genomes sequence at present. Approximately 1% of the variants these subjects held is novel and may direct to new genes that influence exceptional longevity. Finally, both subjects were enriched for coding variants close to longevity-associated variants that had been found through a large genome-wide association study.

These analyses indicated that there were both common and rare longevity-associated variants

that may counter the effects of predisposing disease variants and lengthen life span. Also, the continued analysis of the genomes of both subjects provided insight into the genetic processes that add to the maintenance of health during extreme aging.

Although the two genomic sequences do not give sufficient data for general inference on the genetics of exceptional longevity, they provide the foundation in generating a reference panel of exceptionally long-lived individuals and contribute insights regarding the genetic backgrounds that may be instrumental to exceptional longevity.

The NECS has made the whole genome sequence of both subjects available on a data base at the National Institute of Health. This enables researchers to retrieve all of the data and use them for their own exploration.

### **Middle-Aged Mothers Live Longer**

Previous studies have observed an association between older maternal age at birth of last child and exceptional longevity (Sun et al. 2015). These studies showed that women's ability to obtain exceptional longevity and their ability to bear children at an older age have common determinants and that prolonged fertility could be a marker of slower aging. The current study further investigated this phenomenon (Alpert et al. 1997).

Participants of this study consisted of 132 women born in 1896 and living in the suburban Boston area. They included 78 female centenarians and 54 women who died at 73 years of age in 1969. Next of kin of the subjects were located using data obtained by the Massachusetts Registry of Vital Records to get consent to participate in the study. Comparisons were then made between these two groups. Comparing women with the same year of birth minimized concerns about temporally related influences upon fertility such as health- and contraception-related trends, fluctuations in the economy, and war. The exclusion criterion for this study was if the women have not had the opportunity to have children, such as hysterectomy or never married before 35 years of age. No significant differences were found between the two cohorts in relation to loss of

spouse before age 45, rate of hysterectomy, marriage without children, and religion or years of education.

Results of this study revealed that women who lived to a minimum age of 100 were four times more probable to have had children while in their forties compared with women from the same birth cohort who had their last child at a younger age and lived only to age 73. This indicates that the ability to bear children after age 40 may be a marker for slow ageing and subsequently the ability to achieve exceptional longevity.

The study of such women predisposed to extreme longevity may also have implications regarding the theoretical basis of menopause and human life span. During the first quarter of this century, fertility-enhancing interventions for older women were not available. Under these circumstances, late menopause as well as pregnancy after 40 may be associated with extreme longevity. In addition, these women may also possess a decrease in susceptibility to age-related diseases that contribute to living longer.

Research has discovered that women who took estrogen were less likely to develop Alzheimer's disease or if the disease had already developed, they were likely to show delays in the disease onset. This may be true for women who experience late menopause, as they have prolonged exposure to endogenously produced estrogen (or other concomitantly produced substances). Avoiding or delaying age-related diseases that can cause premature mortality such as Alzheimer's disease, heart disease, or stroke could therefore be related to achieving longevity.

The evolutionary mechanisms that select for genetic variants that facilitate survival long after the age at which reproduction ends could be explained by allowing women to bear more children (Perls and Fretts 1998, 2001). This is consistent with the disposable soma theory, which states that there is a tradeoff in energy allocation between reproductive health and repair/maintenance roles. Women who age more slowly and delay/escape age-related diseases that negatively affect fertility may have biological mechanisms that strengthen the efficiency of energy production, therefore assisting the delay in the tradeoff.

The findings of this study provide support to previous research that demonstrated a positive association between older maternal age and higher odds for surviving to extreme old age.

## Conclusion

The New England Centenarian Study (NECS) is one of the largest studies of centenarians in the world. It began as a population-based study of centenarians in Boston and expanded to investigating medical and genetic research questions related to longevity by investigating characteristics of centenarians, their family members, and spouses. Today, the NECS continues to collect data, and those interested can contact research staff to participate.

Findings from the NECS are immense, spanning more than 110 peer-reviewed papers. This entry focused on four discoveries and publications. Firstly, the genetic contribution to exceptional longevity gets larger with older age. Centenarians and those in the general population share the same number of genetic variants that increase risk for age-related diseases; however, a number of genetic signatures were predictive of exceptional longevity. Secondly, health span approximates life span among supercentenarians: as the limits of human life span were effectively reached in supercentenarians, compression of morbidity – that is, the time of developing diseases towards the very end of their life – was observed. Thirdly, the whole genome sequences of male and female supercentenarians have been analyzed, identifying both common and rare longevity-associated genetic variants that may counter the effects of disease-risk variants and extend the life span. Lastly, middle-aged mothers live longer than younger mothers, indicating a positive association between older maternal age at birth of last child and exceptional longevity. That is, women were four times more likely to be a centenarian if they had their last child while in their forties. These studies provide invaluable insights into the mechanisms of exceptional longevity and can be used to inform models for aging well.

## Cross-References

- ▶ [Okinawa Centenarian Study, Investigating Healthy Aging among the World's Longest-Lived People](#)

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## Normative Cognitive Aging

Jonna Nilsson and Martin Lövdén

Aging Research Center, Karolinska Institutet and Stockholm University, Stockholm, Sweden

### Introduction

The term cognitive aging refers to the change in cognitive abilities (e.g., memory, reasoning, processing speed, and language) that is associated with chronological age. Research on this topic strives to describe, explain, and predict within-person change in cognition across adulthood. The research field is integrative in nature with roots in both cognitive psychology and lifespan development research and often interprets cognitive changes within the broader context of health conditions and biological factors. The longitudinal and multifactorial nature of cognitive aging and its inherent focus on a variable that cannot be experimentally manipulated (i.e., chronological age) demand specialized methodological approaches. While cognitive performance is typically measured in a controlled laboratory setting on a computer or with pen-and-paper tests, the test results are reliably associated with functioning outside the laboratory, including work performance and various health factors (Salthouse 2012). In the aging population, individual differences in cognitive performance are also associated with the level of independence in performing daily activities, such as cooking, budgeting, taking medications, and travelling. Cognitive aging research is therefore important for understanding how age-related changes in cognition can be expected to affect the daily life of individuals as well as the society at large.

### Methodological Principles

#### Age as a Variable of Interest

Since age cannot be experimentally manipulated, it does not qualify as an independent variable in the classical sense. As such, even though

cognitive change can be demonstrated to occur in parallel with increases in chronological age, age cannot be said to *cause* cognitive change. In fact, since age defines the passing of time since birth, it merely represents a descriptive axis against which developmental phenomena can be arrayed (Wohlwill 1970). Increasing age can instead be understood as an indirect and general measure of the intricate network of developmental sources that by complex interaction shape cognition across the lifespan.

Given the limitations of age as a variable of interest, alternative operational definitions of developmental time have been proposed. Biological age, or BioAge, aims to capture the underlying vitality of essential biological systems (DeCarlo et al. 2014). The markers that constitute a BioAge measure have varied between studies and range between being relatively distal to cognition (e.g., sensory function, blood pressure) to having more direct relevance to cognition (e.g., oxidative stress, neuroinflammation). In support of its application, BioAge has been found to explain more age-related variance than chronological age in cognitive level and change at an individual level. The biological status of an individual, as indexed by BioAge, therefore could provide a superior developmental axis against which cognitive change can be understood. Given the diversity of biological markers with links to cognition, as well as potentially relevant nonbiological markers, the creation of theoretically motivated multivariate models of cognitive development represents an important target for future effort in the field.

#### Normative Cognitive Aging

It is not straightforward to separate normative cognitive aging from pathological cognitive aging, particularly in very old age. One difficulty comes from the fact that age-related cognitive change generally forms a continuum instead of falling into discrete groups of normal and abnormal patterns of change (Deary et al. 2009). For example, it is known that individuals who will later develop Alzheimer's disease display lower cognitive performance several years before clinical diagnosis.

Consequently, a more or less arbitrary level of cognition is often applied to isolate individuals who demonstrate a presumably normative pattern of change. Such levels can vary widely, from only excluding volunteers with a dementia diagnosis to excluding all volunteers who demonstrate mildly lower cognitive performance according to some predefined criteria. To add to the complexity of defining a normative sample, various age-related health factors other than dementia affect cognition (e.g., cardiovascular disease and diabetes). A critical consideration and ongoing debate in the field is therefore what pattern of age-related change can and should be considered normal or healthy.

### Experimental Methods

The typical approach to studying within-person change in cognition as a function of age is to repeatedly administer the same cognitive test to a large sample of individuals at multiple time points from birth to death. An alternative to this longitudinal approach is the cross-sectional approach, which involves administering the cognitive test only once but to two or more samples of different ages. The longitudinal and cross-sectional approaches come with advantages and disadvantages (Schaie 1965). While both methods can be described as unifactorial designs with age as the only factor, they differ in that the cross-sectional method utilizes independent samples, while the longitudinal method utilizes dependent samples. The most damaging limitation of the cross-sectional design is that it does not allow the direct study of cognitive change at an individual level and thus also the study of between-person differences in individual change. Another important drawback is the so-called cohort effects that arise from that the age samples differ not only in regard to age but also in regard to birth cohorts, which means that results cannot be interpreted as pure age effects. The longitudinal design suffers from different limitations. Repeated testing in the cognitive domain means that the dependent variable cannot be assumed to be unaffected by the repeated observations. In fact, practice effects are common and should not be underestimated. Longitudinal designs are also

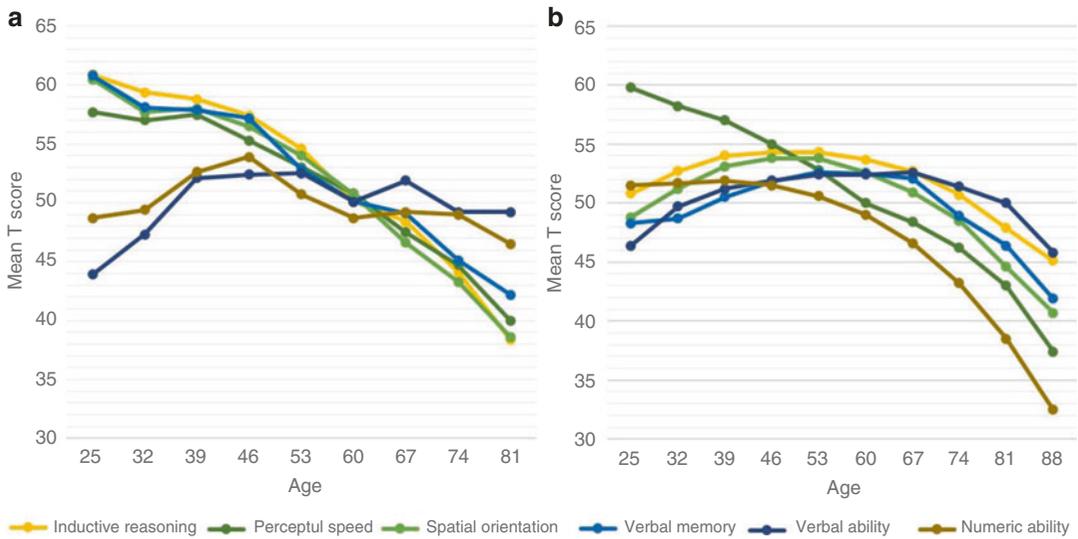
limited by the fact that results are specific to the birth cohort under study.

A more advanced approach involves combining the longitudinal and cross-sectional designs in a bifactorial model with age and cohort as components (Schaie 1965). In such a cohort-sequential design, the same cognitive test is administered to several birth cohorts (e.g., those born in 1950, 1960, and 1970) at the same ages (e.g., at age 60, 70, and 80). Under some assumptions, this design can allow for teasing apart the variance associated with chronological age from variance related to cohort and practice effects.

### Differential Decline Across Cognitive Abilities

Different cognitive abilities show distinct relationships to chronological age. Cross-sectional studies reveal that well-practiced skills and acquired knowledge show improvement or stability until late in life, while abilities that are thought to capture the efficiency of cognition, such as processing speed and reasoning, follow a linear decline with an earlier onset (Schaie 1994). Differential decline has been reported also among the declining cognitive abilities, ranging from age correlations of  $r = -0.52$  for processing speed and  $r = -0.40$  for reasoning to  $r = -0.27$  for short-term memory (Verhaeghen and Salthouse 1997). Above and beyond average decline, moment-by-moment intraindividual variability in cognitive performance, most markedly processing speed, also increases reliably in old age (Hultsch and MacDonald 2004). In support of its application, intraindividual variability in processing speed has been found to be superior to the average in predicting subsequent cognitive change.

Cross-sectional and longitudinal investigations have generally produced consistent results in terms of which cognitive domains that are most vulnerable to decline as a function of age. However, discrepant results have emerged when it comes to both the rate and the onset of the decline (Fig. 1, adapted from Schaie (1994)). While cross-sectional studies tend to demonstrate a linear



**Normative Cognitive Aging, Fig. 1** Cross-sectional estimates (a) and longitudinal estimates (b) of age-related change in cognition (Adapted with permission from Schaie (1994))

decline that starts in early adulthood, longitudinal studies show decelerating improvements across young adulthood, peaks in middle age, and accelerating declines thereafter, with the exception of processing speed, which starts to decline already in early adulthood (Schaie 1994).

The differential relationship between age and different cognitive abilities has influenced theories of cognitive and intellectual development, with two-component models of age-related cognitive decline now being widely accepted in the field. In such models, one component captures the process-based cognition that is strongly associated with age, while the other captures knowledge-based cognition that remains relatively stable (Horn 1989). The models can also be understood in terms of an interaction between a biological (process-based) component determined by neurophysiological status and a cultural (knowledge-based) component determined by biographically acquired knowledge. While the biological component declines as a result of deterioration of the supporting neural infrastructure with increasing age, the cultural component continues to increase as long as the biological component allows the acquisition, maintenance, and production of knowledge (Baltes et al. 2007).

Other models of cognitive aging provide a more explanatory structure of age-related cognitive changes. Variants of cognitive resource theory postulate that a large proportion of age-related cognitive change can be reduced to a small number of sources, namely, an age-related restriction on cognitive resources (Hertzog 2008). The processing speed theory postulates that most if not all of age-related cognitive decline can be accounted for by changes in processing speed. Other variants have emphasized the importance of working memory capacity, self-initiated processing deficits, and inhibitory loss. Empirical evidence supports the need for such common cause models; over 60% of the interindividual variance in cognitive change in old age is shared across different cognitive abilities. However, since not all variance can be accounted for by common factors, ability-specific accounts also have a natural place in the field. Such accounts are not concerned with explaining overall age-related cognitive change but focus on age-relationships within specific cognitive domains. In the associative deficit hypothesis, for example, age-related decline in episodic memory is proposed to be underpinned by a deficit in creating and retrieving links between single units of information.

## Differential Decline Between Individuals

Individual differences in cognitive status in old age depend on two factors: prior cognitive ability and the change trajectory that follows. Prior cognitive ability is perhaps the strongest predictor of cognitive status in old age. Even at the age of 80, childhood intelligence contributes 50% or more to the level of cognitive ability (Deary et al. 2009). While such between-person differences in level of cognitive performance remain relatively stable across adulthood, between-person differences in cognitive change trajectories tend to be more sizable in old age, reflecting that changes in performance are steeper for some than for others (de Frias et al. 2007). Although some of the heterogeneity in cognitive trajectories in old age is accounted for by pathological conditions, such as dementia, the same pattern appears to hold even for the positively selected segment of individuals who are deemed to age “normally.” Cognition therefore does not adhere to a pattern of universal nomothetic change with age. The heterogeneity clearly questions the usefulness of an average aging pattern and begs the question of what factors that predict within-person change in cognition.

A large number of factors, genetic and environmental, are thought to shape individual change trajectories. Heritability estimates are often based on comparisons of relatives who differ in terms of genetic relatedness (e.g., identical vs. fraternal twins) or environmental similarity (e.g., reared apart vs. reared together), which means that estimates can differ between populations of different ages as well as between different times of measurement. In normal populations, heritability estimates for cognitive level range between 40% and 70% and tend to increase in midlife and decrease again in late adulthood with corresponding changes in non-shared environmental variance (Reynolds 2008). The direct genetic influence on cognitive *change* trajectories is thought to be much weaker. An alternative approach to understanding the genetics of cognitive aging is to identify candidate genes. Despite a large number of studies being published, there is only one candidate gene that has been consistently associated

with cognitive change in old age. This gene, which codes for apolipoprotein E (APOE), has been associated with an increased risk of late-onset Alzheimer’s disease but also with cognitive change in healthy aging.

In addition to genetic determinants, lifestyle and health factors are thought to be important in cognitive aging. Work complexity and educational exposure have been related to the level of cognition in old age (Hertzog et al. 2008). However, such factors tend to be unrelated to cognitive change, which suggests that they represent individual differences in prior cognitive ability or effects that operate on cognition earlier in life. In contrast, other lifestyle factors, such as engagement in cognitively stimulating leisure activities, social activities, and physical exercise, reliably predict cognitive level, and changes in these factors are associated with changes in cognitive performance in old age (Hertzog et al. 2008; Prakash et al. 2015). Several health factors, including cardiovascular disease, metabolic disorders, and smoking, are also thought to play a role in old-age cognition. Relative to genetic influences, which are necessarily non-modifiable, lifestyle factors and health factors are to some extent open for modification.

## Recent Trends

### Intervention Studies

The influence of modifiable factors on cognitive decline in old age suggests that a certain degree of prevention may be possible. At an applied level, prevention and intervention studies therefore hold great promise for improving cognitive ability with major implications for the individual as well as for the society at large. By allowing for causal inferences, intervention studies also make critical contributions to the understanding of the mechanisms that underlie cognitive change in old age.

The literature has recently seen an explosion of interest in different factors with potential of improving cognition in old age. Cognition itself represents an obvious target and consequently numerous studies have implemented training of cognitive strategies and processes. A critical

aspect of cognitive interventions is that the training gains must be shown to generalize to non-trained tasks. This ultimately aims to demonstrate an extension to everyday cognition through effects on processing efficiency rather than on knowledge and expertise. In this regard, training of cognitive processes, such as working memory and executive function, as opposed to cognitive strategies has been put forward as being more promising. However, meta-analytical results in old adults have indicated that working memory training may not result in reliable transfer of training gains to fluid intelligence measures (Melby-Lervag and Hulme 2015). In more detail, while studies with passive control groups tend to show small but significant transfer ( $g = 0.15$ ), studies that include an active control group that receives a task of similar content and duration do not ( $g = 0.02$ ). The existing evidence for transfer effects following working memory training therefore remains confounded by nonspecific effects, such as expectancy, motivation, computer use, and social interaction. Another popular target for intervention studies is physical fitness. In such investigations, previously inactive individuals engage in a physical exercise regime during a fixed period of time. In older adults, moderate-intensity aerobic exercise has been found to have a modest but significant effect on cognitive performance in several domains (Prakash et al. 2015). Longer training regimens, longer training sessions, and regimens combining strength and aerobic exercise have been associated with greater cognitive gains.

Considering the modest effect sizes associated with single-domain interventions, an alternative approach has been to target several domains simultaneously. Since the independent contributions of the manipulated domains cannot be distinguished, multi-domain intervention studies tend to adopt a more applied approach. Recent evidence suggests that a combination of interventions targeting diet, exercise, cognitive training, and vascular risk monitoring is associated with maintained or improved cognition over a 2-year period in older individuals (Ngandu et al. 2015). Similar to single-domain intervention, however, effect sizes are limited. Considering the

multifactorial origins of cognitive aging, it is possible that even a relatively long-term multi-domain intervention in old age only reflects a small modification in the context of a lifelong accumulation of environmental and genetic effects. On the other hand, even small effects provide important clues about the underlying mechanisms of cognitive aging and can have a monumental impact in a public health context.

### Theoretical Perspectives

Detailing the pattern of cognitive change across the lifespan can be likened to trying to hit a moving target. The well-established cohort effect (or Flynn effect) supports the appropriateness of this metaphor; mean intelligence scores show a steady increase between subsequent generations when measured at the same ages. In aging populations, such cohort differences have been demonstrated both in regard to level of cognitive performance and to trajectories of cognitive change (Skirbekk et al. 2013). Different change patterns are believed to be due to a continuous interaction between genetic predispositions, contextual influences, and individual decisions, which likely differ between cohorts. Since a change trajectory derived from one birth cohort cannot be safely assumed to apply to other birth cohorts, research efforts are increasingly going beyond description to also investigating underlying mechanisms. The reasoning is that the proximal causes and mechanisms of cognitive change are likely to be similar across cohorts, even though the timing and impact as a function of chronological age may be different.

Within-person change in cognition occurs at more than one time scale. Cognitive aging refers to the enduring change in cognitive performance that occurs over the course of a decade or more. However, in addition to such developmental change, within-person change also occurs at a much shorter time scale and in a less enduring manner, for example, through processes of practice and learning. Critically, longitudinal investigations are typically based on assessments that are completed several years apart, which limits the temporal resolution of the measurement and confounds estimates of long-term cognitive aging

with shorter-term practice effects (Rast et al. 2012). Measurement burst designs offer an approach to estimating such short-term changes by comprising a number of closely spaced assessments, separated by days, hours, and even minutes. The improved accessibility to devices that allow remote cognitive testing, including home computers, smartphones, and tablets, represents an important aspect for the feasibility of such a design. Integrated into a longitudinal design, measurement bursts can improve the precision of the occasion-specific score as well as allowing long-term age-related change to be separated from short-term variability. Furthermore, it allows for an examination of the relationships between within-person changes in cognitive as well as biological variables at different time scales and how such relationships may change as a function of age. Indeed, the relationship between moment-to-moment variability in cognitive performance and subsequent cognitive change in old age exemplifies such a relationship (Hultsch and MacDonald 2004). Taking one step further, a longitudinal burst measurement design would also allow the investigation of the prospect that the mechanisms underlying within-person change at different time scales, such as learning and cognitive aging, might share important principles.

With an increased focus on the mechanisms underlying cognitive aging, the field is gradually merging with the field of neuroscience. As a result, general frameworks of how to frame and understand the role of the brain in age-related cognitive decline are becoming increasingly important. The characteristics of such metatheories can be categorized into three themes: brain reserve, cognitive reserve, and brain maintenance (Nyberg et al. 2012). According to the brain reserve view, various protective factors during the life course, such as education and occupation, will lead to higher cognitive performance that is maintained into old age. The cognitive reserve account instead states that such protective factors may aid compensatory reactions to age-related brain changes. Thus, while a greater brain reserve would provide more time until the critical threshold for functional impairment is reached, a greater cognitive reserve would

provide more efficient compensation mechanisms to counteract negative effects when they occur. According to the brain maintenance account, protective factors are instead proposed to prevent age-related brain changes from occurring in the first place, allowing the brain to remain young with optimal function for longer. While useful as general frameworks, further progress in the field, including operational definitions, will be required to disentangle the relative importance of the reserve and maintenance views. Particularly, it will be important to identify the various processes that give rise to the different but likely complementary mechanisms of cognitive aging.

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## Nutrition in Aging, An Exploration of a Close Relationship

Veronique S. Chachay  
 School of Human Movement and Nutrition  
 Sciences, School of Medicine, The University of  
 Queensland, Brisbane, QLD, Australia  
 Faculty of Health and Behavioural Sciences,  
 The University of Queensland, Brisbane, QLD,  
 Australia

### Synonyms

Aging disease prevention; Bioactive food constituents; Chronic disease prevention; Dietary pattern; Food matrix; Healthspan; Inflammaging

### Definition

The role of food constituents in modulating age-related metabolic changes to impact positively on healthy life expectancy.

## Introduction

Nutrition is a fundamental pillar in physiological survival. In addition, it is the lifestyle habit with perhaps the greatest impact on healthy life expectancy (HLE) or the quality of life span, because it is practiced several times a day most days of life.

Nutrition and aging are closely intertwined in negative and positive feedback loops. Firstly, aging can impact on nutrition processes through reduced organ function, impaired digestion and absorption of nutrients, or loss of appetite. This in turn impacts on the nutrition status – or how well nourished one is – and therefore on overall mental and physiological functions. In addition to the burden of malnutrition outcomes, the aging process may accelerate due to scarcity of protective and regenerative substrates. Secondly, the chronic signaling of good or poor nutrition is slow acting and cumulative, just like aging mechanisms. The biochemical effects of daily food choices cumulate into health outcomes that surface as decades add up. The outcomes could be a fit and healthy physiology during the retirement phase of life, with minimal decline from aging. Or conversely, the outcomes could be the gradual onset of chronic disease, disabling the last 30 years of life and speeding up the onset of mortality.

In the search for solutions for HLE in an aging population, the role of nutrition as a corner stone in the prevention of aging and chronic disease deserves careful attention, as indeed it can be a friend or a foe.

This paper will explore three main topics: (1) a definition of nutrition and its processes, (2) a description of how aging influences the nutrition processes and related outcomes, and (3) an evaluation of how nutrition can modulate the aging process through the example of systemic inflammation, with highlights on current foci of nutrition research.

### The Nutrition Process

Nutrition is foremost the intake and transformation of foods to provide the necessary

nourishment for optimal physiological function. Many will argue that nutrition is also – or perhaps primarily – about the pleasure of eating, tastes and smells of food, or sharing meals with friends and family (Wardlaw et al. 2016). While these factors are of definite relevance when describing nutrition, only “nutrition for nourishment” will be considered in this discussion.

**Nutrition: Intake, Digestion, Absorption, Metabolism, and Transport of Food Constituents**

Food constituents consumed are not useable by cells until they have been digested into small monomers, absorbed by the absorptive cells along the gastrointestinal tract (GIT), metabolized, and finally transported to cells for uptake. Nutrition is a five-step process. Briefly, a set of mechanical steps involves the structures and organs of the GIT in breaking down food matter, starting from the teeth in the mouth. Digestive juices, hormones, and enzymes secretions from organs and cells along the GIT orchestrate the chemical digestion of food particles, in order to free micronutrients and break down macromolecules into monomers. Absorptive cells along the GIT perform biochemical transformations and release nutrients into the portal vein or the lymphatic circulation. Further metabolism occurs in the liver, to convert vitamins and minerals into their biologically active form. Bacteria inhabiting the GIT digest the remaining undigested food particles, fiber, and polyphenols and in the process produce metabolites. Hormone signaling and transport molecules are required to deliver most nutrients to the cells. For example, the insulin signaling induces the recruitment of transporters to the muscle cells’ membrane for glucose uptake and conversion to fuel that is useable for physiological function: adenosine triphosphate (ATP) (Wardlaw et al. 2016).

This brief summary highlights the complexity of the nutrition process. Optimal nutrition relies not only on ingesting optimal foods but also on a well-functioning GIT and its related organs. Decline in aging can reduce the efficiency and impair the mechanical and chemical steps of nutrition, as outlined further.

**What’s in Food?**

Foods contain a variety of constituents within a matrix. Food constituents are generally categorized according to the biochemical role they have (Wardlaw et al. 2016).

- *Macronutrients* yield energy, which metabolic pathways convert to ATP. Macronutrients also provide the building blocks for body structures and for the formation of DNA products. Macronutrients include protein, fats (saturated, trans mono- and polyunsaturated), and carbohydrate. Alcohol is not a macronutrient per se, but it yields energy. Table 1 outlines the energy-containing food constituents, with their energy yield in calories and kilojoules per gram (Wardlaw et al. 2016).
- *Micronutrients* do not yield energy but are required in the metabolic pathways of energy production that convert macronutrients into ATP. They are also required as cofactors in a plethora of functions such as detoxification mechanisms, bone formation, DNA and neurotransmitters synthesis, nerve impulse transmission, or gene expression signaling. Commonly, 14 or so vitamins and 14 or so minerals are considered essential to the diet, based on the clinical evidence available on deficiency signs and symptoms in the absence of these nutrients. Other trace minerals are present in food; however, clinical evidence of essentiality is lacking at this point in time (Wardlaw et al. 2016; Higdon 2003).
- *Phytonutrients (also referred to as phytochemicals)* form the large family of plant constituents, which don’t qualify as micronutrients. They contribute to colors of plant material and include the various types of fiber found in

**Nutrition in Aging, An Exploration of a Close Relationship, Table 1** Energy-yielding food constituents

Constituents	Calories yield per gram	Kilojoules yield per gram
Protein	4	17
Fat	9	37
Carbohydrate	4	16
Alcohol	7	29

fruit, vegetables, whole grain, herbs, and spices. Small amounts of each phytonutrient are consumed through the diet; however, the large variety of constituents in this family suggests that in a diet rich in fresh fruit, vegetables, and whole-grain plant foods, the total intake of phytonutrients is substantial. While essentiality in the diet has not been determined in terms of deficiency signs and symptoms, phytonutrients have demonstrated *in vitro* biological activity, including gene expression signaling in a variety of pathways such as the regulation of inflammation, the antioxidant defense, and chemoprevention, qualifying them as bioactive food constituents (Wardlaw et al. 2016; Williams et al. 2004).

Furthermore, in populations following dietary patterns, which include a large variety of phytonutrients – such as the traditional Mediterranean diet (TMD) (Hoffman and Gerber 2013) – the antioxidant defense and anti-inflammatory pathways are shown to be significantly upregulated, compared to control populations with less dietary exposure to phytonutrients. The predicted long-term outcome, based on surrogate markers of chronic disease such as circulating inflammatory cytokines, insulin sensitivity, and endothelial function, is an overall protective effect (Wardlaw et al. 2016).

Table 2 outlines the micronutrients considered essential and some examples of phytonutrients with established biological activity.

Water is also present in food, as are various additives, in greater or lesser amounts. As a rule of thumb, the more processed a food is (longer shelf life or multi-ingredient designer packaged foods), the more likely it will contain additives for preservation, plastic packaging-related toxins such as endocrine disrupting chemicals, or food processing-related toxins such as advanced glycation end products. Additives and food preparation toxins may add significant burden to the liver detoxifications system, the inflammatory pathways, and the aging process (Wardlaw et al. 2016). The association between health outcomes, food additives, and food packaging is the topic of active public health research. In the

**Nutrition in Aging, An Exploration of a Close Relationship, Table 2** Food constituents: essential micronutrients<sup>a</sup> and phytonutrients

Vitamins	Minerals	Examples of phytonutrients
Vitamin A	Calcium	Anthocyanidin
Thiamin (B1)	Chromium	Beta-glucans
Riboflavin (B2)	Copper	Catechins
Niacin (B3)	Fluoride	Curcuminoids
Pantothenic acid (B5)	Iodine	Daidzein
Pyridoxine (B6)	Iron	Geneistin
Biotin (B8)	Magnesium	Gingerol
Folate (B9)	Manganese	Hydroxytyrosol
Cobalamin (B12)	Molybdenum	Lycopene
Choline	Phosphorus	Lutein
Vitamin C	Potassium	Procyanidins
Vitamin D	Selenium	Quercetin
Vitamin E	Sodium	Resveratrol
Vitamin K	Zinc	Sulforaphane

<sup>a</sup>Links to organizations for recommended nutrient intake targets are provided in the reference section

absence of robust human evidence on the acceptable ranges of exposure to these compounds or causal relationship with chronic disease, this topic is not included in the present discussion. Readers are referred to references provided (Gore et al. 2015; Ramasamy et al. 2005).

**How Much of Each Nutrient is Required for Optimal Health?**

Public health organizations determine nutrient targets per life stage for macro- and micronutrients (but not phytonutrients to this day) based on the currently available human scientific evidence on requirements. The targets provide guidance to avoid micronutrient deficiencies in the average healthy population and suggest dietary targets to reduce chronic disease, where the evidence for a link between the food constituent and the disease is robust. An example is the recommended target for daily fiber intake, based on the link between high-fiber diets and reduced risk of colorectal cancer (Wardlaw et al. 2016; Higdon 2003).

From the nutrient targets, eating guidelines are devised for the general, not older, healthy



population, in order to cover the recommended nutrient intake through foods, considering equity and sustainability (Wardlaw et al. 2016).

Reference ranges for nutrient targets do not take into account individual characteristics, such as genetic polymorphisms in key metabolism enzymes, overall health status, previous and current comorbidities, medication use, physical activity, environmental factors, and stage of life, which all may alter requirements. Nutrition professionals tailor the nutrient targets based on individual requirements and may advise on supplementations where needed (Wardlaw et al. 2016).

#### If Some is Good, More Must Be Better? Nutrients Versus the Whole Food Matrix

A greater understanding of the role played by individual nutrients in biochemical pathways should not distract from the sources in which these nutrients are found, namely, in foods, and how they should be consumed, namely, in dietary dosage. A dietary dose of any nutrient is the amount at which it is found in the whole food. This is usually a small amount. Food constituents contained in the whole food matrix are combined with other micro- and macronutrients, including fiber, phytonutrients, and usually water, to provide a variety of nutrients with synergistic effects on absorption and bioavailability. For instance, vitamin C plays a role in free radical neutralization, as an electron donor. When it is consumed in an orange, it comes with flavonoids, themselves bioactive in cell signaling and gene expression for improved antioxidant function. The vitamin C and flavonoids are combined to fructose and glucose for energy production and with fiber to feed the gut bacteria that also play a significant role in the modulation of immune function (Wardlaw et al. 2016).

#### Nutritionism and Nutraceuticals

The reductionist approach, perhaps imposed by research paradigms required to demonstrate causality, may have led to a distorted perception of nutrition, where the single nutrient becomes the focus, rather than the whole food, in achieving a particular health outcome. “Nutritionism” is

viewed as the reduction of nutrition to the isolated constituents associated with health benefit in *in vitro* experimental findings (Wardlaw et al. 2016). As a result the concept of nutraceuticals emerged, offering bolus pharmacological doses of isolated nutrients, sometimes combined with a few others in propriety formulae not found in whole foods. For instance, the bioactive constituent resveratrol found in the skin of red grapes, and therefore in red wine, is consumed in small amount when eating grapes (0.5 mg per cup) or drinking a standard glass of red wine (1.5 mg per 150 mL). It is consumed within the matrix of the original grape juice, which also includes a large variety of other phytonutrients. Resveratrol capsules in nutraceutical products provide up to 1500 mg each of pure resveratrol extract, with no other phytonutrient (Poulsen et al. 2015).

The reductionist view of nutrition has proposed the hypothesis that “if some is good, more is better,” but with little to no evidence to support this hypothesis in humans. To the contrary, evidence has mounted over the last two decades to demonstrate that pharmacological (as opposed to dietary) dosages of micro- and phytonutrients taken daily as capsules are not associated with the prevention of chronic disease, but instead were shown to increase the incidence of all-cause mortality in large retrospective and prospective cohorts (Goodman et al. 2011; Bjelakovic et al. 2012).

#### Antioxidant Nutraceuticals to Fight Aging?

The antioxidant therapy approach to preventing aging decline purported that free radicals should be aggressively fought with antioxidants in high-dose capsules to prevent oxidative stress and damage that lead to aging. The lack of successful outcomes with this approach, also called the “antioxidant paradox,” has since been explained by new understanding on free radical behavior and biology. This includes the following: (1) *in vitro* free radical neutralization by antioxidant nutrients may not be duplicable in physiological conditions due to the complexity of homeostatic mechanisms involved, and (2) free radicals such as reactive oxygen species (ROS) are also critical signaling molecules in the

activation of the endogenous antioxidant defense and detoxification systems (Halliwell 2013; Finkel and Holbrook 2000). A rise in free radicals triggers the activation of the nuclear factor erythroid 2-related factor 2 (Nrf2), which induces the expression of gene coding for antioxidant and detoxification enzymes. These enzymes constitute the endogenous antioxidant system that is operating 24 h a day, 7 days a week. Suppressing free radicals aggressively by ingesting large doses of antioxidant nutrients may switch off this mechanism or reduce its efficacy with an overall imbalance in endogenous signaling pathways (Cardozo et al. 2013). Furthermore, large bolus doses of antioxidant nutrients taken once a day may result in cellular imbalance of cofactors and increase in reactive species. Indeed, when vitamin E donates an electron to stabilize a free radical, it becomes itself an unstable molecule and requires stabilization by vitamin C, for example. Large bolus doses may thus result in a sudden increase of reactive molecules that may have deleterious effects (Hoffman and Gerber 2013; Halliwell 2013). On the other hand, a sudden increase in concentration of ROS leads to the increase in inflammatory cytokines production, by activation of the nuclear factor kappa-light-chain-enhancer of activated B cells (NF- $\kappa$ B). Increased systemic inflammation is a driver of chronic disease, as will be discussed further.

While modulating the concentration of circulating free radicals remains a focus in prevention and management of aging-related and chronic disease, it is the maintenance of the redox homeostasis status that appears of greater importance, where the balance between reducing and oxidizing molecules is actively maintained (Finkel and Holbrook 2000).

#### Safety of Pharmacological Dosages of Nutrients

Consuming high bolus doses of one or more nutrients is therefore “not better,” unless evidently, deficiencies have been identified biochemically (Higdon 2003). The micronutrient target ranges mentioned earlier indicate the upper levels of intake for vitamins and minerals for which toxic levels of intake are known (Higdon 2003). Water-soluble vitamins in excess will mainly be

excreted via the urine, but fat-soluble vitamins and minerals may remain stored in body tissues with significant toxicity implications (Wardlaw et al. 2016). Targets for phytonutrients have not been established, other than recommendations to consume a diet rich in fresh plant products to increase exposure (at dietary dosage) to these bioactive constituents. However there is no evidence on the long-term safety or toxicity of pharmacological doses of phytonutrients consumed as nutraceuticals. The common assumption is that since they are coming from foods – rather than being synthetic pharmaceutical molecules – they must be safe. Consuming 6 kg of tomatoes, 4 kg of carrots, and 4 kg of kale would barely be possible in 1 day and certainly not on a daily basis. Nutraceutical products offer the phytonutrients contained in this amount of food in one capsule, but it is unknown if the constituents are fully absorbed, if cells can deal with such high dosage, and if this is safe (Poulsen et al. 2015; Valtueña et al. 2008).

#### Nutrient Density in Dietary Patterns

Consuming daily a large variety of micro- and phytonutrients within the whole food matrix is characteristic of a *nutrient-dense* dietary pattern, and this “is better” indeed. Nutrient density generally describes the variety and ratio of micronutrients and phytonutrients to calories contained in the food. Nutrient-poor foods – or empty calories – are devoid of micro- or phytonutrients but provide calories through carbohydrate and fat primarily, such as crisps, chocolates bars, and pastries. Nutrient-dense foods can also be energy dense, such as dried fruit or mixed nuts (Wardlaw et al. 2016).

Nutrient density at dietary dosage confers a variety of beneficial molecular stimuli and at multiple occasions throughout the day (as opposed to one capsule daily). The human evidence for the short- and long-term benefits on HLE and life span of nutrient-dense dietary patterns are best demonstrated by the traditional Mediterranean diet (TMD) (Hoffman and Gerber 2013). This dietary pattern is rich daily in fresh plant-based raw and cooked foods and condiments, as well as including dairy products, fresh seafood, lean

meats, moderate (red) wine drinking, and abundant use of extra virgin olive oil providing the combination of monounsaturated fatty acids and a variety of phytonutrients of the polyphenol family. In addition, the TMD pattern promotes meals made of several dishes (increased variety of foods), and meals prepared freshly that reduce the exposure to processed and refined nutrient-poor foods (Hoffman and Gerber 2013).

The nutrient-density and macronutrient composition, combined with the minimal exposure to processed foods, is thought to explain the numerous health benefits attributed to the TMD. The evidence in humans for health benefits ranges from the primary prevention of coronary heart disease in a high-risk population, to the reduced or delayed onset of chronic disease, and aging-related decline in immune function, antioxidant defense, DNA repair, and cognition (Estruch et al. 2013).

### **The Influence of Aging on Nutrition and the Related Health Outcomes**

Optimal nutrition relies not only on nutrient-dense food choices but also on a well-functioning gastrointestinal tract and related organs and structures, as described earlier. With the aging process, degenerative mechanisms can gradually impair nutrition (Wardlaw et al. 2016). Food intake may be reduced due to a loss of appetite or a loss of pleasure when eating. A loss of acuity in olfactory and gustatory function alters the sensory perception of food, influencing food choices and intake (Wardlaw et al. 2016). Mechanical and chemical digestive functions may become less efficacious, reducing the amount of nutrients being absorbed. The metabolism of converting vitamins to their biological active form may become impaired. The availability of nutrients to cells may thus become severely reduced. If undernutrition and malabsorption are sustained over time, the deficiencies in energy, protein, and essential micronutrients result in weight loss, loss of lean body mass, and malnutrition (Wardlaw et al. 2016; Hickson 2006). A decline in overall metabolism, immune function,

cognition, and well-being ensues, promoting the exacerbation or development of underlying chronic diseases. Nutrition therapy prioritizes the increase of energy and nutrient density in each mouthful, to stop weight loss and restore nutrient sufficiency (Hickson 2006).

Of note, malnutrition is defined as an imbalance (deficiency or excess) between nutrients and energy requirements and dietary intake, causing measurable outcomes on weight, body composition, metabolic function, and clinical markers. As such, malnutrition applies to overweight individuals as well, where the imbalance between energy intake and requirements results in accumulation of excess fat mass. Excess weight can also be associated with micronutrient deficiency due to a nutrient-poor diet, as excess energy intake does not guaranty nutrient density, as previously discussed. Furthermore, obesity can mask sarcopenia (Prado et al. 2016) (the loss of muscle mass) resulting from the aging process or underlying chronic disease. Protein and micronutrient malnutrition promotes sarcopenia at any weight (Prado et al. 2016).

It is worth noting that overweight to moderate obesity (with good micronutrient status) is suggested to be protective in aging and should not be undermined. The healthy weight range for adults is a weight resulting in a body mass index (BMI) between 20 and 24.9 kg/m<sup>2</sup>. A recent meta-analysis of 32 studies including subjects over the age of 65, living independently in the community, confirmed previous findings in cohort follow-up studies that the adult BMI recommendations may not be suitable for the older age group. The meta-analysis found that individuals over 65 years old, with a BMI between 23 and 31 kg/m<sup>2</sup>, had a significant lower risk of all-cause mortality compared to individuals with a BMI under 23 kg/m<sup>2</sup> or over 33 kg/m<sup>2</sup>. There are currently no adjusted recommendations from the World Health Organization on the healthy BMI range in the older population; however, local public health organizations have reviewed guidelines based on study results and derived recommendations (Winter et al. 2014).

Table 3 outlines the possible effects of aging-related function decline on nutrition processes.

**Nutrition in Aging, An Exploration of a Close Relationship, Table 3** Changes that may occur with aging, impacting on the nutrition processes

Structures, digestive processes, or other factors influenced by aging and outcomes		Nutrition-related consequences <sup>a</sup>
Reduced hunger and appetite	Early satiety due to reduced stomach stretch capacity, reduced ghrelin secretion, increased circulating inflammatory cytokines acting on the central nervous system in reducing hunger	The reduced dietary intake for extended time leads to energy, protein, and essential nutrients malnutrition. Weight loss and loss of lean body mass, loss of strength and balance. Deficiency symptoms associated with nutrient deficiencies
Reduced or loss of acuity in smell and taste	Food tastes and smells bland. The cues from the smell of food that normally signal appetite and the start digestive secretions are absent	
Loss of teeth or ill-fitting dentures	Difficulty and pain when chewing food. Larger chunks are being swallowed, or avoidance of specific foods such as fresh fruit requiring chewing, leafy and raw vegetables, nuts, meat, multigrain breads, etc.	May lead to indigestion if food is not chewed adequately, or protein food is not broken down by hydrochloric acid and pepsin. Nutrients are not available for absorption if food was not chewed or avoided. Examples of nutrients at risk include individual amino acids, iron, zinc, vitamin B6, B12, and folate. May lead to nutrient deficiencies
Reduced hydrochloric acid production, reduced secretion, and conversion of pepsinogen to the active form pepsin	Bacteria contained in foods are not neutralized efficiently. Protein is not denatured and broken down into smaller particles for enzymatic cleaving; nutrients are not freed for absorption	
Reduced intrinsic factor production by gastric cells	Intrinsic factor is required for the absorption of vitamin B12 in the distal ileum. Reduced gastric function results in less intrinsic factor being produced	Impairment of vitamin B12 absorption and deficiency signs and symptoms over time
Reduced pancreatic and liver function: reduced digestive enzymes and bile production	Macronutrients are not broken down adequately to monosaccharides, amino acids, and small fat droplets for absorption. Micronutrients are not available for absorption. Undigested food particles remain in the intestine unabsorbed	Reduced nutrient absorption, resulting in nutrient deficiencies over time; indigestion, diarrhea, and steatorrhea
Reduced or impaired liver function	Impairment of cholecalciferol to calcitriol conversion. Impairment of vitamins to coenzyme active form conversion. Reduced transport protein production. Reduced alcohol, xenobiotics, and medication metabolism	Deficiency in biologically active vitamins and related impaired pathways. Impairment of vitamins, fatty acids, and mineral transport to cells. Slow break down of alcohol
Reduced or impaired kidney function	Impairment of cholecalciferol to calcitriol conversion. Impaired clearance and reabsorption of electrolytes in the kidney. Impaired excretion of waste products	Dehydration or water retention. Nausea and loss of appetite. Blood pressure fluctuations
Reduced intestinal smooth muscle function	Reduced peristalsis; low-fiber diets reduce stretch signaling of the small further	Constipation; increased risk of diverticulae and diverticulitis. Reduced appetite and food intake
Reduced thyroid and growth hormones	Decreased lean body mass, increased fat mass, reduced metabolic rate	If the dietary intake is not adjusted accordingly, weight gain may result

(continued)



**Nutrition in Aging, An Exploration of a Close Relationship, Table 3** (continued)

Structures, digestive processes, or other factors influenced by aging and outcomes		Nutrition-related consequences <sup>a</sup>
Increased circulating pro-inflammatory cytokines	Reduced cellular sensitivity to insulin, increased risk of arteriosclerosis, and other chronic disease	Reduced insulin-mediated glucose uptake, hyperglycemia, increased burden on the pancreas to secrete insulin, formation of advanced glycation end products. Inflammatory cytokines may suppress hunger
Change in gut microbiota profile	Change in the amount and diversity of gut microbiota. Change in the ratio of <i>Firmicutes</i> (reduced) and <i>Bacteroidetes</i> (increased). Significant decrease in <i>Bifidobacteria</i> and increase in <i>Proteobacteria</i>	Increased diarrhea and resulting poor nutrient absorption. Increased gut permeability and resulting increased inflammatory cytokine production as enteral toxins translocate. May affect hunger signaling
Polymorbidity and polypharmacy, herbal supplements use	The nutrient-drug interactions and the herb-drug interactions interfere with nutrient or medication absorption and metabolism and may increase clearance or half life	Loss of, or increased appetite, nutrient deficiency signs and symptoms
Loss of joint mobility, joint degeneration, change in body composition with loss of lean body mass and increase fat mass; increased visceral adiposity	Decline in endocrine function and anabolic metabolism; change in protein metabolism Loss of muscle strength and function Going out to purchase fresh food regularly, cooking meals, using cutlery, and opening food packaging may become difficult and painful Increase in systemic inflammation with increased visceral adiposity	Energy requirement decrease, but protein requirement increase. There may be fat mass gain if energy intake is not adjusted to decreased requirement The diet may become less varied by convenience and may contain less nutrient-dense foods because cooking is a tiresome burden. This may lead to nutrient deficiencies and weakness
Sedentary indoor lifestyle	Lack of exposure to the outdoor and UVB ray exposure A sedentary lifestyle may reduce hunger – because of being less active or conversely promote boredom snacking	Reduced vitamin D production opportunity by the skin. Snacking often on packaged foods increases intake of salt, saturated fat, refined sugar, overall nutrient-poor foods
Living alone, feeling lonely, depressive symptoms	Cooking for oneself may become a burden and appears “unnecessary.” Loss of interest for taking care of self	Reduced food intake or less-varied dietary intake requiring less cooking and preparation. Loss of appetite and interest in foods, with resulting malnutrition outcomes

<sup>a</sup>For full details on consequences of specific nutrient deficiencies, consult reference (Higdon 2003) and additional links provided.

This is by no means an exhaustive list, and all factors may not apply systematically or in all living conditions (independent or in age-care facility). These factors however need consideration when assessing the nutrition status of elderlies and when troubleshooting for the management of poor nutrition status.

The effects of aging on nutrition are multiple and can have the consequences of aggravating the aging process in positive feedback loops, as the paucity of nutrients availability for biochemical pathways further promotes the aging decline (Wardlaw et al. 2016). The awareness of mechanisms that can affect nutrition allows for the

prevention and adaptation to avoid deleterious long-term effects. Nutrition professionals play a key role in addressing aging-related nutrition issues. In addition, the use of functional foods, as discussed further, may be particularly relevant in this context.

### **Nutrition in the Modulation of the Ageing Process**

To achieve a slowing down of functional decline and compression of morbidity, avoiding diet-related chronic disease appears a sensible approach. Nutrition is the most significant lifestyle habit, besides sleeping, based on time involved and frequency. It can thus be viewed as both the preventative measure and the slow acting foe *par excellence*, due to the chronically repeated stimuli. Indeed, food constituents and dietary patterns act beyond the mere provision of energy and cofactors in physiological pathway. They also can counteract or contribute to the common denominator of aging and chronic disease: systemic inflammation (Calder et al. 2011; Minihane et al. 2014).

#### **Inflammation, Aging, and Chronic Disease**

Physiological aging is characterized by some degree of chronic low-grade systemic inflammation, with persistently raised inflammatory biomarkers such as C-reactive protein (CRP), interleukin-6 (IL-6), and TNF-alpha. This inflammatory status coined “inflammaging” (Franceschi and Campisi 2014) is partly explained by: an overactive innate immune system in aging (while the adaptive immunity tends to decline) (Fagiolo et al. 1993); a change in body composition that favors accumulation of visceral adipose tissue that is proficient at secreting pro-inflammatory factors (Prado et al. 2016); a reduction in gut microbiota mass and shift in variety resulting in loss of gut integrity and a pro-inflammatory enteral milieu; and a decline in cellular antioxidant and detoxification functions (O’Connor et al. 2014).

It is well established that the pathophysiology of most chronic and aging-related disease is linked to chronic inflammation (O’Connor

et al. 2014). Dysregulations in cardiometabolic conditions (insulin resistance, type 2 diabetes, atherosclerosis, and nonalcoholic steatohepatitis), in cancer, arthritis, and neurodegenerative disease arise from chronic low-grade systemic inflammation. For example, the rise in circulating inflammatory cytokines IL-6 and TNF-alpha interferes with insulin signaling, leading to insulin resistance in metabolic tissues normally insulin sensitive. Hyperglycemia and hyperinsulinemia ensue and promote the development of nonalcoholic fatty liver disease and type 2 diabetes. This hyperglycemic and inflammatory milieu causes vascular endothelium damage, which develops into atherosclerosis and related cardiovascular disease (O’Connor et al. 2014).

The chronic inflammatory state generated by the aging process may be preceded by the earlier onset of obesity. Excess weight can be stored in hyperplastic and hypertrophic adipocytes. The latter secrete more pro-inflammatory (IL-6, TNF-alpha) and less anti-inflammatory factors (adiponectin, interleukin 10 (IL-10)), resulting in chronic low-grade inflammation. The rise in circulating inflammatory factors generates an increase concentration in reactive molecules and species. If antioxidant molecules concentration is low (antioxidant nutrients lacking in the diet and poor endogenous antioxidant enzymes production), free radicals concentration progresses to oxidative stress, to activate NF-κB, the transcription factor for inflammatory cytokine genes expression (Wardlaw et al. 2016; Calder et al. 2011).

#### **Food Constituents in the Modulation of Inflammation**

Dietary choices throughout life expose the internal milieu chronically to factors that either activate or downregulate inflammatory pathways in a variety of mechanisms. A selection of these factors is discussed here:

1. Over-intake of dietary energy results in an overall positive energy balance and may develop into obesity. Hypertrophic adipocytes and visceral adipose tissue are associated with a low-grade inflammatory status as explained earlier (Wardlaw et al. 2016).

2. Polyunsaturated fatty acids (PUFA) are precursors of eicosanoids involved in the inflammatory response. Arachidonic acid, an omega 6 PUFA found in meats and eggs, is the precursor of pro-inflammatory prostaglandins, while the omega 3 PUFA eicosapentaenoic and docosahexaenoic acids are precursors to anti-inflammatory prostaglandins. While both omega 3 and omega 6 fatty acids are important in physiological function, the ratio of omega 6 to 3 fatty acids in the diet promotes a dominantly pro- or anti-inflammatory milieu. The typical Western dietary pattern, characterized by abundant meat and other animal products consumption, but low in plant and animal sources of omega 3 PUFA, is associated with a pro-inflammatory status, because the ratio of omega 6 to 3 is high (Calder et al. 2011).
3. Numerous food constituents, such as vitamins A, C, E, polyphenols, and carotenoids, act as electron donors to neutralize free radicals. Furthermore, a variety of minerals in the diet are required as cofactors for the function of endogenous antioxidant enzymes. For example, superoxide dismutase requires zinc and copper, and glutathione peroxidase requires selenium for their free radical neutralizing function. These food constituents contribute to redox homeostasis and the reduction of NF- $\kappa$ B activation by an elevated concentration of reactive species (Wardlaw et al. 2016; Halliwell 2013).
4. With the development of nutritional genomic investigations, the understanding of the nutrient-gene relationship has provided new mechanisms of action by which food constituents are involved in the modulation of chronic inflammation. While these mechanisms are primarily demonstrated in *in vitro* experimental models, they shed some light on how nutrient-dense energy patterns promote health, prevent chronic disease onset, and reduce aging decline (Müller and Kersten 2003).

Specific food constituents have been identified as activators or inhibitors of transcription factors that induce the expression of genes coding for pro-inflammatory cytokines,

detoxification, and antioxidant enzymes. The inhibition of NF- $\kappa$ B binding to the DNA by curcuminoids from turmeric results in the downregulation of inflammatory cytokines and other inflammatory mediator expression. Activation of Nrf2 by hydroxytyrosol in extra virgin olive oil, or sulforaphane in broccoli sprouts, upregulates the expression of a variety of cyto-protective enzymes. As a result, the neutralization of free radicals suppresses NF- $\kappa$ B activation by these reactive species (Cardozo et al. 2013; Müller and Kersten 2003).

Another example is omega 3 PUFA that are ligands for the nuclear peroxisome proliferator-activated receptors (PPARs). PPARs induce the transcription of an abundance of genes involved in tissue-specific metabolism. Via gene expression, PPAR-alpha regulates inflammation in the vascular endothelium, while PPAR-beta and PPAR-delta regulate inflammation in the adipose tissue. Thus, the regular presence – or absence – of omega 3 PUFA in the diet can impact on the inflammatory status (Grygiel-Gómiak 2014).

5. The investigation of the effects of food constituents and dietary patterns on the epigenome is also revealing promising mechanisms for the prevention of aging and chronic disease. Methyl group binding is one of many epigenetic mechanisms. It generally suppresses gene expression. Methyl group donors are abundant in nutrient-dense dietary patterns (examples include folate, choline). During development, the *in utero* environment, the health, and nutrition status of the mother during pregnancy all program the fetus' epigenome to influence chronic disease susceptibility, aging, and longevity.

The epigenome is plastic. It continues to respond to environmental factors throughout life and changes with the aging process. Dietary patterns and food constituents may have thus a significant influence on epigenetic modifications. The chronic state of hyperglycemia, for instance, was shown to upregulate epigenetically the expression of NF- $\kappa$ B in macrophages and vascular cells. Similarly,

pro-inflammation epigenetic modifications were observed when cells were exposed to hypercholesterolemic conditions (Wardlaw et al. 2016; Park et al. 2012).

It is still too early to determine clearly how dietary patterns can be modified to epigenetically influence the aging process favorably and prevent chronic disease. The currently available evidence nevertheless points to yet other mechanisms by which daily nutrition choices may influence aging outcomes.

6. Probiotics (microorganisms that colonize the gastrointestinal tract) and prebiotics (fermentable food constituents such as fiber, a variety of polyphenols) assist in maintaining the diversity and mass of gut bacterial colonies.

It is now well recognized that the gut microbiota is linked to immune, cardiometabolic, and neurological function. Newly emerging knowledge is providing understanding in the mechanisms of actions. The gut bacterial diversity is significantly modified with aging, resulting in less variety and change in dominant phyla (more *Proteobacteria* and *Bacteroidetes*, less *Firmicutes*). Bacterial populations play a significant role in gut integrity. Poor gut integrity promotes permeability and translocation of endotoxins to the circulation, with resulting promotion of low-grade inflammation. Increased inflammation in turn affects bacterial diversity. Gut permeability increases with aging, as bacterial diversity and mass decrease.

Bacterial profiles respond rapidly to diet composition by adjusting in diversity. However it is unclear how long dietary changes need to be maintained to sustain the change in diversity. More intriguing, it appears that diet composition primarily influences the types of metabolites produced by the bacteria from dietary substrate fermentation, more so than the variety of bacterial species. It appears that food constituents have a nutrient-gene relationship with bacterial DNA that results in the production of metabolites with beneficial or deleterious effects on host health.

The content of fermentable substrates in dietary patterns is therefore of great

significance in modulating inflammation. The short chain fatty acids (butyrate, propionate, and acetate) produced from bacterial fermentation confer health benefits as varied as protection from colon cancer, regulation of energy metabolism, modulation of the inflammation response of hypertrophic adipocytes and macrophages, and cognition. A Western dietary pattern, characterized by high sugar, low-fiber refined starch products, high fat, and high meat intake, generates bacterial fermentation products that promote the inflammatory milieu. Conversely, traditional vegetarian dietary patterns are associated with bacterial diversity and metabolite profiles that downregulate inflammation by modulation of the immune system (Wardlaw et al. 2016; Franceschi and Campisi 2014; Keenan et al. 2015).

7. Processed carbohydrate foods (refined starches, sugars found in sweetened processed foods) are all digested into simple sugars, such as glucose and fructose. Hyperglycemia from high glucose absorption causes postprandial inflammation. When these foods are consumed all day long, the inflammation pathways are chronically triggered. Advanced glycation end products (AGEs) are produced during food processing methods (high-heat baking, roasting, and frying) and endogenously in chronic high hyperglycemia. AGEs activate NF- $\kappa$ B, with the resulting pro-inflammatory gene expression cascade. Dietary patterns that contain a dominance of packaged baked goods and sweetened foods promote AGEs production and a pro-inflammatory state. Increased concentration of circulating AGEs consumed in the diet is associated with type 2 diabetes, chronic kidney disease, and heart disease (Ramasamy et al. 2005).
8. Moderate alcohol consumption in humans is observed to reduce circulating pro-inflammatory cytokine interleukin (IL)-1- $\alpha$  and increase the anti-inflammatory cytokine IL-10 in healthy and in high risk for heart disease individuals. This is in addition to promoting favorable cardiovascular protection (inhibition of fibrinolysis, increasing high-density lipoprotein (HDL) cholesterol,

improved endothelium function, increased insulin sensitivity). When alcohol is consumed as red wine as opposed to spirit, additional benefits are observed on inflammatory markers: IL-6 and CRP are decreased, suggesting that the abundance of polyphenol phytonutrients contained in red wine contributes to reducing inflammatory pathway activity (Hoffman and Gerber 2013).

9. Fat intake recommendations in the prevention of chronic disease such as cardiovascular disease have for long focused on reducing the overall amount of fat intake, saturated fat, dietary cholesterol, and more recently trans fats (Wardlaw et al. 2016). The current evidence tends to challenge the “low-fat” message, in light of positive results in a primary prevention intervention with individuals at high risk of coronary heart disease, involving the traditional Mediterranean diet pattern with the inclusion of daily substantial amounts of olive oil. The fat intake equated to 47% of total energy intake (when healthy-eating recommendations are no more than 35%). The fat intake was however issued mainly from mono-unsaturated fatty acids, contained in olive oil, very low exposure to trans fats, and moderate amounts of saturated fat (Estruch et al. 2013). In numerous human trials, higher trans fat (partially hydrogenated vegetable oils in baked and deep-fried products, and margarines) consumption is associated with increased circulating pro-inflammatory cytokines and factors that impair endothelium function, compared to low trans fat intake. In vitro experiments show activation by trans fats (among a variety of deleterious effects) of NF- $\kappa$ B with increased monocytes and endothelial cell expression of TNF- $\alpha$  and IL-6 (Mozaffarian et al. 2006). Furthermore, the association between saturated fat intake and dyslipidemia is considerably weakening in the literature, with the evidence that numerous lifestyle and other dietary factors (such as high sugar intake) are associated with raised total cholesterol and triglycerides, lowered high-density lipoprotein, and raised low-density lipoprotein cholesterol

(Ruiz-Núñez et al. 2016). It appears that the type of fat, more so than the quantity per se in the diet, is of importance, with a dominance of unsaturated fatty acids (mono and poly) and reduced exposure to trans fats for optimal health outcomes.

In the context of diet-induced inflammation, it is both *what one consumes* and *what one does not consume* that influence the low-grade inflammatory status throughout life (Barbaresko et al. 2013). Dietary patterns describe the combination of foods and beverages, as well as how food is sourced and prepared and how frequently foods are consumed (Wardlaw et al. 2016).

In the long-term prevention of aging disease, the role of nutrition factors in modulating low-grade inflammation acutely and chronically certainly deserves serious consideration. However, it is always important to focus on the relevant dietary priorities at any given time point. On the background of advanced aging, with loss of weight and malnutrition, for example, the priority is not to limit processed food intake to avoid AGEs exposure, but rather to increase energy, protein, and micronutrient intake first, even if this means consuming processed sweetened foods that encourage appetite (Wardlaw et al. 2016; Hickson 2006).

### **Food as Medicine: Functional Foods and Super Foods in the Prevention and Management of Aging Decline?**

Functional foods are generally defined as foods that have been manufactured specifically to provide health benefits of disease prevention in addition to providing the usual selection of macro- and micronutrients. The health benefit may come from an added ingredient or nutrient to the traditional recipe (calcium added to orange juice, milk with added omega 3 fatty acids) or an increased concentration of a specific nutrient as a result of breeding and agriculture technology (eggs with omega 3 fatty acids, tomatoes with more lycopene concentration) or a particular combination of nutrients to confer additional benefits (yogurt with additional probiotics and added soluble fiber) (Webb 2011). Super foods are the foods

that contain in their natural state a high concentration of nutrients with known health benefits (oats are rich in the soluble fiber beta-glucans; salmon is rich in omega 3 fatty acids; extra virgin olive oil is rich in monounsaturated fatty acids and antioxidant polyphenols) (Wardlaw et al. 2016).

Functional and super foods are of particular interest in the context of aging disease prevention or the management of chronic disease in aging. Functional and super foods increase the nutritional value of each mouthful. The high concentration of food constituents conferring benefits is embedded within the food matrix. This provides nutrient density and food constituents of interest, with the usual energy provided from macronutrients contained in this food. Compared to nutraceutical capsules, the dosage of nutrient is within dietary dosages and therefore physiologically relevant. With cautious examination of food labels and ingredients contained, these foods may be a suitable addition for gut health, balanced blood lipids, modulation of blood glucose, modulation of inflammation, increased micronutrient absorption, etc.(Fagiolo et al. 1993).

## Conclusion

Nutrition has a significant long-term role to play in the goal of extending healthy life expectancy. Food is made of (1) macronutrients providing energy and the building blocks of body tissues, (2) micronutrients involved in biochemical reactions, and (3) phytonutrients assisting in pathways of disease prevention. The effects of nutrition go however beyond the mere provision of energy and cofactors in physiological pathways; it is also a significant source of signals for gene expression resulting in specific phenotypic outcomes.

This is a double edge sword: certain food constituents trigger gene expression patterns promoting the foundations of chronic disease, while others trigger gene expression patterns that promote metabolic health, resilience, and the prevention of chronic disease over time. It is therefore both what is consumed daily and what is not

consumed that must be considered, because food constituents can either exacerbate or dial down chronic systemic inflammation and redox homeostasis. Favoring nutrient density in the whole food matrix over nutrient-poor processed foods with bolus doses of nutrients in nutraceuticals is key in the modulation of aging chronic disease, by reducing the effects of chronic inflammation and oxidative stress.

Dietary priorities are primordial when approaching nutrition in advanced aging. Prevention of weight loss and quality of life becomes the priority over aiming to reduce diet-induced inflammation. Micronutrient supplementation may be required, when aging decline affects the efficiency of the digestive tract. Every mouthful counts: calorie (if there is unintentional weight loss), protein, and nutrient density may be improved by using functional foods. Furthermore, the healthy weight is age specific. Keeping a healthy weight and body composition is key to reducing chronic disease risk.

The gut microbiota has emerged as a significant partner in health. It responds to dietary factors and aging mechanisms (as well as numerous other factors) by changing in variety and mass and producing metabolites that impact profoundly on host health.

As aging is not avoidable, nutrition presents itself as a primary prevention measure to ensure good health is part of aging. Ideally, the prevention approach would start early in life. The relationship between nutrition and healthy aging is nevertheless one of continuous adjustments for optimal outcomes.

## Cross-References

- ▶ [Aging and Quality of Life](#)
- ▶ [Assessment of Older People in Primary Care](#)
- ▶ [Burden of Disease and Aging](#)
- ▶ [Eating Disorders and Eating Disordered Behaviors](#)
- ▶ [Frailty in Later Life](#)
- ▶ [Healthy Aging](#)
- ▶ [Obesity and Weight Gain in Older People](#)
- ▶ [Plasticity of Aging](#)

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### Web Links of Interest

- <http://daa.asn.au/for-the-public/>  
<http://lpi.oregonstate.edu/mic/dietary-factors/phytochemicals/flavonoids#disease-prevention>  
<http://www.eatright.org/>  
<http://www.hc-sc.gc.ca/fn-an/nutrition/reference/index-eng.php>  
<http://www.nutrition.gov/>  
[https://ods.od.nih.gov/Health\\_Information/Dietary\\_Reference\\_Intakes.aspx](https://ods.od.nih.gov/Health_Information/Dietary_Reference_Intakes.aspx)  
<https://www.eatforhealth.gov.au/>  
<https://www.nrv.gov.au/>



# O

## Obesity and Weight Gain in Older People

Willy Marcos Valencia<sup>1,2</sup> and Rachita Sood<sup>3</sup>

<sup>1</sup>Geriatrics Research, Education and Clinical Center (GRECC), Miami VA Medical Center, Miami, FL, USA

<sup>2</sup>Department of Public Health Sciences, University of Miami Miller School of Medicine, Miami, FL, USA

<sup>3</sup>University of Miami Miller School of Medicine, Miami, FL, USA

### Definition

Overweight and obesity are defined as abnormal or excessive fat accumulation that may impair health. Specifically, the World Health Organization (WHO) defines overweight as a body mass index (BMI) equal to or greater than 25 kg/m<sup>2</sup> and less than 30 kg/m<sup>2</sup> and obesity as a BMI equal to or greater than 30 kg/m<sup>2</sup> (WHO 2013).

### Synonyms

There may not be a proper synonym for obesity. Albeit commonly done in conversations, obesity and overweight are not truly interchangeable terms. The definitions for obesity and overweight (based on BMI) are standard. However, when discussing with patients, special care must be

taken to address the problem and convey the message appropriately. Introducing the issue as weight gain can facilitate engagement in the discussion, but proper definition of terms would need to include the description of obesity as a disease and incorporate concepts covering obesity-related conditions, complications, and comorbidities.

### Overview

Obesity has been linked to impaired medical, functional, and social health and recognized as a disease by the American Association of Clinical Endocrinologists and the American Medical Association (AACE Position Statement et al. 2012; AMA 2013). Globally, obesity affects 13% of the world adult population, doubled since 1980 (WHO 2015). However, there are major differences between high-income and low-income countries. For example, the burden of obesity is greater in the United States, where more than one third of adults have obesity (CDC 2014).

Obesity affects segments of the population differently. While public health has recently focused on rising rates in children and adolescents, attention must be paid to the older population. According to the 2011–2012 National Health and Nutrition Examination Survey (NHANES), 35.4% of US individuals aged 60 and above were categorized with obesity (BMI  $\geq$  30 kg/m<sup>2</sup>) and 36.2% with overweight

(BMI 25 to 29.9 kg/m<sup>2</sup>). These numbers represent a statistically significant increase in prevalence from 2003 data, in contrast to obesity prevalence rates in younger adults, which did not change (Ogden et al. 2014).

Furthermore, with the dual burden of an obesity epidemic in the aging population and in children and adolescents, we may see rising prevalence of obesity and its impact in health and function throughout their lifespan, with greater prevalence of chronic obesity-related conditions and healthcare costs.

## Etiology and Pathophysiology

While the biochemical, hormonal, and pathophysiological processes leading to obesity are quite complex, the basic etiology is an imbalance between caloric intake and caloric expenditure (AHA 2013). In older adults, inactivity due to functional impairment contributes to the caloric imbalance. However, weight gain in the older person is confounded by physiologic age-related changes in body composition (Zamboni et al. 2005), and even in the absence of obesity, fat mass increases and muscle mass decreases.

This decrease in muscle mass, called sarcopenia, and the loss of muscle strength, called dynapenia, can co-occur with obesity in the older person, a synergy (sarcopenic obesity) that is associated with worse functional decline than muscle changes or obesity alone (Stenholm et al. 2009; Kalyani et al. 2014). However, consensus on a definition of sarcopenic obesity and widespread clinical application are lacking. A systematic literature review used eight different definitions of sarcopenic obesity to project prevalence in older US adults and found a range of 4.4–84% in men and 3.6–94% in women (Batsis et al. 2013). Moreover, sarcopenic obesity impacts cardiometabolic health, disease development, and mortality. A study on 2,943 older adults, classified as sarcopenic obese, sarcopenic nonobese, non-sarcopenic obese, and non-sarcopenic nonobese, found that individuals with sarcopenic obesity had higher likelihood of

having insulin resistance, metabolic syndrome, and CVD risk factors (Chung et al. 2013).

In addition, older individuals face symptoms of impaired psychological and sexual function, leading to poor quality of life (Han et al. 2011). Older adults have a greater prevalence of depression and other mental health problems, as well as stressful life events like the death of a spouse and retirement, which can lead to eating disorders (Gadalla and Piran 2007; Ng et al. 2013), followed by increased caloric intake and weight gain. The bidirectional relationship between obesity and depression (Byrne and Pachana 2010) and anxiety disorders can be associated with functional limitations (Gonçalves et al. 2011) which then can lead to sedentarism, physical inactivity, increased weight, and more depression. This trajectory can be complicated with any of the abovementioned issues related to changes in body composition and physical function, thus leading to a negative vicious cycle and perpetuation of the problem (Valencia et al. 2014).

Social factors like social isolation and lack of meaningful social interaction have been related to obesity, as they are also associated with other risk factors for poor metabolic health, such as older age, male sex, minority classification, and lower socioeconomic status (Stringhini et al. 2012; Yang et al. 2013). In addition, researchers have found an association between the neighborhood environment (hazards and socioeconomic deprivation) and obesity in community-based older adults (Glass et al. 2006, Keita et al. 2014).

## Effects of Obesity in Older Persons

### Medical Domain

Obesity has been clearly identified as a risk factor for several medical conditions, including type 2 diabetes (T2D), cardiovascular disease (CVD), hypertension, stroke, gall bladder disease, osteoarthritis, and even certain cancers, including breast and colon cancer. According to recent surveillance data, prevalence of diabetes among US adults over 65 years old ranges from 22% to 33%, based on diagnostic criteria used (Kirkman et al. 2012). Projections predict this prevalence

to increase 4.5-fold by 2050, compared to a three-fold increase in the total population (Narayan et al. 2006). Older adults are at increased risk for T2D due to a combined effect of increasing insulin resistance and pancreatic cell dysfunction. In addition, diabetic individuals over 65 years old have the highest rates of lower-extremity amputation, myocardial infarction, visual impairment, and end-stage renal disease, compared to other age groups.

The link between obesity and cardiovascular disease is influenced by augmented adipocyte secretion of leptin, increased levels of c-reactive protein, higher stroke volume, and a pro-inflammatory state, all of which lead to changes in cardiac and endothelial morphology and function. These changes in older persons with obesity lead to a range of cardiovascular disease, including hypertension, coronary artery disease, congestive heart failure, and atrial fibrillation (Lavie 2004). The obesity-related chronic diseases described above affect older adults as new-onset cases or as long-standing cases, which are ongoing since earlier in life. Age alone is a risk factor for many of them.

### Functional Domain

Functional disability constitutes impairments in mobility, instrumental activities of daily living (IADLs), and activities of daily living (ADLs). The latter include activities such as bathing, dressing, toileting, transferring, feeding, and continence, while IADLs include the ability to use a telephone, to shop, or to handle finances. Impairment in these activities is a common cause of morbidity and mortality in older individuals. A large body of literature suggests a relationship between obesity or BMI and risk of functional disability (Launer et al. 1994; Bannerman et al. 2002; Jensen and Friedmann 2002; Larrieu et al. 2004).

Evaluation of the US National Health and Nutrition Examination Survey (NHANES) data from 1999 to 2004 found that BMI and waist circumference were associated with higher prevalence of all measures of disabilities. The associations were stronger in women than in men (Launer et al. 1994). In a sample of 8966 older French

community dwellers, there was a significant association between BMI and mobility, continence, ADL, and IADL in women and a significant association with mobility only in men (Larrieu et al. 2004). At BMI greater than 40 kg/m<sup>2</sup>, higher functional decline can be expected, more so in women (Jensen and Friedmann 2002).

The increased risk of functional disability holds with increased waist circumference, an important distinction because abdominal fat increases with age, even in individuals without obesity (Chen et al. 2002; Guallar-Castillon et al. 2007; Chen and Guo 2008).

### Mental/Psychological Domain

Obesity has also been linked to increased risk of adverse mental health outcomes, including mood and anxiety disorders. In a survey of 9125 US adults, obesity was associated with an approximate 25% increase in odds of major depressive disorder, bipolar disorder, and panic disorder. Odds of substance abuse disorder decreased by approximately 25% in individuals with obesity. These associations held across all age groups (Simon 2006).

A large body of literature examines the reciprocal relationship between obesity and depression, an especially relevant association as 8–16% of community dwelling older adults experience clinically relevant depressive symptoms, and 1–4% have major depression (Blazer 2003). Cross-sectional studies have repeatedly revealed an association between obesity and diabetes (de Wit et al. 2010), both associated with increased risk for depression. A systematic review and meta-analysis of 15 longitudinal studies examining this bidirectional relationship found an odds ratio of 1.55 for baseline obesity increasing risk of depression at follow-up and an odds ratio of 1.58 for baseline depression increasing risk of obesity at follow-up (Luppino et al. 2010). A 5-year prospective study in US adults 70–79 years old found that baseline depression was associated with a significant increase in sagittal diameter and visceral fat (Vogelzangs et al. 2008).

Several biological mechanisms in obesity have been hypothesized to contribute to depression,

including a pro-inflammatory state, dysregulation of the hypothalamic-pituitary-adrenal (HPA) axis, and brain changes induced by insulin resistance. Social stigma around obesity may also be a contributing factor. The reciprocal pathway of depression to obesity may also be mediated by a hyperactive HPA axis, unhealthy lifestyle, or side effects of antidepressant medications.

### **Understanding the Obesity Paradox in Older People**

An obesity paradox has been described as better health outcomes in older people with greater than normal weight. Through a number of studies, researchers reported decreased mortality and complications as well as better outcomes in older adults with overweight or obesity, when compared to leaner counterparts. Earlier studies compared subjects with BMI greater than 25 kg/m<sup>2</sup> with those below 25 kg/m<sup>2</sup>. The latter group includes subjects with underweight, which is associated with frailty syndrome, terminal – potentially undiagnosed – conditions, and other medical issues, all of which likely contributed to poorer outcomes in the “lean” subjects. More recent studies addressed this issue and, excluding patients with underweight, still reported a paradox for patients with type 2 diabetes and heart failure (Carnethon et al. 2012; Hainer and Aldhoon-Hainerová 2013). Importantly, other researchers have reported opposed results, finding no evidence for an obesity paradox (Flegal et al. 2013; Tobias et al. 2014). However, reports on a paradox, indicating that a greater weight is potentially associated with better outcomes, can be confusing and potentially negate meaningful clinical interventions, lead to clinical inertia, or, even worse, foster misunderstanding toward weight gain. The obesity paradox concept must be properly understood in the right context. Even though the original studies reported to control for several covariables, they mostly did not incorporate a geriatrics approach, which would have considered the role of physical function.

Several studies have addressed the potential flaws in the approach made by the obesity

paradox. The most important clinical application from these concepts is that for any older adult, with normal or increased weight, modest intentional weight loss through proper lifestyle improvements and slowly but progressively increasing physical activity can reduce morbidity and mortality risks. In other words, BMI alone is a great tool for screening purposes, but physical function, functional reserve, and cardiorespiratory fitness are truly the variables that differentiate health status within and across BMI groups. Older individuals with overweight or obesity can certainly benefit from lifestyle interventions and purposeful modest weight loss and progressively increasing exercise and increasing levels of physical activity (Lavie et al. 2014; McAuley and Beavers 2014; Barry et al. 2014; Banack and Kaufman 2014).

Improvements in cardiorespiratory fitness and physical function in older patients with obesity, rather than clinical inertia and sedentarism, are more likely to contribute to their health, regardless of the baseline weight. Understanding the obesity paradox means there should not be clinical inertia toward obesity and weight gain management in older people. Older adults with obesity can benefit from modest intentional weight loss, through lifestyle and exercise, to improve their cardiorespiratory fitness and physical function and enjoy the myriad of benefits related to exercise, including improvements in health and well-being, even if they remain within the same BMI category (Valencia et al. 2014).

### **Current Management Recommendations**

#### **Intensive Lifestyle Intervention and Intentional Weight Loss**

The guidelines from the American Heart Association, the American College of Cardiology, and the Obesity Society support intensive lifestyle interventions (ILI) as the first-line therapy for obesity in any age group, including the aging population (Jensen et al. 2014). ILI includes decreasing calorie consumption, increasing physical activity, and modifying unhealthy behaviors.

The guidelines emphasize addressing psychosocial or behavioral characteristics and outcomes and involving psychologists as part of the interdisciplinary teams taking care of patients with obesity.

When ILI leads to a 7% weight loss, the relative risk of T2D decreases by 40–70%, as seen in the Finnish and the Diabetes Prevention Program (DPP) (Tuomilehto et al. 2001; Knowler et al. 2002). These are landmark studies for early interventions in older persons with obesity, given their increased risk to develop diabetes. Furthermore, the DPP results showed ILI leading to disproportionately higher weight loss in older participants, and that being older was the strongest predictor of achieving weight loss goals (Wing et al. 2004). Although a reduction in CVD from IWL has not been documented, the Look AHEAD study showed that ILI improved CVD risk factors; decreased levels of sleep apnea, depression, and loss of mobility; and increased quality of life (Korytkowski 2013).

In order to achieve the documented benefits, lifestyle intervention programs must be tailored to the myriad age-related barriers seen in older adults, including frailty, limited mobility, loss of muscle mass, and multimorbidity. Likely due to these barriers, the DPP did not enroll significant numbers of individuals over 70 years old or with functional or cognitive impairment.

### Pharmacologic Intervention

There is limited evidence for the use of weight loss medications in older adults. The safety profile is likely different across these agents, and the studies made for the approval of these agents included few to no older people. Future studies on this age group would be desirable, especially for healthy older individuals who properly understand the risks and benefits, under proper specialized supervision (see below section “[Future Directions](#)”).

### Surgical Intervention

Bariatric surgery is an accepted, effective treatment for obesity and its metabolic complications, but its role in older adults remains unclear. Concerns raised about effectiveness include whether

impaired functional status and mobility in the older patient may preclude adequate response to bariatric surgery. In addition, the higher rate of medical comorbidities in this age group has led to safety concerns and the classification of patients over 60 years as high risk.

An analysis of 48,378 bariatric procedures in the American College of Surgeons National Surgical Quality Improvement Program found that patients over 65 years old experienced prolonged hospital stay, but did not have higher risk of major complications (Dorman 2012). In contrast, an earlier study from 99 academic centers found that older patients had significantly higher overall, pulmonary, hemorrhagic, and wound complications. In-hospital mortality rate was also higher, but did not exceed expected, risk-adjusted mortality (Varela 2006). Thus, the authors conclude bariatric surgery to be safe in older patients. A recent systematic literature review involving 8,149 patients and 26 studies showed that complication rates and outcomes of hypertension, diabetes, and lipid disorder resolution were comparable to patients less than 60 years old (Giordano and Victorzon 2015).

### Future Directions

Focus should be paid to better understanding lifestyle modification interventions for management of obesity in the aging population. First, further investigation, constituting studies with long-term follow-up, is needed to understand the impact of modest intentional weight loss on cognition and cognitive outcomes in older persons. In addition, clear evidence on factors related to adherence to weight loss interventions in older persons is still lacking. Furthermore, research into the behavioral aspects of weight loss management in older persons requires special attention to new technologies and approaches to physical activity monitoring and tracking, especially since our aging populations is more computer savvy and technologically savvy.

From a clinical perspective, healthcare professionals and healthcare systems ought to increasingly recognize the epidemic of obesity and

weight gain in older adults and implement active screening and timely interventions, individualized to each patient. To date, there is very limited data on weight loss medications in older adults. With a growing number of pharmacologic agents, further experience and research in this age group will provide more information on appropriate clinical use. Similarly, as bariatric surgery expands in younger populations, experience and research will add to the dearth of data in older persons. Obesity is a chronic, complex, perpetuating disease, in a world where the population is aging, with longer life expectancy and, in some areas, better health outcomes. Thus, standard of care interventions for younger adults, such as pharmacologic and surgical treatments, might take a place in the management of obesity in healthy or relatively healthy older persons, particularly those with preserved physical and mental function and enough life expectancy to suffer negative consequences from untreated obesity. Further research is required to carefully understand outcomes and identify who benefits the most from pharmacologic and surgical interventions.

## Summary

Obesity and weight gain are prevalent in older adults and can negatively impact their health, physical and mental function, quality of life, and survival. Proper screening and evaluation include the assessment of psychosocial or behavioral characteristics and outcomes, followed with comprehensive interventions, including the involvement of psychologists as part of the interdisciplinary teams taking care of these patients. Standard of care aims to the successful implementation of individualized lifestyle interventions aiming toward modest intentional weight loss, through improvements in diet and behaviors, physical activity, and exercise tailored to this age group. Modest weight loss may not alter the weight category of the patient, as based solely on BMI, but the resulting improvements in cardiorespiratory function, physical and cognitive function, medical and psychological diseases,

well-being, and quality of life are desired outcomes in the older adult with obesity.

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## Occupational Health, Well-Being, and Aging

Antje Schmitt and Magdalena Bathen  
Department of Business Psychology, Economics and Management and Institute of Psychology,  
University of Kassel, Kassel, Germany

### Synonyms

Age-related changes in health and well-being; Gains and losses related to well-being and health; Physical and mental health; Psychological well-being; Subjective well-being

### Definition

Health is not merely the absence of disease but a multidimensional construct, reflecting dimensions of physical, mental, and social well-being (Pinquart 2001). Frequently used objective indicators of physical health are, for instance, blood pressure, cholesterol, body mass index, psychosomatic complaints, fatigue, and insomnia. Frequently used indicators of mental health or psychological well-being are feelings of anxiety, depression, and irritation. Social well-being is characterized by social support, social connectedness, and low social exclusion. These dimensions of health are usually assessed in terms of an individual's subjective self-rated perceptions of well-being (Ng and Feldman 2013). The literature on well-being, more specifically, differentiates between hedonic well-being (i.e., high levels of life-domain satisfaction, general life satisfaction, positive affect, and a low level of negative affect) and eudaimonic well-being (i.e., successful personal development in terms of purpose in life, environmental mastery, autonomy, and competence) (Delle Fave et al. 2011). For occupational health, the dimensions of physical, mental, and social well-being are described in the context of

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Magdalena Bathen: deceased.

work. Over time, constraints in occupational health may result in a decline in an individual's performance and to chronic health and well-being problems such as symptoms of burnout, depression, and cardiovascular diseases.

With regard to the concept of age, one needs to differentiate between an older adult as compared to an older worker. The age range in the active workforce is narrower than the age range in the general population. People typically retire at the age of 65. Thus, the usual cutoff point for older workers in research is 40 years of age. In contrast, an older adult in the general population is older than 65 or 70 years of age (Ng and Feldman 2013).

## Introduction

In industrial countries, the population grows older and the retirement age continues to rise so that there is an increase in the number of older workers who are past 60 years of age. At the same time, there is a tendency in both general society and empirical research to focus on and document deficiencies and problems associated with older age. A common negative age stereotype is that older workers suffer from more health problems compared to young workers (Ng and Feldman 2013). A perspective on gains and resources that are also evident in older people has largely been missing. Organizations can no longer neglect occupational health-related issues in the subgroup of older employees. There is an increasing need for organizations to provide conditions necessary to ensure maintenance of occupational health, well-being and safety, and to change attitudes toward aging and age stereotypes. Managing health and preventing early retirement may be one of the key challenges in the context of an aging workforce (Zacher et al. 2014a; Ng and Feldman 2013).

The aim of the present chapter is to provide a better understanding of the relationship between the age of workers and their health and well-being at work. In the following section, age-related changes that are documented in the literature are summarized. Second, this chapter focuses on personal resources, characteristics, conditions, and

strategies that might help older workers to manage potential deficiencies and problems related to health and well-being, and that account for successful aging at work. Third, implications and directions for future research as well as for practical interventions are briefly discussed.

## Age-Related Changes in Occupational Health and Well-Being

Theory and research suggest that there are a number of physical and psychological changes that occur in individuals over their lifespans and these may affect their occupational health and well-being (Zacher et al. 2014a; Scheibe and Zacher 2013; Ng and Feldman 2013). These changes in indicators of health and well-being refer to both losses and gains.

For instance, people experience age-related changes in their cognitive capacities. The capability to solve problems, think logically, and temporarily process and retrieve memory information tends to decline with age. Older people also tend to experience lower health and well-being. Yet, the decline in people's self-reported health status is more strongly evident and most likely in the subgroup of old-old individuals (>75 years). This group of people is likely to report, for instance, worse overall fitness, hearing problems, insomnia, or cardiovascular diseases (Pinquart 2001). Thus, health-related problems that are evident in the general population are likely to occur when people have already left the active workforce (Ng and Feldman 2013).

If older *workers* face any health-related problems at all, these problems are more likely related to decline in clinical or objective indices of physical health (e.g., blood pressure, cholesterol level, body mass index), but generally tend to be unrelated to their mental health status, psychosomatic complaints, or their self-reported physical or cognitive health (Ng and Feldman 2013). Hence, aging in the workplace is more strongly linked to objective physical health, while mental health problems are not more common in older than in young workers (Pinquart 2001; Ng and Feldman 2013). For mental health outcomes,

some previous research has even provided evidence for a U-shaped relationship: Middle-aged workers in the range between their late 20s to early 40s tend to report lower levels of occupational mental well-being compared to young or older workers (Zacher et al. 2014b). A potential explanation is that workers in this stage of life need to fulfill various expectations related to different social roles, such that role overload, role conflicts, and ambiguities may deplete their mental and cognitive resources.

Apart from age-related losses, people also experience developmental gains over their lifespans that may positively influence their health and well-being. For instance, older workers are more likely to report higher levels of job involvement and job satisfaction and lower levels of burnout symptoms as compared to young workers (Ng and Feldman 2010). While there is an age-related decrease in extraversion and openness to experience, people experience an increase in agreeableness and conscientiousness over time. Also, people's general experience-based knowledge, vocabulary, and judgment are relatively stable or may even improve with age (cf. Zacher 2015). In addition, goal orientations change over one's lifetime, such that older workers tend to focus on preventing resource losses and maintaining existing resources instead of maximizing gains (Zacher et al. 2014a; Lang and Carstensen 2002). Their limited temporal perspective and expectations concerning their personal future at work are related to an improvement in emotional response and the control and regulation of negative and positive emotions. Emotional stability increases and mood fluctuations decrease over the lifespan with the peak in emotional balance being reached in the mid-60s. This positive emotional capacity of older workers may benefit their occupational health and well-being (Scheibe and Zacher 2013).

One reason that speaks against a strong decline in older workers' perceived health is selective survivorship in the workforce or the "healthy worker survival effect" (Pinquart 2001; Richardson et al. 2004). According to this effect, people who remain employed at older ages tend to be healthier than those who leave their jobs, because

people who are employed generally need to be healthy in order to work. The general population, however, also includes those people who are unable to work due to health-related problems. The healthy worker survival effect provides a potential form of selection bias that is difficult to control in empirical research.

Another explanation for the fact that the young-old workers (i.e., 40–65 years) are generally likely to maintain their health at work and may suffer, if at all, from clinical indices of physical health problems than from self-reported mental or cognitive health problems is the availability of resources to effectively cope with these potential deficiencies in mental or cognitive health. Whereas physical health and well-being are more strongly determined by genetic dispositions and biological aging processes, mental well-being can be better self-controlled by employees (e.g., by using cognitive-behavioral self-management strategies) (Ng and Feldman 2013).

Based on theory and evidence from lifespan approaches, the following section in this chapter focuses on the importance of resource availability, personal characteristics, and cognitive-behavioral strategies that may be used by older workers to deal with changing circumstances and to manage and compensate for health-related problems and deficiencies.

## Successful Aging and Managing Age-Related Changes

Human aging is characterized by increased interindividual heterogeneity. Some workers are better able to manage their aging process than others. This effect is referred to as successful aging at work. In general, the definition for successful aging varies across studies and comprises a number of criteria and supportive factors (Zacher 2015). Besides the maintenance of cognitive and physical functioning, a strong focus in research is placed on personal characteristics such as wisdom and resilience (Ardelt 2000; Baltes and Baltes 1990).

One perspective on successful aging at work is based on person-environment fit theory (Zacher

et al. 2014a; Edwards and Cooper 1990). It describes personal factors and characteristics that are relevant to cope with environmental demands. If employees' characteristics do not mesh well with work demands, low levels of P-E fit are associated with greater occupational strain and poorer well-being (Edwards and Cooper 1990).

The P-E fit perspective is particularly useful to explore the relationships among age and occupational well-being because it integrates the two separate approaches into a person-by-situation framework. Age-related changes in employee characteristics as well as personal characteristics and environmental demands may affect P-E fit both individually and in combination (Zacher et al. 2014a). Some personal characteristics and resources that help to realize P-E fit and successful aging will be discussed in more detail next.

## Personal Characteristics and Resources

There is a growing body of research on the genetic dispositions and influences that contribute to indices of successful aging (Depp et al. 2010). Apart from genetic dispositions, individual characteristics and personal resources play an important role in successful aging and may serve as buffers for occupational strain, particularly in older workers. Personal resources can be defined as states, conditions, or characteristics that are valued by individuals and that may help them achieve their goals (Halbesleben et al. 2014; Hobfoll 1989). Specifically, this chapter focuses on wisdom and resilience as two personal resources. Both wisdom and resilience have shown to be positively related to successful aging and help older people to buffer some of the detrimental effects of declines in physical health (Baltes and Baltes 1990). While wisdom is associated with a positive acceptance of life circumstances, resilience buffers feelings such as irritability, sadness, anger, or fear (Depp and Jeste 2006).

**Wisdom:** Wisdom can be defined as a combination of cognitive, reflective, and affective qualities of a person (Clayton and Birren 1980). These three aspects of wisdom are represented by knowledge (cognitive quality), reflection of

one's own behavior and that of others (reflective quality), and a deeper understanding for the imperfections and contradictions associated with human nature (affective quality). There are several positive outcomes associated with wisdom, most importantly a positive effect on life satisfaction, physical health, and the quality of family relationships. Wise older people experience age quite realistically, while simultaneously accepting physical deterioration and the nearing of death. Wisdom is associated with satisfaction even under conditions of social and physical limitations, because a realistic understanding of things is related to a greater acceptance of negative life aspects (Blazer et al. 1991).

**Resilience:** Resilience can be defined as the physical and/or emotional capacity to recover from stress or adversity (Block and Kremen 1996). Resilience is associated with reduced depression, better self-rated successful aging, and life satisfaction in older people in spite of health limitations (Depp et al. 2010). Because of its positive effects on occupational outcomes such as task performance and work satisfaction (Luthans et al. 2006), resilience is an important factor for successful aging at work. Some research suggests that older workers tend to report higher levels of resilience than young workers (Patrickson and Ranzijn 2003). This higher level of resilience is associated with positive outcomes such as a positive attitude towards organizational changes (Shin et al. 2012) and greater problem tolerance (Jackson et al. 2007). These attitudes and competencies are in turn related to higher levels of performance at work.

Social support from both colleagues and supervisors is an important antecedent for older workers' resilience. Social support was found to buffer the effects of negative attitudes that older workers are exposed to. These negative attitudes range from biased thinking about older workers' productivity to negative thoughts about their physical health and stereotypes about resistance to change (Maurer et al. 2008).

Whether or not the aging process develops successfully not only depends on genetic dispositions and personal characteristics and resources. There is also a proactive perspective which

emphasizes older people's ability to actively influence their development. The proactivity model of successful aging (Kahana and Kahana 1996) describes strategies to proactively deal with and adapt to stressors associated with aging. Even more, the model also introduces several preventive actions in order to delay or minimize the number of age-related stressors. These preventive actions include health promotion, planning for the future, and maintaining a social network. Applied to aging workers, this model emphasizes the importance of planning the final career steps, cultivating social contacts outside work, and planning the transition from work to retirement.

### **Use of Cognitive-Behavioral Strategies in Dealing with Age-Related Changes**

Apart from personal resources and characteristics that may be functional to aging successfully, older workers may apply self-regulation strategies to adapt better to the loss of resources, to fit with their work environment, and to maintain their level of well-being (Zacher et al. 2014a; Zacher and Frese 2011; Schmitt et al. 2012). As a prominent psychological approach to successful development based on lifespan development psychology, the selective optimization with compensation (SOC) model argues that the synchronized use of the three self-regulation and life-management strategies of selection, optimization, and compensation contribute to healthy and successful aging (Baltes and Baltes 1990). *Selection* occurs when individuals choose specific goals and decide on goal priorities. Selection can be determined by personal preferences or result from experiencing a loss in personal or external resources (e.g., an increase in job stress or a lack of time). *Optimization* means that people obtain, improve, and coordinate the use of personal resources to achieve their goals (e.g., learning new procedures, modeling other successful ones, and investing more time in pursuing relevant goals). *Compensation* refers to the use of alternative means to reach relevant goals and to maintain effective functioning in the face of resource losses

(e.g., asking others for help, delegating work tasks to others, or using reminders and calendar functions to compensate for deficiencies in short-term memory capacity) (Baltes and Baltes 1990; Zacher and Frese 2011).

The SOC model states that as older workers experience resource limitations, and accordingly face challenging circumstances at work, the use of cognitive-behavioral strategies for selecting and pursuing goals can enhance or maintain well-being, successful adaptation, and daily functioning (Zacher and Frese 2011; Baltes and Baltes 1990; Schmitt et al. 2012). Since these self-regulation strategies facilitate the optimal allocation of resources, maximize gains, and minimize losses, they are particularly beneficial for older people (Zacher et al. 2014a; Baltes and Baltes 1990).

Previous research shows that especially older workers in jobs with low resources (e.g., lower levels of job complexity) benefit from selection, optimization, and compensation (Zacher and Frese 2011). The use of SOC strategies facilitates the maintenance of a high focus on work opportunities for workers in low-complexity jobs. A high focus on work opportunities refers to a large amount of options, goals, and possibilities that workers believe they have in their future at work (Zacher and Frese 2011). An open-ended and future-oriented perspective in terms of a high focus on work-related opportunities has shown to provide workers with positive activating and motivational resources (Schmitt et al. 2013).

### **The Health-Generating Effect of Work Itself**

Work itself may have a health-generating or health-maintaining function especially for older workers. This is in line with the healthy worker survivor effect, which describes a continuous selection process such that those who remain employed tend to be healthier than those leaving employment (Richardson et al. 2004). However, the strengths of the health-generating or health-maintaining effects depend on the nature of

the job. Autonomy, for example, is associated with high decision-making authority. A lack of autonomy is related to negative health outcomes such as cardiovascular diseases (Ganster et al. 2001). Moreover, it is the interplay of job demands and job resources such as autonomy that affect health outcomes. In general, jobs with high demands and low autonomy are more likely to have a negative impact in health than jobs with low demands and high autonomy (Ganster et al. 2001).

A number of studies have taken the specific situation of older workers into account, giving insight into the relevant factors for successful aging that are related to the work itself and to external influences at the workplace (Truxillo et al. 2012). For instance, there are some aspects related to ergonomic and physical factors that can help older workers to maintain their workability. The physical environment of the workplace needs to be organized in order to meet the needs of older workers (i.e., reduced physical workload and favorable ergonomic conditions) (Danna and Griffin 1999). Further, cognitive stimulation at work – such as whether an individual has access to education – provides an important resource that determines how well equipped a person is against brain pathology (Tucker and Stern 2011). The exposure to complex mental challenges at work can stimulate changes in the brain that are beneficial for cognitive functioning in terms of the generation of new dendritic branches and synapses. This assumption is also supported by longitudinal data from the Maastricht Aging Study. This study indicated that older people (average age of 61 years, ranging from 50 to 85 years) with mentally demanding jobs face lower risks of developing cognitive impairment over time. The relationship was independent of participants' intellectual abilities at baseline as well as demographic characteristics such as age, gender, or education or other factors such as smoking, physical activity, or alcohol consumption (Bosma et al. 2003). Therefore, evidence suggests that older workers benefit from the cognitive and social stimulation associated with work itself in terms of well-being and health.

## Conclusion and Directions for Future Research

As the population grows older and workers retire later than they did previously, taking responsibility for the health of an aging workforce is an important issue for employers and organizations. Some prevailing stereotypes suggest that aging is primarily related to deficiencies and losses. However, this assumption cannot clearly be verified by empirical research conducted with members of the active workforce, as most health-related deficits are evident after people have retired.

Some extant research suggests that successful aging at work is also related to gains and strengths. These gains and strengths are associated with personal resources and characteristics, such as wisdom and resilience, which may buffer effects of work- and age-related strain. Further, cognitive-behavioral strategies can be used by older workers to manage and compensate for health-related problems and deficiencies. In addition, work itself in terms of cognitive stimulation, social interactions, recognition, and social support can be functional and protective against health-related complaints.

Future research is needed to develop evidence-based interventions that are related to the maintenance of health and well-being in an aging workforce and to strengthen older workers' resources and competencies (Ng and Feldman 2013; Danna and Griffin 1999). These interventions may help to reduce age discrimination in organizations over time. Specifically, to examine within-individual changes in occupational health over the lifespan and to better understand the dynamics of the fit between personal characteristics and environmental demands in predicting occupational health, more rigorous scientific research is needed in terms of longitudinal studies over the lifespan (Zacher et al. 2014a). In addition, researchers should oversample workers at the higher end of the age distribution (i.e., select more participants from the subgroup of older workers ranging from 55 to 70 years) and weigh this selection of individuals according to their actual proportion in the population (Ng and Feldman 2013). Another avenue for

future research is to study individuals' personal perceptions of the aging process (subjective aging) and relationships with occupational health and well-being. Feeling younger than one's chronological age may explain the additional variance in workers' well-being apart from their chronological age (Hubley and Russell 2009; Zacher et al. 2014a).

## Cross-References

- ▶ [Activity Theory, Disengagement Theory, and Successful Aging](#)
- ▶ [Adaptive Resources of the Aging Self, Assimilative and Accommodative Modes of Coping](#)
- ▶ [Affect and Emotion Regulation in Aging Workers](#)
- ▶ [Aging and Quality of Life](#)
- ▶ [Psychological Theories of Successful Aging](#)
- ▶ [Selection, Optimization, and Compensation at Work in Relation to Age](#)
- ▶ [Stereotype Threat and Aging in the Workplace](#)
- ▶ [Work Motivation and Aging](#)

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## Okinawa Centenarian Study, Investigating Healthy Aging among the World's Longest-Lived People

Makoto Suzuki<sup>1,2</sup>, D. Craig Willcox<sup>1,3,4,5</sup> and Bradley Willcox<sup>1,4,5,6</sup>

<sup>1</sup>Okinawa Research Center for Longevity Science, Urasoe, Okinawa, Japan

<sup>2</sup>Faculty of Medicine, University of the Ryukyus, Okinawa, Japan

<sup>3</sup>Department of Human Welfare, Okinawa International University, Ginowan, Okinawa, Japan

<sup>4</sup>Hawaii Lifespan and Healthspan Studies, Kuakini Medical Center, Honolulu, HI, USA

<sup>5</sup>Department of Geriatric Medicine, John A. Burns School of Medicine, University of Hawaii, Honolulu, HI, USA

<sup>6</sup>The Queen's Medical Center, Honolulu, HI, USA

### Synonyms

Centenarians; Gene-environment interactions; Healthy aging; Oldest-old; Successful aging

### Definition

This entry outlines the goals, methods, and results of the Okinawa Centenarian Study, an ongoing (since 1975) study of healthy aging among the oldest old in the southernmost prefecture of Japan and well known as a “Blue Zone” due to the longevity of its citizens.

There is wide variability in disease prevalence and lifespan across populations worldwide. Past studies have suggested that while genes are important to specific diseases, the majority of the variation in overall human lifespan is environmental. Important environmental factors include dietary habits, physical activity, smoking and other risk behaviors, societal and public health practices (e.g., immunization), and basic health care.

We know from human epidemiological comparisons that some populations, such as the Japanese and, in particular, the Okinawans, who inhabit the most southwestern prefecture of Japan, have high active (“healthy” or “disability-free”) life expectancy – a measure of healthy aging. Japan is ranked first in active life expectancy, according to the World Health Organization, and Okinawa leads the Japanese rankings. Despite being the poorest prefecture in Japan, Okinawa has long been among the healthiest and longest lived. As a result, Okinawa has long had among the highest prevalence of centenarians in Japan and the world (Suzuki 1983; Suzuki 1987).

Understanding how the Okinawans achieved a markedly long healthspan and lifespan, despite socioeconomic disadvantages, has been the principal aim of the Okinawa Centenarian Study (OCS) for the past four decades. In 1975, Dr. Makoto Suzuki, a cardiologist and geriatrician, established the OCS as a population-based study of centenarians and other selected elderly persons to study genetic and environmental reasons for their healthy aging (Suzuki 1985). In 1994, Canadian twin brothers, Dr. Craig Willcox and Dr. Bradley Willcox, trained in medical anthropology/public health/gerontology and internal medicine/geriatrics/genetic epidemiology, respectively, joined the OCS team. Almost 1,000 centenarians have since been examined. This represents almost a quarter of all centenarians who have ever lived existed in Okinawa. The population-based design has limited the selection bias often seen in studies of the oldest old and provided a representative sample. Assessments of study participants include a geriatric medical exam that involves a physical and cognitive assessment, anthropometric measures, and activities of daily living. Other data collected include: sociodemographic characteristics, medical history and medication use, lifestyle habits (e.g., smoking, alcohol, diet, and physical activity), family pedigree, a blood sample, and a 12-lead resting electrocardiogram (Honma et al. 1999). Centenarian ages are validated through *koseki* (household registration) records and are reliable (Willcox et al. 2007a).

From a historical perspective, Okinawa has always led the Japanese population in longevity. Of the 47 Japanese prefectures, the Okinawans have traditionally had the lowest risk for coronary heart disease, stroke, cancer, and other major diseases linked to aging (Suzuki 1999). In the 1950s and 1960s, with the advent of public health awareness and a publicly-funded health care system, the leading causes of death at that time, infectious diseases, notably tuberculosis and gastroenteritis, were markedly reduced and Japan emerged as the world leader in longevity (Suzuki 1999). The Okinawans remained the leaders within Japan although recent decades have seen changes in the traditional lifestyle, in particular, diet and activity patterns, that have resulted in emerging health risks, such as obesity, in younger generations and slowing the growth in life expectancy (Suzuki et al. 1995; Willcox et al. 2008a). Currently, stark gender differences in health risk behaviors stand out that drive a large gap in life expectancy between men and women (Suzuki et al. 2014; Willcox et al. 2012).

Regarding the genetics of longevity, in 1985, OCS investigators performed the first extensive study of centenarian family pedigrees. This study found more long-lived siblings in centenarian families than average-lived control families. This original study was later extended and expanded to show that siblings of Okinawan centenarians had lifelong mortality advantages (Suzuki et al. 1985; Willcox et al. 2006a). The initial pedigree study was followed by the first study on the genetics of human longevity using centenarians as a study model, which showed that Okinawan centenarians had higher prevalence of specific type-2 HLA gene variants that tend to lower inflammation and favor longevity (Takata et al. 1987). Several of these findings have been replicated in other populations and inflammation has since become a major focus of studies in cardiovascular diseases (CVD), cancer, and other age-related diseases. The aforementioned studies do not address whether Okinawans have population-wide genetic advantages, which is an ongoing investigation, but rather they indicate that human longevity is influenced by genetic factors. Indeed, after the publication of these early findings, a

plethora of supportive studies has been published and two genes have emerged as the principal human longevity genes – APOE and FOXO3 – both of which are also linked to inflammation (Willcox et al. 2008b; Morris et al. 2015).

The study of environmental factors in the OCS has focused mostly on the traditional diet. The findings indicate a dietary pattern dominated by low calorie density foods with high nutrient density (Suzuki et al. 1999; Willcox et al. 2009a, 2014). The diet is suggestive of mild caloric restriction (10–15% fewer calories than usually recommended). This led to leaner more metabolically efficient bodies which favor longevity (Willcox et al. 2007a). This dietary pattern was made possible by hearty intake of low calorie foods, such as vegetables (over a kilogram per day) and legumes (mainly soybean products), and moderate consumption of fruit, fish, lean meats, and sanpin (jasmine) tea. High consumption of foods that contain compounds that mimic the biological effects of caloric restriction also occurred and resulted in fewer cell-damaging free radicals, greater insulin sensitivity, and activation of the FOXO3 longevity gene (Willcox and Willcox, 2014). Specifically, these foods include Okinawan sweet potatoes (anthocyanins), seaweed, other marine-based carotenoid-rich foods (astaxanthin), and turmeric (curcumin) (Willcox et al. 2014; Willcox and Willcox, 2014).

Eating a healthy diet is part of a traditional belief in Okinawa called *nuchi gusui* (“food is medicine”).

There is also evidence that physical activity, alcohol in moderation, avoidance of smoking, social support and health care, climate, and productive activity, among other factors, were additional environmental factors that helped optimize the odds of healthy aging and longevity in Okinawa (Robine et al. 2012; Willcox et al. 2007b). The OCS also reported that good cardiovascular health is among the most important longevity factors with exceptionally healthy CVD risk factors found, such as healthy blood pressure and very low LDL (bad cholesterol) with concomitant high HDL (good cholesterol) (Suzuki et al. 2001). In an OCS autopsy study of a “typical” centenarian there was no clinical evidence for coronary

artery disease *and* there was a complete absence of coronary calcification (an early indicator of hardening of the arteries present in the vast majority of older persons) (Bernstein et al. 2004). Other studies involving the OCS dataset and/or the OCS team found healthier blood chemistry and hematology, younger hormonal patterns, higher bone density, and better cognitive function than age-matched counterparts in mainland Japan or the USA (Nozaki et al. 1995; Chan et al. 1997; Willcox et al. 2009b). Other factors such as stress-resistant personalities, positive attitudes, and social support also may be important. These concepts are illustrated by Okinawan customs of *ikigai* (“find a reason for living”), *nan kuru nai sa* (“don’t worry, be happy”), and *yui maruu* (“help others”). As a whole, data were consistent a healthy lifestyle that promotes a younger biological age in older Okinawans than expected for their chronological age.

The principal findings showed that diet, physical activity, and other behavioral and psychosocial factors appear to be the major modifiable determinants of healthy aging in Okinawa. In 2002, these factors were incorporated into a lifestyle intervention plan called the “Okinawa Program.” Analysis of persons in the Honolulu Heart Study, a 50-year longitudinal study of Americans of Japanese (and Okinawan) ancestry in Hawaii, showed that persons who had similar health profiles and lifestyles as the Okinawans at younger ages had up to 19-fold increased probability of healthy aging into their 90s and 100s (Willcox et al. 2006b).

The OCS interventional program (Okinawa Program) for healthy aging was later published as an evidence-based book for the general public by Random House in the USA (Willcox et al. 2002). The major message of “The Okinawa Program” was that we can adopt the life-lengthening strategies that have served the Okinawans so well for generations. Key recommendations were based on 25 years of research into the Okinawan longevity phenomenon. The book introduces the healthy Okinawan diet and lifestyle while adapting it to modern busy lifestyles using martial arts for exercise, reducing stress using meditation, and bringing new

meaning into life by developing inner spirituality, by doing volunteer work, and by building a solid network of friends and family.

It became a New York Times bestseller and was translated into over a dozen languages worldwide. It was also nominated as “Best Wellness Book of the Year” by a panel of reviewers from Books for a Better Life, an arm of the MS Society as well as one of the “Top 50 Non-Fiction Books of the Year” by both Barnes and Noble and Amazon.com.

The OCS continues its efforts to provide scientific discoveries that can be translated into evidence-based information to help people around the world live healthier, longer lives. More information on the Okinawa Centenarian Study can be found at the OCS website ([www.okicent.org](http://www.okicent.org)).

## Cross-References

- ▶ [Blue Zones](#)
- ▶ [Health Promotion](#)
- ▶ [Healthy Aging](#)
- ▶ [Nutrition in Aging, An Exploration of a Close Relationship](#)

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## Older Adults in the Emergency Health Care Setting

Judy Lowthian

School of Public Health and Preventive Medicine,  
Monash University, Melbourne, VIC, Australia

### Synonyms

Accident and Emergency room; Ambulance service; Emergency department; Emergency medical service

### Definition

Older people are increasingly seeking health care from ambulance services and hospital emergency departments. The terms “emergency medical services” and “ambulance services” and “emergency rooms,” “emergency departments,” and “accident and emergency rooms” are often used interchangeably in the literature. All provide immediate health care for people who perceive the need for immediate treatment or care, which is generally provided for a short period of time. Modern emergency rooms are not designed for frail older patients who typically have special needs compared with other age groups, requiring a different approach from clinical staff.

### Increasing Emergency Demand by an Aging Population

Aging of populations across developing and developed countries necessitates review of how emergency services are provided to ensure that the health and social care needs of older people are optimally managed during times of acute illness and associated stress. Older people are high users of health care in all settings; however, they are increasingly seeking care from ambulance and emergency department services. People aged 70 years or more are currently the highest users of ambulances and hospital emergency departments (Lowthian et al. 2010, 2011a). They are also more likely to re-attend an emergency department on multiple occasions within a 12-month period and more likely to be admitted to hospital, compared with people under 70 years of age (Aminzadeh and Dalziel 2002). This growth in demand for emergency care by older people is increasing at rates faster than what can be accounted for by population aging, and this is expected to continue over coming years (Lowthian et al. 2011b, 2012).

There are other numerous interrelated factors that contribute to the reasons for seeking unscheduled health care. These include increasing health awareness as a consequence of successful health promotion and public health campaigns,

and the information superhighway. Community expectations for timely specialized care are also changing; and the convenience of a “one-stop-shop” that provides a 24-h total specialist service including current diagnostic technologies cannot be ignored. Fragmentation of social support for older parents and relatives due to changes in family structures and cultural norms also affects timely access to alternative transport and alternative health care. Furthermore, changes in the organization of community-based primary care services impact the availability of such care in a timely manner.

### Geriatric Emergency Care

The consequences of these intermingling factors are a growing cohort of older people seeking unscheduled health and social care from emergency departments that may be of a nonurgent and nontime critical nature. As a consequence, alongside the special needs this population has at times of acute illness and/or exacerbation of chronic illness, a new subspecialty of emergency medicine has evolved.

Geriatric emergency care is provision of health care to evaluate and/or treat medical conditions in older people at times when immediate unscheduled medical or social care is called for. While many developed countries regard older age as 65 years or more, for developing countries, the World Health Organisation uses 50 years and over to encapsulate chronology as well as changes in social roles and in capabilities. Geriatric emergency care is delivered in the prehospital setting by ambulance service personnel and/or in the hospital emergency department by emergency physicians, nurses, and/or allied health professionals.

### Older People Seeking Emergency Care

Older people typically present for unscheduled care with age-related medical problems related to a high burden of chronic disease, multiple co-morbidities, frailty, and poly-pharmacy. Prominent issues relate to cardiovascular, respiratory,

musculoskeletal, neurological and abdominal conditions, adverse drug reactions, and injury (Steinmiller et al. 2015).

In addition, there is evidence that older people aged 70 years or more who present to the emergency department have a high likelihood of loneliness, social isolation, lack of social support, or feeling depressed (Lowthian et al. 2011a; Aminzadeh and Dalziel 2002). Feeling depressed is associated with higher rates of ambulance use and emergency department attendance (Rottenberg et al. 2013). Recent research identified that 56% of a community-dwelling older emergency department cohort felt socially isolated (Lowthian et al. 2013) and 24% had symptoms of depression (Lowthian et al. 2016). Loneliness, social isolation, and depression are also associated with higher rates of re-hospitalization (Mistry et al. 2001).

The consequences of undiagnosed social isolation, loneliness, and depressive symptoms in older people have far-reaching public health impacts in terms of reduced quality of life, increased burden of disease, and increased hospital use (Hawton et al. 2010). Furthermore, with population aging, it is likely that the number of older people at risk of social isolation and loneliness will continue to grow, as will their rates of emergency healthcare use.

### Challenges for Geriatric Emergency Care

Emergency departments are noisy, bright, and chaotic environments that traditionally have had a key focus on the assessment and treatment of acute conditions of a sole medical nature with rapid throughput, particularly in the context of persistent demand, crowding, and time targets. This environment is not conducive to the often multimodal and complex needs of older more vulnerable patients. Furthermore, emergency physicians have typically not been trained in geriatric medicine, and many report being less comfortable when faced with managing older patients (Schumacher et al. 2006).

Importantly, for an older person, an emergency department attendance is described as a sentinel

event, associated with a number of negative sequelae, with increased risk of unplanned return to the emergency department and hospitalization, functional decline, admission to nursing care home, and death well documented in subsequent months (Aminzadeh and Dalziel 2002; Hastings et al. 2007; McCusker et al. 1997). As mentioned, older people are also more likely to experience increasingly complex psychosocial care needs that confound their medical issues in the acute setting.

### Goals of Geriatric Emergency Care

Emergency health service providers in the USA, United Kingdom, and Australia have begun questioning how they can optimize the quality and safety of health and social care for this growing group of the ED population. This has led to development of geriatric-focused emergency units being established within or co-located to some hospital emergency departments. These “senior friendly” emergency departments address specific environmental issues such as provision of nonslip cushioned flooring to reduce noise, adjustable lighting, pressure reducing mattresses, assistive devices for vision and hearing, bedside commodes, and orienting aids such as clocks. Comprehensive guidelines, including *The Silver Book* in the United Kingdom and *The Geriatric Emergency Department* in the USA, have also been developed that focus on the emergency department episode with standardized recommendations for staffing, education, equipment, policies and procedures, follow-up care, and performance improvement measures to effectively improve the quality of care of the geriatric population.

A key goal of geriatric emergency care is recognition of patients who would benefit from inpatient care and the effective implementation of care and services for those not requiring inpatient resources. Another objective for optimal management of older emergency department patients includes holistic screening of their health and social care needs that inform the recommendations for discharge and care transition safely

back to the community, including appropriate referrals to community services. The aim is to hopefully reduce the risk of potential postdischarge adverse outcomes and risk of early unplanned return to the emergency department or unplanned admission to hospital. Two important areas of assessment in geriatric emergency care are cognitive impairment and depression.

### Cognitive Impairment in the Emergency Department

Cognitive impairment is relatively common, with 25% of all older emergency patients presenting with medical conditions alongside one or more of the 3Ds – delirium, dementia, or depression. Therefore, cognitive screening, encompassing delirium, delirium risk, dementia, and depression, is vitally important. However, cognitive impairment is not systematically assessed in the emergency department, therefore is often unrecognized. Multiple studies report that, if tested, 25–40% of community-dwelling older adults demonstrate dementia or delirium; however, over half of these cases are neither recognized nor documented (Han et al. 2010). This has led to the recent development of emergency department-specific process and structural quality indicators to support the quality of care for older people with delirium and dementia (Schnitker et al. 2015a, b).

*Delirium* is an acute brain syndrome occurring as a result of an underlying condition. It may in fact be the only sign of a significant medical illness such as pneumonia, sepsis, or abdominal infection. Delirium is present in up to 10% of the older emergency department population. It can be severe and is associated with increased mortality, and the majority of patients are admitted to hospital. Approximately half of the patients in emergency department with delirium have underlying dementia as well, hence an imperative for differential diagnosis.

The four key features of delirium are an acute onset and fluctuating course; inattention with difficulty focussing or keeping on track and distractibility; disorganized thinking with incoherent

illogical rambling; and an altered level of consciousness with lethargy and drowsiness. Screening tools have been developed for quick and easy use in the emergency department, including the Confusion Assessment Method (CAM), 4AT, and RADAR.

*Dementia* is a chronic cognitive deficit occurring in up to 25% of older emergency attendees. Diagnosis is relevant to establishment of the discharge plan as it affects every stage of the patient's management, from obtaining a history, consent for diagnostic testing, engagement in the treatment plan, and development of a safe plan for discharge from the emergency department. Complete diagnosis of dementia is reliant on lengthy neuro-psychological assessment which does not outside the scope of the emergency department; however, screening is possible with tools such as the Six-item Screener or the Mini-Cog.

*Depression* is also often not fully appreciated in the emergency department environment, although it may be present in up to one-third of older patients. Because geriatric depression has features that differ from those typically observed in younger people, it may interfere with the clinical presentation of acute medical problems (Meldon et al. 1997). Depression in older people is also associated with greater numbers of emergency department attendances. A brief validated three-question tool for use in the emergency department is the ED-DSI (Depression Screening Instrument).

### **Care Transition from the Emergency Department to Community**

Numerous models of care are implemented in many countries to support safe transition of older people from the emergency department back to the community. Core components usually include geriatric assessment by nurses or allied health professionals with community-based referral and liaison with the primary health care provider. Such care models have been shown to improve health outcomes when implemented in the inpatient setting with decreased likelihood of functional deterioration or death and increased likelihood of

living at home at 12 months following hospital discharge. However, the evidence for effectiveness when implemented in the emergency department setting is mixed regarding maintenance of functional independence in activities of daily living, unexpected death, or return to the emergency department with or without hospital admission (Lowthian et al. 2015).

Importantly, a differentiating feature in studies that report a significant reduction in early emergency department re-attendance and decreased need for nursing home admission was the use of telephone follow-up shortly after discharge from the emergency department. These telephone calls enable confirmation that emergency department discharge instructions are understood and also potentially counteract any confounding issue of poor functional health literacy. Functional health literacy is the extent to which individuals have “*capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions.*” (Institute of Medicine Committee on Health Literacy 2004). US studies indicate that 60% of older patients report not understanding their emergency department discharge information. Furthermore, it has been identified that 50% of Australians aged 65 years or older have inadequate functional health literacy. Therefore, follow-up telephone calls are a potential safety net to check the patient's comprehension of the emergency department encounter.

Implementation of “quick response programs” that provide rapid referral for home-based services immediately following emergency department discharge has also been reported to be effective in qualitative cross-sectional studies. Such programs facilitate early take-up of services recommended by emergency department clinicians.

In addition, family members and carers could be engaged to enhance emergency department community transition, but there is an absence of literature about their potential involvement. This is of particular importance where functional health literacy may be poor and in the context of admission avoidance. This calls for further research about the effectiveness of including

them in the model of care, from the point of emergency department arrival through to discharge and transition back to the community.

Population aging requires health care systems to be vigilant in their provision of integrated care across the continuum including emergency care. As such emergency care needs to be delivered safely and effectively, with a holistic approach with appropriate communication and handover to facilitate safe transition back to community following an emergency department visit.

## Cross-References

- ▶ [Behavioral and Psychological Symptoms of Dementia](#)
- ▶ [Clinical Issues in Working with Older Adults](#)
- ▶ [Mental Health and Aging](#)

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## Older People and Their Psychological Well-Being in Japan, Evidence from the Japanese Study of Aging and Retirement (JSTAR)

Hideki Hashimoto

Department of Health and Social Behavior, The University of Tokyo School of Public Health, Bunkyo, Tokyo, Japan

### Definition

The Japanese Study of Ageing and Retirement (JSTAR) is a member survey of a cross-country harmonization project based on the U.S. Health and Retirement Study, to provide a comprehensive measurement of demographics, physical and psychological health, socioeconomic conditions, and social and labor participation of aged over 50 to 75 in 10 cities in Japan. The data is publicly available for research and policy purposes from the Research Institute of Economics, Trade, and Industry, Japan.

### Introduction

As of 2013, Japan's life expectancy is 80.2 years for males and 86.6 for females (Ministry of Health Labour and Welfare 2014). Japan's life expectancy exceeded the OECD average in the late 1970s and has continued to extend until today.

Achievement of longevity has mixed impact on the life of older Japanese. Older Japanese people enjoy not only the longest life expectancy but also the longest healthy life expectancy in the world, though the proportion of disabled life years to total life expectancy has been increasing, especially among women (Hashimoto et al. 2010). The number of frail elderly with care needs is rising, while informal care provision by traditional family becomes less available because the proportion of older people living in single and couple household is rising (Tokunaga et al. 2014).

According to a cross-national survey by the Cabinet Office, 90% of Japanese aged 60 and over are satisfied with their current life conditions,

and 70% answered their household economy is relatively good (Cabinet Office 2010). However, recent OECD comparative data indicate the relative poverty rate among older people in Japan is about 19%, higher than among OECD member countries (OECD 2013).

Furthermore, longevity has created a social dilemma. The longevity with declined fertility resulted in a demographic change of the population; the proportion of those aged 65 and older reached 25% in 2013 and is expected to rise up to 36% in 2050 (Institute of Population and Social Security Research 2012). Sustainability of the national economy is threatened by increasing demand of social benefit for elderly healthcare and pensions, with increasing dependent ratio of the population with low fertility. As a countermeasure, the government announced a new policy to encourage active social participation and health promotion by older people themselves under community support (Cabinet Office 2014).

Japan's near future projects social issues common to developed as well as emerging economy countries that will soon pass the population dividend. How Japan responds to the situation will attract global interest among those countries that aim to achieve quality of life in people's later life, while avoiding intergenerational conflict over life chances.

To find the better way, it is very important to know what the life of older people in Japan is like. However, it is not relevant to take the older generation as a homogenous group defined simply by age. Older people are diverse in terms of health, socioeconomic, and psychological aspects of life after a life-course trajectory of experiences.

A social survey with comprehensive measurement of health, household economy, and social life in a longitudinal design is regarded as an imperative tool for capturing the various pictures of older peoples' lives. The global set of panel surveys following the US Health and Retirement Study are now available to provide a scientific platform for comparative assessment of older people across countries to learn lessons from each other. This entry provides an overview of the Japanese sister survey, Japanese Study of Ageing and Retirement (JSTAR), and some of the currently available

evidence on the psychological impact of health, socioeconomic conditions, and social participation among Japanese older people.

## JSTAR Description

Details on the background and sampling strategy of JSTAR are available elsewhere (Ichimura et al. 2009). To be brief, after a pilot study in 2005, JSTAR started its first wave in 2007 in five cities across the country. JSTAR invited middle-age and old adults aged 50–75 at the time of the first contact who were probabilistically selected from municipality residential registration records. Targeted municipalities were carefully selected according to the location, demographic, and industrial characteristics to cover various pictures of the older people over the country. JSTAR intentionally chose the sampling strategy above, rather than random sampling across the whole country, because municipality local governments are responsible for implementation of policies related to long-term care and community-based public healthcare plans in Japan, and that municipality-based sampling would provide opportunities to evaluate the impact of local policy differences as a fixed effect.

JSTAR conducted computer-assisted personal interviews at the convenience of targeted respondent persons, which took about 2 h on average. JSTAR did not invite a spouse of the targeted respondent, as HRS did, though a spouse could join the interview to help the target answer the question.

The computer-assisted personal interview was originally designed following the first-wave questionnaire conducted in the Survey of Health Ageing and Retirement in Europe (SHARE) for comparative purposes. The survey was supplemented with self-administered questionnaire asking lifestyles, social participation, daily functions, household finance, and quality of life. JSTAR also included a dietary habit questionnaire to assess nutrition intake of older Japanese (Kobayashi et al. 2012).

Following HRS and other sister surveys, JSTAR followed the targeted respondent persons at 2-year intervals since the first contact. In the

wave conducted in 2009, two cities were newly invited, one of which was Naha City in Okinawa Prefecture, once known to be a centenarian island in the country. In 2011, another three cities were invited including Hiroshima City, the first civilian casualty of an atomic bomb in 1945. In 2011, one of the member municipalities, Sendai city, was hit by the East Japan Mega Earthquake and subsequent tsunami. In 2013–2014, a fourth-wave survey is ongoing in ten cities across the country.

JSTAR does not regularly include objective biomarker measurement, except for grip strength. In the second wave in 2009, measurement of blood pressure, waist circumferences, and some anthropometry (height and trunk length) was conducted. Blood tests including genome measurement have not been implemented so far.

As for psychological measurement, administered questionnaires included, in each panel interview, measurement of depression (Center for Epidemiological Studies Depression; CESD 20 items), life satisfaction and self-reported health status (5-response Likert scale), and job stress (simplified demand/control and effort-reward imbalance). Since wave 2 in 2009, quality of life measurement called CASP19 (Howel 2012), consisting of subscales on “control,” “autonomy,” “self-realization,” and “pleasure,” was included for comparative purpose. Furthermore, following HRS measurement, social preferences (risk attitude and time preference) and cognitive functions (simplified Mini-Mental State Examination, numeracy, and word recall of ten words following Alzheimer Disease Assessment Scale-Cognitive Japanese version) were measured during personal interviews. Social participation of community activities, social support reception and provision, and lifestyles related to smoking, drinking, and exercise habits were also measured in each wave through self-administered questionnaire. For details, questionnaire items are available at JSTAR homepages (<http://www.rieti.go.jp/en/projects/jstar/index.html>).

Wave 1 in 2007 included 4,163 individuals. Among them, 3,091 joined the wave 2 in 2009 (follow-up rate = 81%). The rest of this entry will provide statistics derived from data analysis of waves 1 and 2 in the original five cities.

Life satisfaction (4-level Likert scale, dichotomized into satisfied = 1 or not = 0) and depression (CESD > 16 points) were used as targeted outcomes reflecting psychological well-being. Hierarchical logistic regression was adopted to test several sets of variables added in the model, namely, demographic and socioeconomic conditions (model 1), health and functions (model 2), social relationship with family (model 3), and social relationship with nonfamily sources including social network participation in the community (model 4).

### Results of Cross-Sectional Analysis in Wave 1

Table 1 shows the results on life satisfaction. In model 1, older age was significantly positively, and unemployment status was negatively associated with life satisfaction. These two characteristics were consistently and independently related to life satisfaction even after adding other predictors. Self-reported ill health and any limitation in Instrumental Activities of Daily Life (IADL) and Mobility were strong and consistent predictors of low life satisfaction (models 2, 3, and 4). Widowhood, and divorced status was negatively associated with life satisfaction, and social support from non-spousal family (e.g., children and other family members) was positively associated with life satisfaction, independently of socioeconomic and health conditions (models 3 and 4). Finally, social support provision from nonfamily sources (e.g., friends and neighborhood) was significantly and independently associated with life satisfaction (model 4).

Table 2 shows the cross-sectional model predicting depression in wave 1. Model 1 shows similar results with life satisfaction in that older age was negatively and unemployment status was positively associated with depression. In addition, higher household income was negatively associated with depression (model 1), though the significance was gradually attenuated after inclusion of health and social relationship (model 2–4). Ill health, functional limitations, widowhood, and divorced status were all significantly associated with depression, while social support from

non-spousal family and nonfamily sources showed a counter association with depression.

The results of cross-sectional analysis indicated that employment, health and independent functions, and social support from spouse, family, and nonfamily members were consistently associated with better life satisfaction and lower chance of psychological depression. However, the cross-sectional analysis does not tell much about causality and remains susceptible to reverse causation due to selection by mood disturbance on respondent's social behaviors and consequent health conditions. Besides, the explanatory power of the models was not so high, suggesting that unmeasured relevant confounders may still be left out of the model.

### Results of Longitudinal Analysis Between Wave 1 and Wave 2

Table 3 exhibits the results of longitudinal analysis taking depression in wave 2 as an outcome, regressed on variables measured in wave 1 with adjustment for depression status as of wave 1. As similar with the results of cross-sectional analyses, higher age was negatively, and unemployment was positively associated with depression in wave 2, though they no more reached statistical significance. Instead, female gender turned to be significantly and positively associated with depression. As for ill health and functional limitations, they were associated with depression at wave 2, though only the limitation in mobility remained significant. As for social relationship, divorce status in wave 1 was significantly and positively related with depression at wave 2, and social support reception from nonfamily source at wave 1 was significantly and negatively associated with depression at wave 2. Otherwise, social support from non-spousal family and social participation did not reach statistical significance.

The results of longitudinal analyses were basically similar with those of cross-sectional analyses and implied that the loss of mobility function and social support from nonfamily sources was a robust predictor of depression. However, the model fitness was still limited (pseudo R-square = 0.1633).

**Older People and Their Psychological Well-Being in Japan, Evidence from the Japanese Study of Aging and Retirement (JSTAR), Table 1** Life satisfaction in wave 1 (cross-sectional model) by hierarchical logistic regression model

	Model 1			Model 2			Model 3			Model 4		
	Odds ratios	p-value	95% confidence Int.	Odds ratios	p-value	95% confidence Int.	Odds ratios	p-value	95% confidence Int.	Odds ratios	p-value	95% confidence Int.
<i>Demographic and socioeconomic conditions</i>												
Age	1.058	0.000	(1.042 1.075)	1.064	0.000	(1.047 1.081)	1.065	0.000	(1.048 1.083)	1.070	0.000	(1.052 1.089)
Female	1.098	0.409	(0.880 1.369)	1.054	0.653	(0.839 1.322)	1.128	0.325	(0.887 1.434)	1.021	0.870	(0.795 1.312)
High school	1.093	0.412	(0.884 1.352)	0.948	0.632	(0.762 1.179)	1.008	0.946	(0.804 1.263)	1.009	0.939	(0.798 1.277)
College	1.137	0.410	(0.838 1.541)	0.974	0.869	(0.712 1.332)	0.947	0.736	(0.688 1.302)	0.991	0.959	(0.705 1.393)
University and over	0.959	0.786	(0.707 1.300)	0.820	0.218	(0.599 1.124)	0.874	0.414	(0.632 1.208)	0.822	0.254	(0.587 1.151)
Non-full time vs. full time	0.981	0.892	(0.742 1.297)	0.976	0.869	(0.734 1.299)	0.942	0.688	(0.703 1.262)	0.953	0.755	(0.702 1.292)
Self-employed vs. full time	1.093	0.557	(0.813 1.468)	1.081	0.614	(0.799 1.461)	1.041	0.798	(0.764 1.419)	0.935	0.679	(0.679 1.287)
Other employee vs. full time	0.991	0.966	(0.654 1.501)	1.049	0.826	(0.687 1.602)	0.950	0.821	(0.613 1.475)	0.925	0.738	(0.585 1.461)
Unemployed vs. full time	0.394	0.000	(0.254 0.613)	0.425	0.000	(0.270 0.670)	0.380	0.000	(0.238 0.607)	0.356	0.000	(0.218 0.583)
Retired vs. full time	1.029	0.874	(0.723 1.463)	1.220	0.281	(0.850 1.753)	1.232	0.273	(0.849 1.789)	1.160	0.461	(0.783 1.718)
Homemaker vs. full time	1.349	0.089	(0.956 1.904)	1.530	0.018	(1.074 2.179)	1.384	0.081	(0.961 1.993)	1.398	0.086	(0.954 2.050)
Other vs. full time	0.311	0.000	(0.207 0.468)	0.520	0.003	(0.337 0.802)	0.544	0.008	(0.347 0.855)	0.559	0.017	(0.347 0.900)
Income (in million JPY)	1.095	0.000	(1.063 1.127)	1.085	0.000	(1.053 1.118)	1.073	0.000	(1.041 1.106)	1.071	0.000	(1.038 1.104)
<i>Health and functions</i>												
Self-reported ill health				0.549	0.000	(0.459 0.657)	0.557	0.000	(0.463 0.670)	0.520	0.000	(0.429 0.631)
IADL limitation				0.581	0.000	(0.488 0.692)	0.598	0.000	(0.499 0.716)	0.697	0.000	(0.574 0.847)
Mobility limitation				0.689	0.002	(0.543 0.874)	0.702	0.005	(0.549 0.897)	0.713	0.011	(0.550 0.924)
<i>Social relationship with family</i>												
Never married vs. married							0.718	0.178	(0.443 1.163)	0.628	0.069	(0.381 1.037)

(continued)

**Older People and Their Psychological Well-Being in Japan, Evidence from the Japanese Study of Aging and Retirement (JSTAR), Table 1 (continued)**

	Model 1			Model 2			Model 3			Model 4		
	Odds ratios	p-value	95% confidence Int.	Odds ratios	p-value	95% confidence Int.	Odds ratios	p-value	95% confidence Int.	Odds ratios	p-value	95% confidence Int.
Widowed vs. married							0.761	0.098	(0.550 1.052)	0.656	0.016	(0.464 0.926)
Divorced vs. married							0.624	0.011	(0.433 0.899)	0.583	0.005	(0.399 0.852)
Contact with child > once biweekly							0.920	0.104	(0.832 1.017)	0.939	0.245	(0.844 1.044)
Social support from non-spousal family							1.378	0.000	(1.254 1.513)	1.196	0.001	(1.075 1.330)
<i>Social relationship with nonfamily</i>												
Social participation (voluntary)										0.974	0.823	(0.774 1.226)
Social participation (community activity)										1.109	0.408	(0.868 1.418)
Social support from nonfamily source										1.497	0.000	(1.342 1.670)
<i>Municipality dummy variables</i>												
City2	1.129	0.324	(0.887 1.435)	1.197	0.152	(0.936 1.530)	1.213	0.132	(0.944 1.560)	1.230	0.125	(0.944 1.602)
City3	1.322	0.061	(0.988 1.770)	1.319	0.068	(0.980 1.777)	1.314	0.079	(0.969 1.783)	1.227	0.210	(0.891 1.690)
City4	1.355	0.033	(1.026 1.791)	1.231	0.151	(0.927 1.635)	1.113	0.470	(0.832 1.490)	0.969	0.843	(0.713 1.318)
City5	1.037	0.777	(0.807 1.331)	1.105	0.444	(0.856 1.427)	1.111	0.435	(0.853 1.448)	1.037	0.801	(0.783 1.372)
Constant	0.068	0.000	(0.025 0.184)	0.098	0.000	(0.035 0.273)	0.047	0.000	(0.015 0.143)	0.021	0.000	(0.006 0.069)
N included in the model	3739			3706			3610			3431		
Pseudo R-square	0.0515			0.0805			0.0974			0.1206		

**Older People and Their Psychological Well-Being in Japan, Evidence from the Japanese Study of Aging and Retirement (JSTAR), Table 2** Depression (CESD > 16) in wave 1 (cross-sectional model) by hierarchical logistic regression model

	Model 1			Model 2			Model 3			Model 4		
	Odds ratios	p-value	95% confidence Int.	Odds ratios	p-value	95% confidence Int.	Odds ratios	p-value	95% confidence Int.	Odds ratios	p-value	95% confidence Int.
<i>Demographic and socioeconomic conditions</i>												
Age	0.980	0.013	(0.964 0.996)	0.973	0.001	(0.957 0.989)	0.969	0.000	(0.952 0.986)	0.969	0.000	(0.952 0.986)
Female	1.221	0.107	(0.958 1.556)	1.303	0.039	(1.014 1.674)	1.182	0.213	(0.909 1.537)	1.285	0.069	(0.981 1.684)
High school	0.958	0.709	(0.765 1.199)	1.153	0.232	(0.913 1.456)	1.095	0.454	(0.863 1.390)	1.096	0.460	(0.859 1.400)
College	0.909	0.564	(0.656 1.258)	1.126	0.489	(0.804 1.578)	1.144	0.438	(0.814 1.610)	1.169	0.388	(0.821 1.664)
University and over	1.041	0.815	(0.744 1.456)	1.289	0.154	(0.909 1.828)	1.161	0.414	(0.811 1.661)	1.206	0.315	(0.836 1.739)
Non-full time vs. full time	0.797	0.170	(0.577 1.102)	0.789	0.162	(0.566 1.100)	0.782	0.154	(0.557 1.097)	0.752	0.109	(0.531 1.066)
Self-employed vs. full time	0.822	0.261	(0.584 1.157)	0.839	0.326	(0.592 1.191)	0.835	0.324	(0.584 1.195)	0.912	0.621	(0.634 1.312)
Other employee vs. full time	1.057	0.806	(0.678 1.649)	0.967	0.886	(0.612 1.529)	1.069	0.780	(0.667 1.714)	1.104	0.687	(0.683 1.785)
Unemployed vs. full time	2.120	0.002	(1.315 3.419)	1.797	0.021	(1.091 2.960)	1.769	0.030	(1.058 2.958)	1.938	0.013	(1.147 3.274)
Retired vs. full time	1.253	0.234	(0.864 1.816)	1.049	0.806	(0.715 1.539)	1.058	0.775	(0.717 1.561)	1.129	0.556	(0.755 1.688)
Homemaker vs. full time	1.059	0.755	(0.739 1.518)	0.901	0.586	(0.621 1.309)	0.964	0.851	(0.657 1.413)	1.017	0.934	(0.687 1.505)
Other vs. full time	3.912	0.000	(2.551 5.999)	2.021	0.003	(1.280 3.191)	1.996	0.004	(1.248 3.194)	1.981	0.006	(1.219 3.219)
Income (in million JPY)	0.957	0.003	(0.930 0.985)	0.969	0.031	(0.942 0.997)	0.975	0.078	(0.947 1.003)	0.976	0.096	(0.948 1.004)
<i>Health and functions</i>												
Self-reported ill health				1.973	0.000	(1.620 2.403)	1.908	0.000	(1.560 2.333)	1.926	0.000	(1.568 2.366)
IADL limitation				1.855	0.000	(1.535 2.240)	1.785	0.000	(1.472 2.165)	1.581	0.000	(1.291 1.938)
Mobility limitation				1.851	0.000	(1.463 2.342)	1.911	0.000	(1.503 2.431)	1.819	0.000	(1.417 2.335)
<i>Social relationship with family</i>												
Never married vs. married							0.882	0.666	(0.500 1.556)	0.991	0.976	(0.559 1.759)

(continued)



**Older People and Their Psychological Well-Being in Japan, Evidence from the Japanese Study of Aging and Retirement (JSTAR), Table 2 (continued)**

	Model 1			Model 2			Model 3			Model 4		
	Odds ratios	p-value	95% confidence Int.	Odds ratios	p-value	95% confidence Int.	Odds ratios	p-value	95% confidence Int.	Odds ratios	p-value	95% confidence Int.
Widowed vs. married							1.659	0.002	(1.207 2.280)	1.753	0.001	(1.254 2.451)
Divorced vs. married							1.508	0.040	(1.018 2.233)	1.565	0.029	(1.047 2.339)
Contact with child > once biweekly							1.074	0.193	(0.964 1.197)	1.061	0.301	(0.949 1.186)
Social support from non-spousal family							0.717	0.000	(0.649 0.793)	0.811	0.000	(0.725 0.906)
<i>Social relationship with nonfamily</i>												
Social participation (voluntary)										0.957	0.722	(0.751 1.220)
Social participation (community activity)										0.902	0.435	(0.697 1.168)
Social support from nonfamily source										0.732	0.000	(0.654 0.819)
<i>Municipality dummy variables</i>												
City2	1.017	0.901	(0.783 1.319)	0.977	0.864	(0.746 1.278)	0.945	0.682	(0.719 1.241)	0.885	0.392	(0.669 1.171)
City3	0.927	0.632	(0.680 1.264)	0.957	0.788	(0.695 1.317)	0.922	0.624	(0.666 1.276)	0.917	0.613	(0.657 1.281)
City4	0.927	0.619	(0.687 1.251)	1.070	0.668	(0.786 1.457)	1.133	0.440	(0.826 1.553)	1.210	0.249	(0.875 1.673)
City5	1.062	0.664	(0.809 1.396)	1.013	0.931	(0.764 1.342)	1.000	0.998	(0.749 1.334)	0.959	0.784	(0.711 1.293)
Constant	0.752	0.595	(0.262 2.154)	0.465	0.171	(0.155 1.394)	1.296	0.666	(0.398 4.217)	2.174	0.214	(0.639 7.400)
N included in the model	3639			3609			3531			3382		
Pseudo R-square	0.0289			0.0717			0.0907			0.1011		

**Older People and Their Psychological Well-Being in Japan, Evidence from the Japanese Study of Aging and Retirement (JSTAR), Table 3** Depression in wave 2 predicted by wave 1 variables; hierarchical logistic regression results

	Model 1			Model 2			Model 3			Model 4		
	Odds ratios	p-value	95% confidence Int.	Odds ratios	p-value	95% confidence Int.	Odds ratios	p-value	95% confidence Int.	Odds ratios	p-value	95% confidence Int.
Depression status at Wave 1	7.595	0.000	(5.935 9.718)	6.577	0.000	(5.106 8.473)	6.411	0.000	(4.951 8.303)	6.234	0.000	(4.781 8.129)
<i>Demographic and socioeconomic conditions</i>												
Age	0.993	0.506	(0.972 1.014)	0.987	0.220	(0.965 1.008)	0.987	0.269	(0.966 1.010)	0.984	0.174	(0.962 1.007)
Female	1.448	0.019	(1.063 1.972)	1.444	0.023	(1.053 1.980)	1.351	0.075	(0.970 1.880)	1.495	0.020	(1.066 2.097)
High school	0.892	0.444	(0.665 1.196)	1.032	0.840	(0.763 1.395)	0.975	0.874	(0.717 1.326)	1.013	0.936	(0.739 1.389)
College	0.988	0.952	(0.663 1.472)	1.160	0.475	(0.772 1.744)	1.115	0.604	(0.738 1.685)	1.042	0.853	(0.676 1.605)
University and over	0.786	0.288	(0.504 1.225)	0.920	0.720	(0.583 1.451)	0.875	0.573	(0.550 1.391)	0.919	0.729	(0.572 1.478)
Non-full time vs. full time	0.911	0.643	(0.615 1.350)	0.913	0.652	(0.614 1.357)	0.917	0.673	(0.612 1.373)	0.865	0.494	(0.571 1.310)
Self-employed vs. full time	1.008	0.972	(0.661 1.535)	1.016	0.941	(0.665 1.552)	1.094	0.682	(0.713 1.677)	1.193	0.426	(0.773 1.840)
Other employee vs. full time	0.771	0.374	(0.436 1.366)	0.718	0.264	(0.401 1.285)	0.841	0.569	(0.464 1.526)	0.850	0.595	(0.467 1.548)
Unemployed vs. full time	1.255	0.503	(0.646 2.439)	1.121	0.742	(0.567 2.216)	1.056	0.880	(0.522 2.136)	1.121	0.753	(0.550 2.288)
Retired vs. full time	0.880	0.605	(0.542 1.428)	0.745	0.244	(0.455 1.222)	0.755	0.272	(0.458 1.246)	0.814	0.436	(0.486 1.364)
Homemaker vs. full time	0.742	0.205	(0.468 1.177)	0.675	0.102	(0.422 1.081)	0.774	0.294	(0.479 1.249)	0.744	0.237	(0.455 1.216)
Other vs. full time	1.989	0.026	(1.086 3.640)	1.232	0.521	(0.652 2.327)	1.162	0.651	(0.607 2.224)	1.037	0.916	(0.530 2.029)
Income (in million JPY)	0.992	0.624	(0.962 1.024)	0.996	0.817	(0.967 1.027)	1.004	0.775	(0.977 1.032)	1.004	0.762	(0.977 1.033)
<i>Health and functions</i>												
Self-reported ill health				1.378	0.010	(1.079 1.761)	1.307	0.035	(1.019 1.677)	1.229	0.114	(0.952 1.587)
IADL limitation				1.358	0.013	(1.065 1.731)	1.293	0.042	(1.010 1.657)	1.149	0.302	(0.882 1.497)
Mobility limitation				1.977	0.000	(1.454 2.688)	2.027	0.000	(1.484 2.770)	2.155	0.000	(1.562 2.974)

(continued)

**Older People and Their Psychological Well-Being in Japan, Evidence from the Japanese Study of Aging and Retirement (JSTAR), Table 3 (continued)**

	Model 1			Model 2			Model 3			Model 4		
	Odds ratios	p-value	95% confidence Int.	Odds ratios	p-value	95% confidence Int.	Odds ratios	p-value	95% confidence Int.	Odds ratios	p-value	95% confidence Int.
<i>Social relationship with family</i>												
Never married vs. married							1.209	0.578	(0.620 2.357)	1.341	0.391	(0.686 2.623)
Widowed vs. married							1.210	0.375	(0.795 1.842)	1.147	0.546	(0.735 1.788)
Divorced vs. married							2.171	0.002	(1.322 3.565)	2.217	0.002	(1.327 3.703)
Contact with child > once biweekly							1.066	0.369	(0.927 1.227)	1.073	0.341	(0.928 1.241)
Social support from non-spousal family							0.862	0.027	(0.756 0.983)	0.897	0.144	(0.775 1.038)
<i>Social relationship with nonfamily</i>												
Social participation (voluntary)										1.089	0.577	(0.806 1.471)
Social participation (community activity)										0.811	0.201	(0.588 1.118)
Social support from nonfamily source										0.822	0.009	(0.709 0.953)
<i>Municipality dummy variables</i>												
City2	0.889	0.484	(0.640 1.235)	0.856	0.360	(0.615 1.193)	0.877	0.441	(0.628 1.225)	0.880	0.469	(0.623 1.243)
City3	0.571	0.007	(0.380 0.858)	0.574	0.008	(0.381 0.864)	0.569	0.008	(0.375 0.863)	0.603	0.021	(0.393 0.926)
City4	0.703	0.063	(0.484 1.019)	0.729	0.100	(0.500 1.063)	0.753	0.148	(0.513 1.106)	0.828	0.352	(0.556 1.232)
City5	0.645	0.019	(0.447 0.931)	0.585	0.005	(0.403 0.850)	0.604	0.009	(0.413 0.884)	0.637	0.025	(0.430 0.944)
Constant	0.255	0.053	(0.064 1.018)	0.249	0.055	(0.060 1.027)	0.305	0.125	(0.067 1.392)	0.534	0.440	(0.109 2.626)
N included in the model	2470			2456			2404			2321		
Pseudo R-square	0.1351			0.1516			0.158			0.1633		

We further conducted panel data analyses using conditional logistic regression with fixed-effect model so that we could better control unmeasured time-invariant confounders (data not shown in tables). However, since measurement of social support was differently conducted in wave 2, we could not include social support from family and nonfamily sources. Besides, changes in the depression status over survey waves were relatively rare, and the fixed model effectively included only a limited number of the sample, resulting in weak statistical power and poor model fitness. Provisional results indicated that change into retirement and homemaking status and limitation in IADL were significant predictors of depression. Differences between the fixed-effect model and the longitudinal logistic model may be caused by sample restriction, omitted variables (social support from family and nonfamily sources), and endogenous effect of unmeasured heterogeneity. The findings require further analyses with more numbers of waves and municipality participations, which should be available in the near future from the JSTAR project.

## Discussion and Conclusion

This entry presented some evidence from JSTAR regarding risk factors of depression and impaired life satisfaction. However, the causal mechanisms of impaired psychological well-being among older Japanese are still to be specified, because psychological well-being is endogenously determined and determines the mode of social participation, lifestyle choices, and subsequent health and functional statuses.

A panel survey with comprehensive measurement, such as HRS and her sisters including JSTAR, is a powerful tool to scrutinize the complex mechanisms of the psychological well-being of older people who stand at a life stage with drastic change in their modes of social participation and health status. For example, a recent study used JSTAR panel data to identify the causal impact of retirement on psychological and cognitive functions (Hashimoto 2013).

Furthermore, comparable panel datasets are expected to provide the opportunities to test how external conditions such as household compositions and policies related to pension, retirement, and healthcare benefits affect the social relationships and behaviors of older people across countries. Indeed, Japan is unique in its generosity and relatively equal distribution of social benefit to older people through public pensions and healthcare provision with relatively low out-of-pocket contribution (Ikegami et al. 2011), which may crowd out the patterns and norms of private transaction within the family. Differences in culture and preferences regarding social integration and roles of senior citizens in the community can also be an interesting topic for comparative analyses. Recently, a researcher term in University of Southern California and RAND Corporation provided harmonization of HRS sister surveys to facilitate cross-panel analysis, of which details are available elsewhere (<http://www.g2aging.org/>).

## Cross-References

- ▶ [English Longitudinal Study of Aging \(ELSA\)](#)
- ▶ [Health and Retirement Study, A Longitudinal Data Resource for Psychologists](#)
- ▶ [Irish Longitudinal Study on Ageing \(TILDA\)](#)
- ▶ [Korean Longitudinal Study of Ageing \(KLoSA\): Overview of Research Design and Contents](#)
- ▶ [Survey of Health, Ageing and Retirement in Europe \(SHARE\)](#)

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## Oporto Centenarian Study

Oscar Ribeiro<sup>1,2,3</sup>, Lia Araújo<sup>1,4</sup>, Laetitia Teixeira<sup>1</sup>, Daniela Brandão<sup>1</sup>, Natália Duarte<sup>1</sup> and Constança Paúl<sup>1</sup>

<sup>1</sup>UNIFAI and CINTESIS, ICBAS – University of Porto, Porto, Portugal

<sup>2</sup>Higher Institute of Social Service (ISSSP), Porto, Portugal

<sup>3</sup>University of Aveiro, Aveiro, Portugal

<sup>4</sup>Polytechnic Institute, ESEV and CI&DETS, Viseu, Portugal

## Definition

This entry presents the first population-based study conducted in Portugal, the Oporto

Centenarian Study (PT100). It starts by providing an overview of the centenarian population in Portugal and then describes PT100's methodological approach (sampling, procedures, and measures) and synthesizes its main findings on three core dimensions considered to be determinants of quality of life in extreme old age (Serra et al. 2011): cognitive and physical functioning, social resources (social relationships and social activities), and personal attitude toward life (valuation of life). An outlook of current satellite projects of the PT100 is presented at the end.

## Centenarians in Portugal

The phenomenon of longevity has been one of the most relevant achievements of the last century. A rapid increase in the size of the older population has been observed in Portugal, with the oldest old (individuals aged 80 and plus) representing 5.6% of the total population and 26.5% of the older population, i.e., of those aged 65 and over (INE 2011). Centenarians almost tripled over the last decade, from 589 centenarians in 2001 (95 men, 494 women; INE 2001) to 1526 in 2011 (273 men, 1253 women; INE 2011). For the year 2013, Statistics Portugal had projected the existence of 3393 centenarians (2440 women and 989 men in a characteristic gender imbalance among the oldest old), expecting an exponential growth of this population, which is likely to continue in the near future.

This aging scenario has raised several concerns and questions, with more pessimistic views suggesting that older populations will impose a growing burden on society. Most of these assumptions are based on the lack of information and real data on centenarians' status, their needs, and their capacities. Such information has been completely absent in a systematic and organized way for the Portuguese context (Ribeiro and Araújo 2012). In order to fill this gap and uncover the living conditions, functional, psychosocial, demographic, and clinical characteristics of these long-lived individuals, the first centenarian study was launched in 2012 in the second largest city in Portugal, after Lisbon, and one of the major urban areas in Southwestern Europe.

As the first Portuguese population-based centenarian study, the PT100 – Oporto Centenarian Study – aims to describe the characteristics of a sample of Portuguese centenarians and their overall personal characteristics and living arrangements using a multidimensional and comprehensive approach. Complementarily, it aims at contributing to the understanding of the longevity phenomenon, particularly the role of psychological and social resources, within a cross-cultural perspective. For this purpose, the study takes part of an international consortium with the Second Heidelberg Centenarian Study (Germany) and the Fordham Centenarian Study (USA) sharing similar methodological procedures.

## Sampling

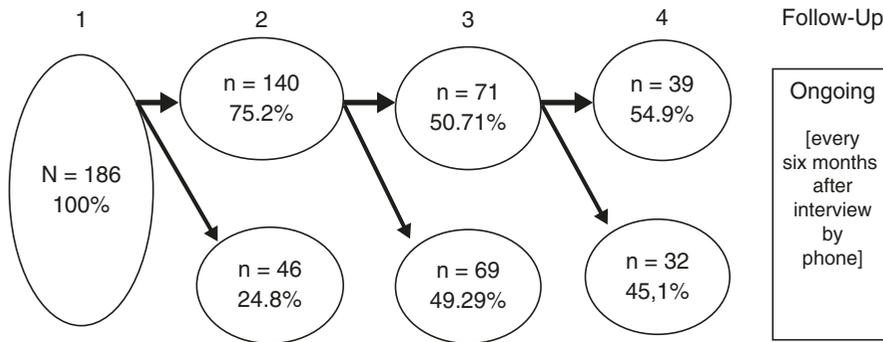
In order to obtain a representative sample of the general population, a specific geographical area was defined: approximately 60 km around Oporto, which comprised a total of 16 municipalities known as the Oporto Metropolitan Area. All inhabitants who were aged 100 years and more between December 2012 and December 2013 were identified through voter registration files after permission given by the National Commission of Data Protection. Since these files only have information on name, data of birth, and address, and a significant amount of information was outdated (i.e., many centenarians had died a long time ago), additional methods for identifying centenarians were used. Specifically, contacts with all the nursing homes listed in the Social Security Institute, parish councils, and parish churches of the Porto Metropolitan Area were made. Media announcing centenarians' birthdays were also contacted, and the project was also presented to the general public in scientific events, in the media (e.g., local newspapers), and in the web (e.g., project's site and Facebook page). In addition, during data collection, the participants who were interviewed also helped to identify centenarians or other people who knew centenarians. This snowball technique proved to be an effective complementary approach.

Altogether, recruitment procedures allowed the identification of 186 potential participants. Although all of these centenarians were contacted, only 140 were effectively face-to-face interviewed. The other 46 centenarians were excluded because they died in the interim or their relatives refused participation because of dementia, severe health problems, or lack of interest in taking part of the study.

## Procedures and Measures

Information was collected during one or two sequential sessions of a structured interview protocol, directly with the centenarian and/or with proxies' respondents at their own homes, nursing homes (if institutionalized), or any other place of their convenience. Each interview session lasted on average 2 h, was conducted by two trained interviewers (psychologist and gerontologist), and was video and audio recorded. The proxies were family or friends with frequent and close contact with the centenarian. In those cases where the centenarian lived in a nursing home, complementarily information was obtained from a reference professional, often the nursing home director, who was also interviewed. Age validation was accomplished with multiple, convergent, and validated sources, such as identity card or birth certificate and crossing information on life events. An informed consent for participating in the study was obtained. This document was approved by the National Commission on Data Protection and included the authorization for taking photos and for video and audio recording the interviews.

The assessment protocol included information about the centenarians' general characteristics (e.g., sociodemographic and economic information), health (e.g., diseases, subjective health), cognition, functional capacity (e.g., daily and instrumental activities of daily living, fatigue), nutritional status and eating/drinking habits, mental health (e.g., anxiety and depression), well-being (e.g., satisfaction with life), personal resources (e.g., personality and coping strategies), social network, and support (e.g., family relations,



**Oporto Centenarian Study, Fig. 1** Participation levels in the Oporto Centenarian Study

use of formal services), among several other variables. The majority of these dimensions were evaluated through the Portuguese version of well-known instruments, such as the Mini Mental State Examination (MMSE; Folstein et al. 1975), the Global Deterioration Scale (Reisberg et al. 1982), the Older Americans Resources and Services Multidimensional Functional Assessment Questionnaire (OARS, Fillenbaum and Smyer 1981), the Lubben Social Network Scale (Lubben, et al. 2006), the Valuation of Life Scale (Lawton et al. 2001), the Brief Geriatric Anxiety Inventory (Byrne and Pachana 2011), and the Geriatric Depression Scale (Yesavage et al. 1983) to name a few.

Based upon the centenarian's willingness to participate in the study and their cognitive ability to answer the assessment protocol (i.e., participants' cognitive level as assessed by the Global Deterioration Scale and the MMSE), distinct participation levels were considered (Fig. 1). By these means, from the 140 centenarians who were effectively face-to-face interviewed, almost half presented signs of having a neurocognitive disorder (49.29%); the other 50.71% had no cognitive deficits, and 39 (54.9%) were able to complete the highest participation level, i.e., to provide a fully complete assessment protocol.

Following the interest to have longitudinal information on the centenarians' health status, social/health service consumption, and death (date, location, cause), each participant is being contacted every 6 months after the interview in a follow-up basis (currently still ongoing).

## Centenarians' Main Characteristics

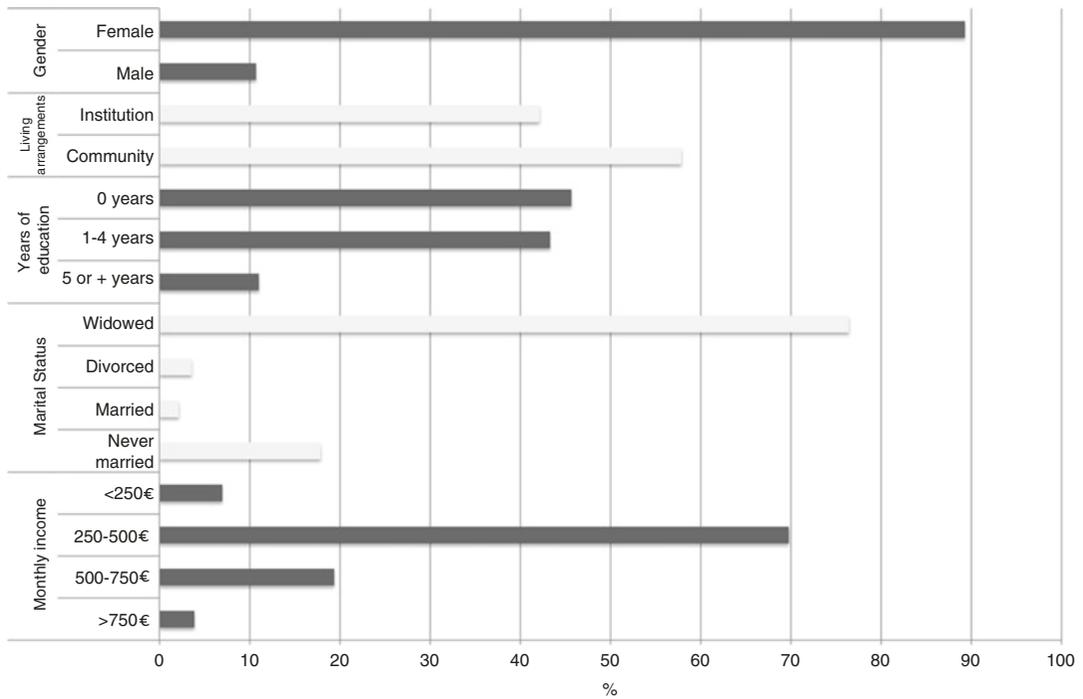
Participants of the Oporto Centenarian Study had ages between 100 and 108, with a mean age of 101.18 (SD 1.59). The majority of the sample was female (89.3%), widowed (76.4%), and lived in the community (57.9%), as presented in Graph 1.

Regarding education and income, 45.7% of the centenarians never attended school (i.e., were illiterate) and 69.8% had a monthly income of 250–500€. Both facts are related with the Portuguese sociohistorical background (i.e., the presence of a right-wing dictatorship that lasted nearly 50 years and was characterized by a global poverty in the country and a scarce access to education) that has affected the living conditions and opportunities of the older generations.

## Cognitive and Functional Status

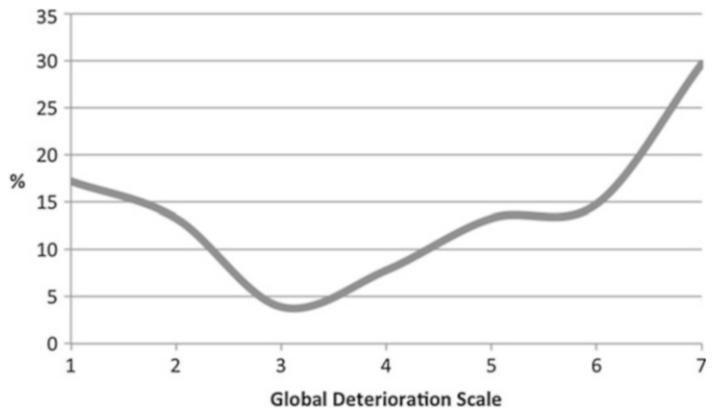
The results of the participants' physical and cognitive deterioration are presented in Fig. 2. There is a higher concentration of centenarians on the two extremes of the Global Deterioration Scale (GDS; Reisberg et al. 1982), with 30.3% having no or very mild cognitive decline (GDS1 and GDS2), and 44.5% having severe/very severe cognitive decline (GDS 6 and GDS7). The remaining participants (25.2%) were in GDS 3–5 at the time they were evaluated.

Regarding their functional status, centenarians predictably presented greater difficulties in their instrumental activities of daily living (mean



**Oporto Centenarian Study, Graph 1** Socioeconomic characteristics of PT100 participants

**Oporto Centenarian Study, Fig. 2** Global deterioration scale of PT100 Participants 1 No cognitive decline; 2 Very mild cognitive decline; 3 Mild cognitive decline; 4 Moderate cognitive decline; 5 Moderately severe cognitive decline; 6 Severe cognitive decline; 7 Very severe cognitive decline



scores 5.58; SD = 4.49; observed range 1–14) than in their basic activities of daily living (mean scores 2.24; SD = 2.37; observed range 0–14). When analyzing the frailty phenotype in this sample, only 4% were classified as “robust,” 36% were classified as “prefrail,” and 60% as “frail” (Duarte et al. 2014).

Overall, these findings on cognition and functionality (independence) are in line with

results from other international studies on centenarians. For example, in the Tokyo Centenarian Study, 167 of 304 centenarians (55%) were classified as *frail*, exhibiting impairment of either cognitive or physical function, and 76 (25%) were classified as *fragile*, exhibiting deterioration of both physical and cognitive function (Gondo et al. 2006).

## Social Networks and Loneliness

Most centenarians continue to maintain contact with other people, drawing mainly on family to have support and care. Of a subgroup of centenarians ( $n = 56$ ) with the cognitive capacity to answer questions regarding social network and loneliness, 8.9% reported to have no regular visits and 13.6% to have no time spent in social relationships with someone they didn't live with. On the other hand, 42.9% reported at least five regular visits and 71.2% had at least two moments of social interaction in the week before the interview. As for social participation, most centenarians had stopped attending social and community activities; 79.4% had no social activity at all, 16.7% still had one activity, and 3.9% had between two and three activities, namely, volunteer work, visiting someone, or attending to church.

A substantial number of centenarians felt lonely: 54.5% of 55 centenarians reported they missed having people around them, and 61.5% (of 52) expressed feelings that they didn't see family and/or friends as frequently as they would like to. Among the oldest old, greater feelings of loneliness are often related to the lack of a spouse or partner to provide companionship and because they have health limitations that may limit their social contact. Study participants also reported that barriers resulting from the aging process contributed to the decreasing in their social participation. Also, sensory impairment (sight and/or hearing loss) was found to be a contributory factor in giving up recreational activities.

## Valuation of Life

A positive mental outlook on life and aging is also an important factor for the centenarians' quality of life. The Portuguese version of the Positive Valuation of Life Scale was used as an indicator of attachment to life. The original 5-point answering format from Lawton's Positive Valuation of Life Scale (VOL, Lawton et al. 2001) was changed to three answer options: "yes," "in between," and "no," with a score range between 0 and 26 (higher scores indicate higher valuation of life and

therefore a positive personal attitude). In a subsample with sufficient cognitive capacity to answer VOL's questions ( $n = 42$ ), the mean score of valuation of life was 14.88 (SD 5.18). When analyzing the VOL subscales (Araújo et al. 2015), centenarians present a mean of 8.54 (SD 3.35) for existential beliefs (possible score between 0 and 14) and 6.34 (SD 2.34) for personal agency (possible score between 0 and 12).

Jopp and Rott (2006) had analyzed positive valuation of life and the respective importance of self-referent beliefs and attitudes (perceived control, self-efficacy, and optimism) for centenarian's happiness and well-being and found similar results. In their study, centenarians presented high values of self-referent beliefs and attitudes, which demonstrate that these resources continue to be effective in very advanced age.

## Satellite Study 1 | PT100 Beira Interior

This first satellite study from the Oporto Centenarian Study was developed between 2013 and 2014, in the inner part of the country in an area with a similar geographical extension to that of the Porto Metropolitan Area around the city of Guarda. The main objectives were to increase the available knowledge on the centenarian population in a different geographical area and living context (more rural, often isolated villages, reduced access to health services, and with overall more adverse living circumstances) from that of the Oporto study. The Beira Interior Centenarian Study used the same methodology as the PT100 main study. One hundred centenarians were interviewed.

## Satellite Study 2 | Centenarians' Offspring: Intergenerational Ambivalences and Demands of Care

Due to the lack of information on the demands, challenges, and needs of these long-lived family systems, as considering the PT100 research team's experience when interviewing community-dwelling centenarians who lived with their children, a new study with centenarians'

offspring was conducted between 2014 and 2015. This second satellite study aimed to analyze the centenarians' offspring experience of caregiving and intergenerational family relations. A sample of 43 children was interviewed in depth in relation to their overall caregiving circumstances (caregiving context, costs, demands, and consequences) and to how their parent's exceptional longevity affected/affects their own aging trajectories. By means of a mixed-methods approach, information was also obtained on their valuation of life, life expectations, and attitudes toward old age. Intergenerational ambivalence was assessed by direct and indirect measures.

### **Satellite Study 3 | Use of Care Services in the Context of Geriatric Morbidity: A Study with Octogenarians, Nonagenarians, and Centenarians**

This third satellite study emphasizes the need to timely identify the care needs of very old individuals in order to help to decrease the rate of frailty and adverse outcomes, such as institutionalization and mortality. The study is currently ongoing (2015–2018) and aims to examine care services used by the oldest old, analyzing the significance of both physical and psychosocial factors, and to examine whether certain psychosocial risks and resources are distributed differently among age groups; complementarily, a risk assessment for hospitalization, institutionalization, and death is also considered.

### **Conclusion**

Centenarians are one of the fastest growing demographic groups of the Portuguese population. This elementary descriptive profile revealed a great heterogeneity in centenarians' cognitive and functional status, social networks and loneliness, and valuation of life, reinforcing the diversity that is to be expected when investigating the worlds of people who have lived to become the oldest old (Fry and Debats 2010; Poon and Cheung 2012).

The Oporto Centenarian Study underscores the importance of examining variation. From a theoretical perspective, the high percentages of centenarians within the high and low ends of functioning demand consider appropriate and distinct paradigms of interpretation. Successful aging and frailty paradigms coexist conceptually in the gerontological literature and are often articulated, but are opposite ends of a shared functioning continuum (Cosco et al. 2015). When studying centenarians, it is important to approach frailty domains, including exhaustion, weight loss, weakness, slowness, and low activity (Duarte et al. 2014), but also successful aging domains, including psychosocial aspects along with biomedical ones, among those centenarians who are able to maintain positive self-appraisals of their status (Araújo et al. 2016).

From a practical perspective, centenarians' health and care needs are of crucial importance and demand urgent attention. The physical and cognitive limitations so common in very advanced age call to evaluate the availability of professional services of domiciliary care provision and nursing homes, as well as to the capacity of the informal caregiving system, which have been particularly considered in the PT100 satellite studies due to its recognized public relevance. As for the social network and family relations among Portuguese centenarians, it is important to highlight that regardless of the high number of participants reporting having regular visits, most presented very low social interactions at a community level and expressed feelings of loneliness (not seeing family and/or friends as many times as they would like to). It is therefore a priority to understand the real impacts of living beyond the average of life expectancy within the social sphere and to explore what kind of strategies centenarians use to compensate the withdrawal from social roles and activities.

As in other southern European countries, in Portugal, the demographic aging of the population has increased dramatically over the last decades in a context of falling birth rates and higher average life expectancy. The oldest old population, and centenarians in particular, is becoming more common and therefore receiving greater public attention. In this context, the Oporto Centenarian Study

by assuming human longevity as a research priority plays an important role in providing information for both scientific and intervention purposes.

## Cross-References

- ▶ [Cognition](#)
- ▶ [Fordham Centenarian Study](#)

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## Oral Health in Older Adults

Rodrigo Mariño and Mike Morgan  
Oral Health Cooperative Research Centre,  
Melbourne Dental School, University of  
Melbourne, Melbourne, VIC, Australia

## Synonyms

Dental health; Mouth diseases and conditions;  
dentistry; Odontology

## Definitions

Oral health: “A state of being free from mouth and facial pain, oral and throat cancer, oral infection

and sores, periodontal (gum) disease, tooth decay, tooth loss, and other diseases and disorders that limit an individual's capacity in biting, chewing, smiling, speaking, and psychosocial wellbeing" (World Health Organization 2012).

**Dentate:** Having all or some of the natural permanent teeth.

Oral health plays an integral part in the general health of older people and should not be considered in isolation. Furthermore, oral health is a human right, an integral part of general health, and is essential for overall well-being (World Health Organization 2005). While oral health diseases are only occasionally a matter of life and death, its importance can be explained by the extent of these conditions in the society and the preventable nature of most oral health conditions and diseases. The most common threats to oral health in older adults include tooth loss, dental caries, and periodontal disease (gum disease). However, oral health is more than just having healthy teeth and gums (International Dental Federation (FDI) 2014), still, compared to dental caries, periodontal disease, and tooth loss, there is less information available on the prevalence of other oral diseases, with the probable exception of oral cancer. Clinical data demonstrates that poor oral health increases the risks to health in the same way as any disease of the body system (Kay and Locker 1998).

Similar to the rest of the body, the mouth changes with age. However, most of the changes attributed to aging actually occur due to oral diseases and conditions which may take years to develop. For example, having no teeth or teeth becoming loose is the result of the accumulation of adverse and traumatic events to the teeth and periodontium and not the direct consequence of aging. Of course, older adults have had increased exposure to those events. Furthermore, there is now increased awareness that the consequences of neglected oral hygiene are not confined to the mouth. Oral diseases and conditions can lead to systemic morbidity, increasing the risk of frailty (Kay and Locker 1998), and may precipitate or exacerbate other medical conditions, such as pneumonia, cerebrovascular and cardiovascular disease, diabetes, and nutritional deficiencies

(Cohen 2002; Australian Health Ministers' Advisory Council 2001).

Oral diseases and conditions can also cause difficulties with chewing, and swallowing, leading to impaired nutrition, and speech, which affect the way in which people look and sound, with a significant impact on self-esteem, psychological and social well-being, interpersonal relations, and quality of life (Australian Health Ministers' Advisory Council 2004). Therefore, oral health is critical to an individual's appropriate physical, emotional, and social activity and functioning.

The oral health of older people and their attendant quality of life can be improved through health promotion, self-management of prevention, and restoration by sophisticated surgical and curative techniques. In fact, evidence would suggest that new cohorts of older adults will tend to be dentate (e.g., retaining at least part of the natural dentition), even in older ages (Australian Institute of Health and Welfare 2007). Yet, for some, this trend comes too late, as they have already lost all their natural teeth.

These are important challenges to oral health providers and the wider society. Tooth retention, combined with an aging population, will undoubtedly place increased pressure on the public health system in the future (Harford 2009). However, despite the well-documented aging profile of the population and repeated calls for comprehensive geriatric assessment (Department of Human Services (Victoria) 2007), there has been little progress in addressing the oral health needs of older adults, and fewer health-care programs are specifically designed to improve their oral health. Thus, increased efforts should be directed to identifying opportunities for the development of community-based models that encourage older persons to improve and maintain their oral health as well as the economic effectiveness of these approaches (Department of Human Services (Victoria) 2007).

This chapter presents an overview of older adults' oral health. It is organized into four main sections; the first section discusses the function of the orofacial complex. The second section presents the most common oral diseases and conditions. The third part will describe some general health implications of oral health. The final section describes

areas where health providers might engage in oral health promotion and oral disease prevention with older adults. It explains the role played by health professionals in promoting oral health and the prevention of oral diseases in older adults.

## Function of the Orofacial Complex

Several structures are found in the oral cavity, which have evolved to provide the individual with important physiological functions (Shay and Ship 1995). Multiple tissues have evolved to carry out the complex vital functions of the orofacial complex. Tissues and structures in the oral cavity work together to provide the individual with essential physiological functions (Shay and Ship 1995): (a) intake of food and nutrients, (b) production of speech and communication, and (c) host protection. These physiological functions are affected by conditions such as tooth loss, dental caries, periodontal disease, hyposalivation, and oral cancer.

Older adults who are edentulous, or have removable partial dentures, avoid eating certain foods such as firm meat and fresh fruits and vegetables and suffer more from problems with speech, food catching in the mouth, avoidance of smiling, and oral pain, compared to dentate older adults (Mariño et al. 2002). Also, due to retaining more of their natural teeth, the sizeable proportion of older adults in the new millennium constitute a group with diverse and complex dental needs, compared to previous older adult cohorts. Additionally, mental health and quality of life might also be affected by diminished pleasure of eating and interest in food, diminished self-esteem, and reduced enjoyment of social activities, intimacy, and companionship (Locker 1995; Mariño et al. 2008). Experiences of oral pain and problems with eating, chewing, smiling, and communication due to mouth or teeth problems tend to substantially affect well-being (Petersen and Yamamoto 2005).

## Oral Disease and Conditions

The oral cavity harbors a diverse, abundant, and complex microbial ecosystem, the dental plaque

or dental biofilm, which accumulates on the hard and soft oral tissues. The dental biofilm is an important part of the natural human microflora and, if maintained in a non-pathologic state, contributes to the host defenses. When there are shifts in the balance of predominant bacterial populations, disease might occur. The two most common oral diseases (dental caries and periodontal disease), which are also the two major causes for tooth loss, are caused by this imbalance favoring pathogenic microorganisms.

### Dental Caries

Dental caries is among the most common diseases in many countries. It is characterized by the decalcification and dissolution of the dental tissues (i.e., enamel and dentine), which eventually will destroy the affected tooth surface and the tooth itself. Dental caries is not just a child's disease; it can happen across all ages as long as there is a pathogenic plaque-fed fermentable diet and susceptible tooth structure. Carious lesions may begin on different parts of the tooth. Most commonly, they appear on the crown of teeth. However, older adults are at increased risk of having dental caries on the root surfaces of the teeth; these lesions are in the area of a tooth close to or below the gumline.

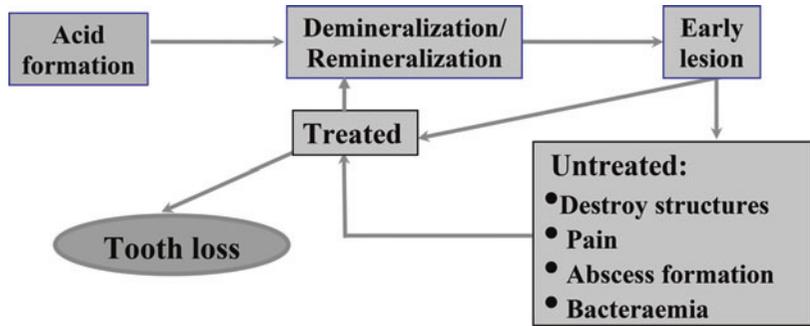
The presence of fluorides enhances remineralization of early carious lesions. Furthermore, early lesions, visible as white spots, can be remineralized and healed with the assistance of fluoride. Because older adults with natural teeth may still develop dental caries, particularly root caries, fluorides will benefit this group (see Fig. 1).

In general, drinking water and toothpastes are the most commonly used vehicles for fluorides. These vehicles, in particular water fluoridation, can reach everyone regardless of age, health status, income, ethnicity, or other sociodemographic differences. Indeed, the use of fluorides is recognized as one of the most successful measures for the prevention of disease in the history of public health (Centers for Disease Control and Prevention 1999).

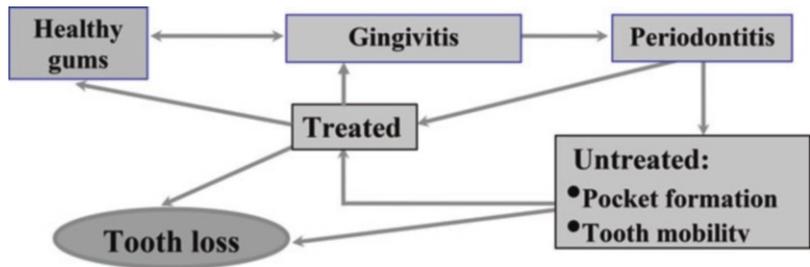
### Periodontal Disease

The bacteria in biofilm can not only cause tooth decay, but also they are involved in periodontal (gum) disease. Periodontal disease is an infection

**Oral Health in Older Adults, Fig. 1** Pathway of dental caries



**Oral Health in Older Adults, Fig. 2** Pathway of periodontal disease and tooth loss



of the complex system that holds the teeth in place. This system includes the gums, the periodontal ligament, and the supporting bone. Periodontal health can be maintained successfully in older people with adequate oral hygiene, periodontal therapy, and maintenance.

At its early stages (gingivitis), periodontal disease is reversible and can usually be eliminated by proper daily oral hygiene care (e.g., brushing and flossing). If left untreated, the infection spreads deeply causing the gums to pull away (recede) from the teeth, and the gap between the tooth and the gums becomes deeper (pocket formation). This is due to a loss of the bone that supports the teeth. Then, gradually the tooth becomes looser and looser until it falls out or needs to be removed even though it may not be affected by dental caries. This more advanced stage of gum disease is called periodontitis (See Fig. 2).

Periodontal disease can also affect overall health. For example, there is significant evidence of the two-way link between diabetes and periodontal disease (Chapple and Genco 2013) but not well promoted. In this way, treatment of periodontal disease will help improve diabetes control (Chapple and Genco 2013). Untreated periodontal disease can also lead to other general health

problems including heart conditions and stroke (International Dental Federation (FDI) 2014).

**Tooth Loss**

Tooth loss is not a direct result of the aging process but is best understood as the effect of local factors acting throughout life, most of them related to social and material inequalities operating at the individual and ecological level (Bernabé and Marcenes 2011). Tooth loss could be stopped by preventing some oral diseases such as dental caries and gum disease, which are the major reasons for tooth loss (see Fig. 2).

Keeping natural teeth into old age has several advantages and some disadvantages; however, the advantages far outweigh the disadvantages. Dentures can improve oral function if one has no teeth or has lost some of one’s teeth, and it might appear that having dentures is more convenient. However, partial or complete dentures are imperfect replacements for teeth. Denture wearing has many disadvantages. Some examples of these disadvantages mentioned by participants in a study conducted in Melbourne, Australia, were difficulties when talking and social interactions, facial aesthetic and appearance, irritation to the gums, loss of self-confidence when speaking, decreased

enjoyment of food and the social enjoyment of food, difficulties in chewing and in keeping adequate nutrition, and bad breath/halitosis (Mariño et al. 2002).

Tooth mortality is an important statistic in studies of oral health status. As access to quality dental care that influences tooth retention, tooth loss could be considered as a crude estimate of access to dental care especially among older adults (Ahluwalia et al. 2010). Moreover, recent research reported number of teeth as an independent predictor of mortality among elderly populations (Österberg et al. 2008; Padilha et al. 2008). Hence, the dentate status has been commonly used as an oral health outcome to assess socioeconomic inequalities among adult populations.

### Oral Mucosal Lesions

In terms of life-threatening conditions, oral mucosal lesions can be benign or malignant. Examples of benign lesions are candidiasis (angular cheilitis), denture-related conditions (stomatitis, hyperplasia), keratosis, aphthous ulcers, and traumatic ulcers. These conditions are benign but can still cause pain and can affect oral function and nutritional status. On the other hand, there are a variety of changes in the oral mucosa that might foreshadow cancer. These include white patches (leukoplakia) or red lesions (erythroplakia). Non-treated leukoplakia may turn into an invasive carcinoma, usually a squamous cell carcinoma.

In extreme cases, oral mucosal lesions may assume life-threatening proportions, such as with oral cancer. Oral cancer is one of the few life-threatening conditions in dentistry, with age among the risk factors for developing this type of cancer. Oral cancer may occur at any age but is more common over the age of 45. Oral cancer may occur in people with natural teeth or without natural teeth. Oral cancer can affect any part of the mouth, including the lip, the tongue, under the tongue, and in the internal parts of the cheeks. The most common intraoral sites for cancer are the sides of the tongue and underneath the tongue. Oral cancer frequently goes unnoticed in its early, curable stages. This is because pain is often not an early symptom. The primary causes for oral cancers are the use of tobacco, heavy alcohol use

(more than four drinks per day), combination of heavy tobacco and alcohol use, and poor diet (Petersen 2005).

Oral cancer is among the ten most common cancers in the world (International Dental Federation (FDI) 2014), but oral cancer is the most common form of cancer in India (World Cancer Research Foundation). Oral cancer is more prevalent than cancers which are heard about routinely such as leukemia, Hodgkin's disease, and cancers of the brain, bone, and ovary and melanoma of the skin (World Cancer Research Foundation 2015). Between 3% and 5% of cancer cases are oral cancers, and 2% of deaths from cancer are due to this type of cancer. There is a significant difference in the incidence of oral cancer in different regions of the world. This is due to regional differences in the prevalence of risk factors.

### Xerostomia/Hyposalivation

Saliva is a fluid with multiple functions and is essential for oral health and oral function. A reduction of saliva causes dry mouth, a condition known as hyposalivation; the feeling of dry mouth is xerostomia. A dry mouth makes it hard to eat, swallow, taste, and speak. Salivary dysfunction can lead to an increased risk of dental caries and periodontal disease and eventually tooth loss, pain, decreased enjoyment of food, and decreased tolerance to prosthetic appliances and may make it harder to keep dentures clean.

Until recently, dry mouth was regarded as a normal part of aging. It is now known that healthy older adults produce as much saliva as younger adults do. Hyposalivation is more likely to be the consequence of certain diseases (Sjögren syndrome), radiation therapy, tumors and the use of medications to treat common medical problems in older adults. Hyposalivation must not be considered a trivial problem in the population. Dry mouth is common to any conditions, syndrome or chronic diseases that affect moisture-producing glands.

More than 400 medications, including medications to control hypertension, antidepressants, antihistamines, decongestants, painkillers, anti-seizure, and diuretics, may lead to salivary hypofunction. In addition, a number of over-the-counter medications (expectorants and

decongestants) can also reduce saliva flow (Walsh 2001). Thus, oral health professionals and general medical practitioners treating older adults must be aware of the xerogenic effect of medications. Some of them may be replaced by others with less xerogenic properties. Also, there is a series of measures that a person with salivary hypofunction can take (Al-Hashimi 2001). Non-pharmacological ways to reduce severity of this condition include keeping the mouth well hydrated by taking frequent sips of (fluoridated, when possible) water; pausing often to drink some water when speaking; using saliva substitutes (e.g., artificial saliva), especially during meals; avoiding alcohol and beverages with caffeine (e.g., coffee, cola drinks) and tobacco smoking to reduce their mouth-drying effects; using tooth-pastes and crèmes (such as Tooth Mousse) that help to alleviate this condition; and using mouth-washes without alcohol in them. Sugary snacks and sugar-containing chewing gums, mints, or candies to stimulate saliva flow should also be avoided. This is because the combination of lack of saliva with a sugar-rich diet increases the risk for dental caries. Instead, the use of sugar-free chewing gums, mints, or candies to stimulate saliva flow should be preferred.

Additionally, some common medication used in the treatment of chronic diseases may produce disturbances in taste (Gheezi and Ship 2000). However, any change in medications or in personal measures will only happen if health professionals are aware of this relationship and have the information to provide the correct advice to patients. Clinicians must be proactive in questioning patients about prescription and non-prescription drugs that their patients are using (Donaldson and Touger-Decker 2013). Nonetheless, despite medical practitioners being aware that some medications caused hyposalivation, it has been reported that medical practitioners identify this problem only when patients complained of xerostomia (Stacey et al. 2013). Furthermore, it was found that, even when practitioners were aware, they often gave advice that was potentially deleterious to oral health and were uncertain as to whether dry mouth would influence their prescribing (Stacey et al. 2013).

## Health Implications of Oral Health

The increase of awareness of oral health as an essential part of general, and the integration of interventions for oral health in older adults into programs of general health, is being encouraged by the World Health Organization (World Health Organization 2008). Despite this, oral health is traditionally evaluated independently of other diseases and chronic conditions. This chapter has already highlighted some of the general health implications of oral diseases and conditions (e.g., diabetes, cardiovascular disease). In the same way, several general health conditions, which are more prevalent at advanced ages, interfere with care of the mouth, mastication, and use of dental prostheses; cause dry mouth and infections; and contribute to oral disease.

For example, muscular and bone conditions can cause degenerative changes in the temporomandibular joint, directly affecting the masticatory function and causing pain. Moreover, arthritis of the hand can limit mobility and the dexterity required for daily oral hygiene (i.e., to hold and use toothbrushes or to hold dental floss). When the active hand is affected by paralysis, oral hygiene practices may need to be relearned. If the paralysis affects facial muscles, it may be difficult to clean certain zones of the mouth, resulting in decay and gum disease. In addition to manual dexterity, decreased visual dexterity and difficulties of movement have a strong association with activity limitations (Chávez and Ship 2000); therefore, it impacts on obtaining the necessary clinical care, as well as for participating in health promotion activities. Diseases and conditions such as Alzheimer's disease and stroke may decrease self-care including oral health care.

## Oral Health Promotion and Disease Prevention in Older Adults

As the population ages, a major challenge in the future will be to translate existing knowledge and sound experience of disease prevention and health promotion into appropriate programs. There are several ways by which health professionals might

improve the oral health of older adults, most of them related to clinical dentistry; however, goals in dentistry cannot be reached solely on the basis of providing treatment. As for any age, health promotion interventions are key to improving oral health in later life as they encourage older adults to be proactive in regard to their health.

Lifestyle modifications have been successfully implemented in the older and very old adults, provided that comorbidities are not overwhelming (Kicklighter 1991). However, although the literature includes many studies involving large samples, it does not give sufficient direction on how best to provide health promotion and disease prevention services to older adult populations (Kay and Locker 1998) and particularly rural older populations. Successful interventions include group learning sessions followed by printed material, with high participant involvement achieved when the social and learning needs of older adults are realized (Little et al. 1997). The literature also indicates that health promotion activities should include active participation by those interested in the planning, implementation, and evaluation (Mariño et al. 2004) of these activities, ensuring that they are based on the target group's own goals and needs (Dahlin-Ivanoff et al. 1998). This increases the participant's sense of program ownership, which is an important goal of health promotion.

The aim is to produce sustainable population-based interventions for older adults particularly catering to the needs of older adults. This can be achieved by creating a program together with older adults that is attractive to them rather than just helping them become users of programs designed for younger generations. However, despite the well-documented aging profile of the world population and repeated calls for comprehensive geriatric assessment, little research has focussed on the oral health needs of older adults; there are few if any health promotion programs designed to improve the oral health of these communities. Therefore, increased efforts should be directed to identifying opportunities for health promotion activities and the development of community-based models that encourage older persons to improve and maintain their oral health.

**Oral Health in Older Adults, Table 1** Oral health topics covered by e-ORHIS

Oral health and aging: what to expect
Dental caries
Periodontal disease
Oral cancer
What to do with remaining teeth
Care of dentures
Dry mouth (xerostomia)
Oral health and nutrition
Use of oral health-care services
Oral health and general health

Ignoring opportunities for these activities may increase inequalities in oral health and may lead to even greater demands for curative and oral rehabilitative services in these groups.

The Melbourne Dental School, University of Melbourne, Australia, designed a study to evaluate the impact of a web-based oral health promotion program aimed at improving the oral health knowledge, attitudes, practices, and self-efficacy of independent-living older adults living in Melbourne, Australia (Mariño et al. 2016). The education program was supported by adapting for the web materials which had been developed and tested under the Oral Health Information Seminars (ORHIS) program (Mariño et al. 2013, 2016). In order to develop an e-learning environment for health promotion, the oral health intervention program, "e-ORHIS," harnessed user-friendly multimedia web technologies, to meet the oral health information needs of older adults. Oral health topics covered by e-ORHIS are presented in Table 1.

The e-ORHIS were delivered in libraries/community centers, facilitated by trained peer educators, who introduced participants to the online multimedia resources and invited them to engage actively with and contribute to these resources, both as a group and individually.

The impact of the e-ORHIS represents an extremely helpful policy approach for the design of oral health interventions. The approach was successful and largely acceptable to the participating communities and certainly sustainable with minimal external input. In the long term, this

approach represents a promising intervention aimed at increasing participants' control over their oral health and ensuring a reduction in severe oral health treatments and teeth mortality, which in turn would ensure better quality of life.

### Use of Oral Health Services

Access to oral health services is critical, as it not only provides opportunities for early diagnosis, and treatment of diseases and conditions, but is also beneficial for maintenance of good oral health, health promotion, and educational awareness (Dolan et al. 1998). However, it has been demonstrated that the use of dental health services tends to decrease after retirement (Australian Institute of Health and Welfare DSRU 2001). A parallel decline in oral health status in older adult populations has also been identified (Australian Institute of Health and Welfare DSRU 2001). This may be indicative of different attitudes to concepts of health but is more likely to be due to the relative lack of access to dental care services for this population group. On the other hand, older adults are much more likely to be examined by general practitioner than dentists (Gift and Newman 1993).

Unique geography, demographics, politics, and health-care system contribute to significant inequity in access to oral health care. For example, older people living in rural and remote areas use dental services on an ad hoc basis, mostly for relief of pain (Brennan et al. 1998), with dental care received less preventive in nature and more teeth replaced by dentures, when compared to their metropolitan counterpart (Brennan et al. 1998).

Further, oral health services may not have been accessed for many reasons. Increasing the use of services will require additional efforts beyond the reduction of financial barriers. Access to oral health services among older adults is affected by many deeply entrenched sociodemographic, financial, psychosocial, and structural barriers, as well as other predisposing and enabling factors. A better understanding of factors related to oral health of older adults will need to be met with different health strategies including primary, secondary (early diagnosis and early treatment of oral

diseases and conditions), and tertiary (rehabilitation and replacement of lost dentition) prevention.

### Conclusion

There is much more that needs to be understood and achieved to improve oral health in older adults, such as training and management of human resources for health. Very often the solutions depend on the collaboration of a wide range of stakeholders, such as those who train health workers, those who employ them, and those who pay for their services. The contention throughout this chapter is that oral health is part of health, and there is no health without good oral health.

Given that the proportion of dentate older adults will increase in the future, improving health professional's awareness of the prevalence of conditions and their pharmacology that may affect health and oral health becomes even more relevant. On the other hand, oral health professionals need to continue communicating the oral health preventive message and educating the public about the risks of tobacco and alcohol use or unhealthy diet, diabetes control, and blood pressure, as well as to promote healthy environments. Oral health professionals also need to be aware of, and be able to identify, risk factors for chronic diseases and verify whether patients are obtaining appropriate medication.

This situation will bring about important challenges to health-care providers. To address this challenge, health professionals will play a dual role: first as part of the health team and second as patients' advocates to put in place comprehensive policies to improve oral health and through treatment of today's older adults and to promote healthy lifestyles and healthy aging for future cohorts of older adults. Oral health programs, and oral health preventive programs, in particular, do not receive the same level of attention as medical care among policymakers. The public, policymakers, and providers may consider oral health and the need for care to be less important than other health needs.

To reach an increased number of older adults, there is a need for collaboration among the team of health professionals working with older adult patients but also with caregivers and family members, older adult organizations, and the older adults themselves. Working together will contribute to improving the oral health outcome and therefore the overall health and quality of life. For this purpose, the health-care team should be aware of this link and its extent in the community that they serve.

Oral health programs are essential for countries' ability to maximize the impact of the health sector in reaching national health objectives and/or priorities and to meet health and social challenges. It is hoped that the information from this chapter serves as an incentive to further discuss the role of oral health-care programs and in particular in reaching oral health objectives.

## Cross-References

- ▶ [Advocacy with Older Adults](#)
- ▶ [Aging, Inequalities, and Health](#)
- ▶ [Aging and Quality of Life](#)
- ▶ [Learning in Older Adults](#)
- ▶ [Active Aging](#)
- ▶ [Burden of Disease and Aging](#)
- ▶ [Health Promotion](#)
- ▶ [Healthy Aging](#)
- ▶ [mHealth Applications Use and Potential for Older Adults, Overview of](#)
- ▶ [Nutrition in Aging, An Exploration of a Close Relationship](#)
- ▶ [Quality of Life in Older People](#)

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## Organizational Climates and Age

Florian Kunze and Daniela Garten  
 Department of Politics and Public Administration,  
 University of Konstanz, Konstanz, Germany

### Synonyms

Age configurations; Age structures; Organizational age processes and outcomes

### Definition

To discuss and describe organizational climates, they have to be conceptually distinguished from the related construct of organizational cultures. In multiple disciplines, such as anthropology, sociology, and psychology, there are many definitions of the term culture (Baldwin et al. 2006). In the field of organizational behavior research, organizational culture is most commonly defined as a deep underlying system of shared meaning, i.e., collective patterns of cognition and behavior, held by the organization's members, which

distinguishes the organization from other organizations (Schein 1990). An organizational culture is a stable property of an organization. It defines the inherent rules and thus favored and rewarded behaviors within an organization and therefore provides employees with a framework and guidance.

Closely related to organizational culture is the construct of organizational climate, which depicts organizational members' shared perceptions about their organization's rather observable aspects, such as the work environment, organizational practices, and processes (Schneider et al. 2011). In contrast to organizational culture, organizational climates describe rather apparent and temporary organizational artifacts of underlying values and can thus be more consciously perceived by organizational members as well as controlled, e.g., by human resource practices. With the rise of an older and thus more age-diverse workforce, employees' perceptions about an organization's treatment of different age groups become more significant. Consequently, employees are likely to identify an age-diversity climate, i.e., the shared perception about the extent to which an organization implicitly and explicitly, e.g., through its policies, practices, and procedures, fosters and encourages age diversity and eliminates age-based discrimination (Boehm and Kunze 2015; Gelfand et al. 2005). If employees perceive their organization's actions and procedures to be unfair toward specific age groups – including older as well as younger age groups – a negative age-discrimination climate can arise (Kunze et al. 2011).

In the following sections, the underlying processes will be explained that are induced by an increasing workforce and its effects on organizational climate will be presented. Furthermore, this chapter presents recent empirical findings of the antecedents and outcomes of different age-related climates will be presented and points actions organizations can initiate to benefit from an age-diverse workforce will be pointed out.

### Age in Organizations

The main source for the evolvement of age-related climates in organizations is the ongoing

demographic change in almost all Western-industrialized countries (OECD 2006). Longer life expectancies and decreasing birth rates do not only result in changing and shrinking overall population figures but also impact the workforces' compositions in many countries. Based on these developments, organizations have to deal with two main consequences: a rising age diversity and average age of their employees. From research on different levels of analyses, it is known that the individual age of employees is mostly unrelated to individual work performance (Ng and Feldman 2008), and team-based age diversity has only a slightly negative relationship to team performance (Joshi and Roh 2009; see Boehm and Kunze 2015 for a recent review of the research field). The conceptual knowledge that exists of age diversity as well as mean age and related climates on the organizational level of analysis will be summarized in the following sections.

### Organizational-Level Age Diversity and Organizational Climates

Research on organizational-level age diversity has been done from two perspectives so far: an economic and an organizational behavior perspective. While the economic perspective (e.g., Grund and Westergaard-Nielsen 2008; Ilmakunnas and Ilmakunnas 2011) has used large-scale secondary data to test the relationships between distal measures of age-diversity structures of the workforces and organizational performance, organizational behavior researchers (e.g., Kunze et al. 2011) have moreover considered processes and/or context conditions, such as organizational climates that explain the link between age diversity and organizational performance. As the focus of this entry is on these inner-organizational age-based processes, the following sections it will focus on the organizational behavior findings in the following.

In line with the age-diversity findings from the team level of analysis, also the two recent organizational-level studies report negative relations between age diversity and organizational performance (Kunze et al. 2011, 2013). Both studies conceptualize a mediation model in which age

diversity leads to a shared perception of a negative age-discrimination climate, defined as a shared perception of an unfair and discriminatory treatment based on age subgroup membership (i.e., being a young or older employee), which in turn negatively impacts organizational performance. The argumentation for a positive relationship between age diversity and a negative age-discrimination climate is based on two main theoretical rationales. First, social identity and social categorization arguments (Turner 1987) might help to explain age-diversity processes on the organizational level of analysis. Based on these classical and well-validated theories from social psychology, individuals perceive and categorize themselves as well as others into social entities (subgroups) that are characterized by at least one common attribute (e.g., age). Due to its immediate visibility and high salience for many organizational processes and decisions, demographic attributes (e.g., gender, age, ethnicity) are often used for these categorization processes. As the amount of older workers within organizations increases and employees vary across different ages and generations, age becomes an especially salient attribute for employees for within-organization differentiation. In contrast, in an organization where all employees are more or less the same age, other attributes such as gender or nationality are more likely to be relevant to categorize oneself and others according to social groups. Additionally, age subgrouping processes are also spurred by the similarity-attraction paradigm (Byrne 1971) which states that individuals are most attracted by similar others. This seems to be especially relevant for age, as individuals who are alike in regard to chronological age share comparable experience from critical and historical events in their childhood and youth and thus developed like values and attitudes. In addition, same-aged employees often encounter similar life stages (e.g., having little children or being close to retirement). The resulting congruence of experience, values, and attitudes leads to higher liking, communication, and cooperation within age subgroups compared to between subgroup relations. Ultimately these mechanisms lead to a fragmented workforce, as same-aged employees across the

organization are likely to group together and enhance their own group identity by undermining other age groups. As a result, stereotypes and discriminatory behavior against dissimilar-aged workers can evolve throughout the organization which leads to a constant perception of age-based discrimination (Kunze et al. 2011, 2013). Older employees may, for example, perceive their younger supervisor's task assignments and performance ratings to be age discriminatory toward older subordinates. Additionally, younger members of the organization may evaluate human resource policies and promotional opportunities to be age discriminatory as certain career stages are required to be fulfilled with a minimum chronological age or as seniors might prefer their own age group in regard to promotions and resource allocation. If such individual experience with the organization consists over time, the individual employee forms a general perception about the organization as a whole (i.e., an age-discrimination climate).

A second conceptual argument for the evolution of a negative age-discrimination climate in age-diverse companies can be made based on the concept of organizational timetables (Lawrence 1988). This concept suggests that in all organizations, implicit norms exist, when an employee should reach a certain career. For example, to get in a first leadership role, an employee often has to reach his 30th birthday, and to become a member of the executive board, an employee has to be at least 45 years old. Increasing age diversity can be assumed to be a potential source of violation of these organizational career timetables for both younger and older employees. Older employees might, for example, perceive it as clear violation of organizational career norms if they have a younger supervisor, as classical status and hierarchy norms suggest that more experienced and older employees always possess the leading position. In contrast, younger employees might perceive a violation of age-based career norms, if usual career paths are blocked by seniors, who stay longer in the workforce due to the limited early retirement possibilities. As a result employees form the perception that promotion decisions are not based on merit and performance,

but rather on seniority-based status norms. Again, such experience can manifest in general perceptions about the organization and can spread throughout the organization, resulting in a negative age-discrimination climate, which in the end negatively affects organizational performance (Kunze et al. 2011, 2013).

### **What Companies Can Do to Prevent Negative Age-Diversity Climates in Organizations**

Fortunately for practitioners and executives in organizations, the negative linkage between age diversity and organizational performance, through an involvement of a negative age-discrimination climate, does not necessarily happen in all organizations. In fact Kunze and colleagues (2013) have identified two contextual factors that can at least help to prevent negative consequences of age diversity for organizational climates and performance outcomes. The first tested context factor are the so-called diversity-friendly HR policies that focus on actively managing diversity and promoting diversity as an eligible organizational asset and value (Triana and García 2009), e.g., by offering trainings and leadership development programs for all age groups, fostering awareness for diversity management on executive levels. It is crucial that organizations not only adopt single HR practices aiming for a positive age-diversity climate but a bundle of aligned practices that foster all employees' (regardless of their age) skills, knowledge, motivation, effort, and opportunities to contribute to the organizational goals. This might imply age-neutral recruiting strategies as well as equal opportunities for training, promotion, and participation for all age groups – including younger as well as older workers. Such HR policies lead to employees' perception that the organization supports their employees regardless of age or other demographic attributes and that discriminatory behavior is not desired. Thus, employees are more likely to behave in line with the company's goal to foster age inclusion, which reduces the likelihood of

age-based discrimination and group formation within the organization. A second factor Kunze and colleagues (2013) identified is the role of top management's attitudes to be crucial for the involvement of an age-discrimination climate in organizations. They report that a positive relationship between age diversity and an organizational age-discrimination climate can only be found if the top managers have negative age stereotypes, whereas an absence of such stereotypes brings also the relation between age diversity and an organizational age-discrimination climate to zero. As explanation they theorize that the top executives have a focal role-modeling position to label age-discriminatory behavior as an acceptable or non-acceptable behavior in organizations. Therefore top managers should be sensitized through trainings, seminars, and coaching for their own age stereotypes and their potential impact on organizational processes.

Yet these currently validated context factors can only help to prevent negative consequences from age diversity on organizational climates and performance. In particular from a practitioner perspective, it is relevant to gain knowledge on context factors that might even turn the relationship between age diversity and an organizational age-discrimination climate into something positive to reap the benefits of age diversity. One promising factor for such a reversal of the current age-diversity effects is a positive age-diversity climate, as introduced and validated by Boehm and colleagues (Boehm et al. 2014). Defined as "organizational members' shared perceptions of the fair and nondiscriminatory treatment of employees of all age groups with regard to all relevant organizational practices, policies, procedures, and rewards" (Boehm et al. 2014, p. 671), such a climate has been shown to relate positively to collectively perceived social exchange relationships with an organization, which in turn affect company performance and collective turnover behavior (Boehm et al. 2014). Additionally from an antecedent perspective, age-inclusive human resource practices (i.e., all HR practices that create an age-inclusive workforce) were reported to shape the pro-age-diversity perceptions within

organizations. It can be speculated that in organizations with an age-diverse workforce, such a pro age-diversity climate can be particularly useful to create a workplace in which employees from multiple age groups do not form age-based subgroups to increase mutual age-based discrimination, but rather combine their joint experience and knowledge for the joint benefit of the organization.

### The Emerging Role of Subjective Age for Organizations

The second trend that has been identified in the introduction is the rising mean age and its relation to organizational climates and outcome. Compared to age diversity even fewer research exists on the organizational level of analysis. Again some economists have considered and tested direct linkages between mean age and organizational performance (e.g., Backes-Gellner and Veen 2013), but almost no study has researched the evolvement of organizational climates based on the average age of the workforce. However, recent research has shown that not the chronological mean age of the employees but subjectively perceived age identities (i.e., how old the employees perceive to be) shape the collective behaviors and processes in organizations (Kunze et al. 2015). In a large-scale multicompany sample, the authors are able to show that what they label as relative subjective age (i.e., how on average the employees perceive their age in comparison to their chronological age) is the focal predictor of company performance, whereas the chronological age per se does not show any statistically relevant interrelation with organizational performance. These findings are in particular relevant from a practical perspective. While currently many organizations are focused on the chronological age structure of their workforces and can only react on their drastic transformation (i.e., a steady rise of the average ages), the subjective age identities of their employees are something that they can actively influence. For example, the study by Kunze and colleagues (2015) identified the average perception of whether the organizational members perceived

their job as meaningful and purposeful as a statistical relevant antecedent of the average relative subjective age in organizations (i.e., employees felt on average younger, when they perceived to have a meaningful job). Beyond meaningfulness, numerous factors, including the pro age-diversity climate and human resource management practices discussed above, might also function as factors that create an organizational environment for a lower relative subjective age in organizations. In consequence the research on subjective age identities in organizations is a very promising future avenue for research on aging in organizations.

### Cross-References

- ▶ [Age Diversity at Work](#)
- ▶ [Age Stereotypes in the Workplace](#)
- ▶ [Age Stereotyping and Discrimination](#)
- ▶ [Age Stereotyping and Views of Aging, Theories of](#)
- ▶ [Human Resource Management and Aging](#)
- ▶ [Leadership and Aging](#)
- ▶ [Organizational Strategies for Attracting, Utilizing, and Retaining Older Workers](#)

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## Organizational Strategies for Attracting, Utilizing, and Retaining Older Workers

Matt Flynn

Centre for Research into the Older Workforce (CROW), Newcastle University, Newcastle upon Tyne, UK

### Synonyms

Ageing workforces; Age management; Age diversity; Generations

When discussing challenges and opportunities relating to an older workforce, many terms are used which, strictly speaking, are not synonyms, but are often used interchangeably.

*Aging workforces* shift the focus of human resource management (HRM) toward a recognition that, owing to increased longevity, declining birth rates, and extended educational careers which are delaying the entry of young people into the labor market, the balance between older and younger people in the workforce is shifting in the formers' direction. This fact increases the imperative on employers to have HR policies in place to manage retirement of staff so as to retain skills and experience.

*Age management*, *age diversity*, and *age inclusivity* are all terms which concern effective strategies for managing workers of different ages – not just older ones. Age management focuses on workforce planning and, from an HRM perspective, can be somewhat directional: having HR policies and processes in place to mitigate negative consequences of ageing (e.g., reduced physical capacity) while maximizing the positive aspects (e.g., experience and tacit knowledge). One of the most notable examples is BMW's redesign of its factories to ensure that they are fit for design for ageing car workers (Loch et al. 2010). *Age inclusivity and diversity* both focus on the barrier which older and younger workers face in finding, maintaining, and

excelling in work. Such barriers may be formal (e.g., mandatory retirement ages or last in/first out redundancy arrangements) or informal (e.g., ageism and stereotypes) (Bytheway and Johnson 1990). While age diversity focuses on the value of a multiaged workforce, age inclusivity concerns how to make use of such a range of talents, for example, by developing age-mixed work teams, mentoring (whereby a more experienced worker supports the development of a newer member of staff), or reverse mentoring (where a younger employee supports an older one in embracing new technology).

Finally, the concept of *generations* may sometimes be used as a signal for age. The premise of generation is that people who were born within a certain time period (and therefore go through different life stages like education, marriage, first job, etc. simultaneously) share orientations and perspectives with regard to work, family, and community (Parry and Urwin 2009). There are certainly events which shape people's perspectives, and this kind of an impact can show patterns within an age cohort. Many Europeans and Americans born in the 1920s would have seen the start of their careers delayed by the Second World War, while those born in the 1970s will have been entering the labor market just as the personal computer was being introduced. Such major events can affect how our lives and careers unfold and shape our perspectives. However, three notes of caution should be made: first, while generations may be an important cohort signifier, there are many others such as gender, race, nationality, and social class that are equally important in influencing how we work and what opportunities are available to us. Social media may be an important way in which "Generation Y" communicate, but over a quarter of young Europeans lack access to the daily use of the Internet. Second, life course may take multiple trajectories, so it is not necessarily true that people pass through life stages at the same time. Many people have more than one marriage or partnership throughout their lifetimes, raise children at the same time as caring for grandchildren, and make a midlife transition from one career to another. It is therefore difficult to identify patterns in how people of the same

generation experience life events. Finally, it is important when identifying shared characteristics of people within a similar generation not to use terms which are a signal for ageism. Attributing an aversion to new technology among baby boomers is not too different from characterizing older people as reluctant to adapt. Both can be exclusionary, inhibiting people in their 50s and 60s from making use of new work opportunities.

## Definition

Managing an older workforce concerns HRM policies and processes for attracting, retaining, and making best use of older workers. Such interventions overlap those focused on work-life balance (e.g., phased retirement to enable older people to combine work with retirement activities), lifelong learning, diversity and inclusion, and talent management. While the immediate focus of employers who are concerned with ageing workforces is how to manage the transition from work to retirement, a growing network of academics and practitioners are more concerned with how employers can maximize the use of talents and experiences of older people and finding ways to make late career work fulfilling and something which older people value.

## What HRM Policies Can Enable Employers to Make Better Use of Their Older Workers' Skills and Talents?

HR policies and practices to support age diversity can be broadly categorized into the following areas, taking definition according to Eurofound (Naegele and Walker 2006), the ILO (2009), and the United Nations (2006), as well as age diversity good practice guides which have been distributed by governments (DWP 2013) and stakeholder organizations such as employer groups, trade unions, and age advocacy groups:

- *Flexible working hours*: the opportunity to adjust working hours in order to improve work/life balance, accommodate

caring responsibilities, or participate in voluntary work or other retirement activities. This is the most common form of workplace adjustment. In the UK, a third of people 50 and over work part-time, a figure which doubles after the age of 65. Ninety percent of employers report offering at least one form of flexible working to employees (CIPD 2005). Several EU countries offer older employees the right to flexible working as they approach retirement. In some countries like the UK, the USA, and Japan, people who work past retirement age can reduce working hours while topping up their pay with pension entitlements (OECD 2011).

- *Lifelong learning*: the opportunity to improve one's skills through training, especially employer-sponsored workplace training. One way in which generational differences may play out is in terms of access to education. Older workers are less likely than younger ones to have received formal qualifications through higher education, although in the West, this difference is reducing as baby boomers who have benefited from expansion of education become older workers. Employers believe that older workers are reluctant to train in order to keep their skills up to date. On average, older workers are less likely than younger ones to take part in training, partly though not exclusively because they are also less likely to be offered learning opportunities by their employers. Older workers usually feel that their skills are sufficient for their jobs and find ways to compensate for skill deficiencies. Training programs are usually not designed with an eye toward older people who are looking for shorter programs which build on the skills and experience which they already have (McNair 2010).
- *Job rotation*: the opportunity to adjust job content through promotion, lateral transfer, or winding down toward retirement. This can also include measures such as experienced workers engaging in skill transfer, for example, by mentoring younger workers. Changing work content is rarer than changing working hours by older people. Part of the reason is because employers tend to

channel development opportunities to younger employees. However, older workers are also often reluctant to seek a job change even when they are eager for a new challenge. Moving from a secured job which one is good (or at least adequate) at to a new job in which your abilities are unknown is a risk which older workers are rarely willing to take close to retirement. As noted below, older job seekers are out of work on average longer than younger ones, and job security is a priority.

- *Healthy working*: interventions to improve health and well-being and to address physical and mental health risks associated with work. There has been growing attention to how employers can adapt workplaces to manage changes in physical capacity with age. For example, Finland has seen a doubling of its 60–64 year-old worker participation rate in part because of a comprehensive program of health interventions organized by the Institute of Occupational Health known as the Work Ability Index (Ilmarinen 2007). The program involves periodic checks throughout the life course to identify risk factors which could lead to early exit. It is important, however, to remember that while age-related changes to physical capacity are universal, it is not uniform. Many 60-year-olds can do the work of people decades younger than them. Further, evidence shows that mental capabilities to manage work do not reduce, at least up until 65 (there have been few studies beyond 65) (Meadows 2004). While the speed of mental processes may decline with age, older people are able to compensate with experience and crystallized intelligence (Warr 1995).

### **Why Is the Older Workforce an Issue and Who Is It Affecting?**

Populations are ageing around the world. In fact, the United Nations World Population Ageing report suggests that populations are becoming older in all but 18 countries (mostly in sub-Saharan Africa). Demographic change is having different implications across nations.

Europe and North America have passed through the “demographic window” in the latter half of the twentieth century, a period in which government, employers, and unions used early retirement as a way to manage job attrition resulting from organizational and labor market restructuring. The demographic window is defined as the time period in which a society’s working age population is growing as a proportion of the overall society. In agrarian-based economies, families are often large so that manual work can be distributed among a large number of children, and parents can depend on their children to care for them as they age. The nonworking age population dominates because children outnumber adults even though the number of older people is low. As the economy shifts from agrarian to manufacturing to service and high technology, families become and the working age population grows as a proportion of the overall population. As society becomes healthier and people live longer, the proportion of the population above retirement age (and thus nonworking) then begins to grow. The demographic window is the “once in a lifetime” opportunity in which labor supply is maximized and government, employers, and other stakeholders can prepare for ageing populations.) This has been called a “collusion towards early retirement” (Ebbinghaus 2001) since, in the short term, encouraging older workers to bring forward their retirements in order to make way for younger ones was seen as an easy way to manage industrial and workplace change. In reality, there is a wealth of evidence to suggest that shrinking the older workforce exacerbates youth unemployment because economies need full employment in order to grow. For Western economies, the focus at both the public policy and organizational levels has been reversing the collusion toward early retirement to one which promotes active ageing and longer periods of economic activity (Muller-Camen et al. 2011). This is done through policy instruments which could be described as sticks (raising pension ages, closing off early retirement routes) as well as carrots (improving opportunities for older workers to pursue fulfilling careers). While Western economies are having to retrofit economies designed for lower retirement ages but not

having to provide for ageing populations, they are doing so with well-developed welfare states and employment regulatory systems.

Middle-income and less-developed welfare states are younger than Western economies, with most not yet reaching, or still passing through, the demographic window. For some, ageing is imminent. China, for example, will pass through its demographic window in 2016. While these economies can focus on older workforce policies before their working age populations start to proportionally shrink (and they can learn lessons from the experiences of old societies), almost all of them are still in the process of developing their welfare states to ensure that the elderly are cared for, and there is a heavy reliance on the family, including older people still in work, to care for those in need. Even in the well economically developed Tiger economies, welfare states are in the process of shifting from favoring social provision to some groups toward more universal models. As a consequence, most developing economies are having to prepare for ageing populations while at the same time expanding social welfare provision – a scenario akin to running up and down the escalator.

### Are All Older Workers the Same?

Not at all. While ageing populations are a global phenomenon, the older workforce is heterogeneous. As people age and follow different trajectories, their experiences as well as perspectives diverge. Approaches to managing older workers need to take into account the diversity of the older population. Three examples can demonstrate this diversity, although many others also exist:

- Social class, education, and income: These three factors correlate highly, with those at the higher end of all three spectra having more opportunities both in work and retirement (McNair et al. 2004). They are more likely to have sufficient pensions and savings to retire at a date of their choosing. Those who “live to work” also have more opportunities to tailor their work arrangements to fit in with

their lifestyles. Because they depend on it as a larger proportion of their retirement income, low-income older workers are harder hit by changes to state pensions such as a rise in the age at which people can draw a full pension. They are also more likely to be in physically and mentally demanding jobs ill-suited to longer working lives (Lain 2012).

- **Gender:** Workforce participation trends of older men and women have taken divergent paths in the West. For men in their 50s and 60s, participation declined in the 1970s and 1980s as a shift from manufacturing to service-based economies shrank the availability of low-skill-/high-paid blue collar work, and both the state and employers encouraged early exit with financial incentives. Now that the number of white-collar older male workers is rising, participation rates are also going up (Hirsch 2003).

Older women's participation rates start from a lower rate but have not gone through the dip as experienced by men in the third quarter of the twentieth century. Older women's participation rates have risen not only because of changes in family structures (i.e., a rise in the number of two-earner families) but also an increase in the number of flexible but precarious work which tends to be female dominated like social care (Arthur and Rousseau 2001). Many older women also find themselves having to delay retirement because of changes to family circumstances like divorce or widowhood, and welfare states are still in the process of catching up to changes in family structure (Cohen 2013). For example, the US Social Security system still does not credit years of full-time caring responsibilities toward state pension provision.

- **Self-employment:** Self-employed people in most countries retire later than those who work for an employer. There are both intrinsic and extrinsic reasons why this may be the case. Intrinsically, self-employed people may have more of their identities and value invested in their businesses and be reluctant to give up an important aspect of their lives. Extrinsically, the self-employed are less likely to have access to occupational pensions than the employed

and therefore may not be able to afford to retire. It can also be a challenge for the self-employed who want to retire to find a buyer to whom to sell their business (Platman 2003). Correspondingly, economic migrants often find themselves in self-employment not necessarily through choice but because language, skills, and documentation status close off opportunities for them, and "neighborhood enclaves" are the only opportunities for work (Rhee et al. 2013). As they age, precarious work histories, as well as limited savings and pension contributions, make them particularly vulnerable to poverty in retirement.

- **Unemployment:** Finally, and perhaps most importantly, it is important to remember that the experiences of those who are seeking work can be harsher than both younger job seekers and older workers who are seeking to extend working life (Ball 2010). In the UK, 43.8% of job seekers over 50 have been out of work for over a year (by comparison 26.2% of job seekers under 30 in the same circumstance). Ageism is a significant barrier facing older job seekers with employers seeing them as more expensive, less willing to adapt, and more difficult to manage than younger ones. Employers also often assume that an older job applicant will be dissatisfied with a job, especially if it is entry level or requires being managed by a younger person. This perception is usually false, as people making a mid to late career change are likely to stay longer with their new employers than a younger person would. Ageism affects people in work as well as jobseekers. However, older workers who are in work usually know their managers well, and their managers know their skills, abilities, and career ambitions. They are therefore able to overcome some of the ageist perceptions which create barriers to work. It is also important to remember that there are relatively few formal state and employer initiatives to help older job seekers find and sustain work. A recent innovation however is Barclaycard which is seeking to attract mid-career job changers by offering apprenticeships for older job seekers.

## What Is Driving Businesses to Adapt to Aging Workforces?

Just as there is diversity within the older workforce, there are also different drivers for employers to adopt HRM policies and practices. What constitutes good practice for one organization might be ill-suited for another. Governments as well as business groups have presented age exemplars – organizations which have developed innovative approaches to managing age. For example, the UK DIY retail chain has had an HR strategy since 2004 of recruiting at least 60% of their shop floor staff among older people (Duncan 2003). The policy has earned the company recognition for providing job opportunities for the older unemployed, particularly former tradespeople who have been forced out of work for health reasons. There are tangible business reasons for the company's recruitment policy: retail firms in the UK face high turnover but can offer flexible work arrangements which suit people who are close to or at retirement age. Many other retailers offer "snowbird leave" for people who want to work part-year in order to be able to afford extended vacations the other part. The UK supermarket chain has a program for offering both training and a guaranteed job interview to long-term unemployed people when they open new stores in regeneration areas. Shops benefit from having local people within their workforces which can attract neighbors to shop in the locality (Flynn et al. 2013).

Some employers are driven to adapt workplace HRM practices by the fact that their own workforces are currently older, and large groups of workers are scheduled to retire at the same time. This was one of the most significant drivers for a landmark collective agreement on age in the German steel sector (Dribbusch 1996) which included healthy living programs, ergonomic redesign, and a demographic fund to support retraining. Similarly, the UK telecoms company BT introduced several phased retirement options for the large cohort of pre-privatization employees who are scheduled for retirement (McNair and Flynn 2005).

Many organizations find synergy between the desires which older workers have with regard to work and retirement and business demands. BAE Systems, for example, introduced a phased retirement option for engineers and factory workers in 1990 (Flynn 2014). The option was originally part of a negotiated arrangement to changes in the pension system, but offering flexibility in how and when older workers retire turned out to be an effective management tool for the firm to manage peaks and troughs in labor demand.

Finally, it is worth noting that small- and medium-sized businesses can benefit in managing age in ways different from large organizations even though most good practice guides are targeted to the latter. SME's tend to be at a disadvantage against large businesses when recruiting younger talent. Younger people are looking for opportunities for promotion and career development opportunities. SME's need employees who are flexible "all rounders" who have the skills to do more than one job. While university leavers tend to be specialized, older workers have a wealth of experience to enable them to perform multiple tasks (Flynn 2015).

## Conclusion

Managing age and work is a challenge facing employers not only in Europe and the USA but also worldwide. Extending opportunities not just for work but for fulfilling work is an essential part of ensuring sustainable retirement regimes as older populations grow. However, extended working life is not just a challenge but also an opportunity for both employers and older workers themselves. Adjustments, often modest, to how older workers work can enable both to make better use of skills and experience longer.

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## Organizational Wisdom and Aging

Bernard McKenna

The University of Queensland, Brisbane, QLD, Australia

## Synonyms

Phronēsis; Prudence

## Definition

The capacity developed from knowledge, life experience, reflection and emotional regulation, and empathy to make sound judgments that produce virtuous and efficacious outcomes.

The paradox inherent in organizational wisdom and aging is that while wisdom is widely considered to come with aging, aging members of an organization are often under pressure to leave.

Nonetheless, with an aging population and workforce, more positive attitudes are beginning to emerge. In the organizational and management literature, the notion of wisdom is slowly working its way into theory but is more prominent in leadership theory. Compared with the rapid advances in wisdom and life-span psychological development (Baltes et al. 2002), research into wisdom in an organizational context is relatively immature and theoretical rather than empirically based. Wisdom and aging in organizations is considered from two perspectives: individual and organizational. At the individual level, people can have degrees of personal wisdom (PW), self-related wisdom in which a person shows insight into their own life, and general wisdom (GW), which shows insight into wider aspects of life. Importantly, GW and PW are substantially correlated (Mickler and Staudinger 2008). At the organizational level, members' wisdom will influence the organizational climate, the aggregated perceptions of how the work environment is perceived to impact on individual well-being, and organizational culture, the normative beliefs, and shared behavioral expectations, or system norms, in an organization.

## Key Principles

An important distinction needs to be drawn between the objective notion of getting older as a chronological accumulation of years and aging within a particular social context. Clearly, as one enters the third (young-old) and fourth (old-old) age, many physiological and psychological variables deprecate such that at a certain point, usually the fourth age, people become increasingly dependent on others and lose their independence. When considering the role of older people in organizations, cultural differences need to be considered. In general terms, it might be said that many Western cultures have a more negative orientation to older people than do Eastern cultures. This orientation is manifest in the widespread cultural beliefs about older people, particularly in terms of respect for older people and acknowledgment of their past and present contributions to family

and society. The cultural orientation is also determined by the degree to which utilitarian and economic factors are considered salient, which can be a negative factor in Western organizations.

Although wisdom is an elusive concept to describe, and even more difficult to measure, a consensus is emerging. At the core of wisdom is virtue if one adopts the Aristotelian approach. Central to this is the teleological goal of *eudaimonia* or "human flourishing." Attaining *eudaimonia* requires the proper use of certain intellectual, esthetic, and moral virtues that is driven by a deep humanity. According to Aristotle, applying virtue, intelligence, and reason to life's problems enhances the person and the lives of those around them. Psychological evidence shows that "there is a kind of deep and enduring happiness that is impossible without virtue," according to Nancy E. Snow. Emerging from this Aristotelian tradition is the distinction between *episteme* (factual or disciplinary knowledge), *technē* (applying this knowledge to produce a good or service), *sophia* (abstract reasoning), *phronēsis* (experience, insight, intuition, creativity), and *prudence* (judgment, including moral judgment and emotional intelligence). Organizational wisdom literature is oriented toward the notion of *phronēsis* and virtuous, thoughtful judgment.

## Defining and Measuring Wisdom

Recent psychological research into wisdom emerged in the 1980s very much from gerontology studies, particularly by Paul B. Baltes, and contemporaneously in the United States, by Clayton and Birren. Although attempts to define and measure wisdom have been diverse, certain common elements emerge. Ardel (2003) uses the three dimensions first devised by Clayton and Birren: cognitive, reflective, and affective. Although all three dimensions need to be present for wisdom, the reflective dimension is regarded as "crucial." Webster (2003) identifies five dimensions: experience, emotional regulation, reminiscence, and reflectiveness, openness, and humor. Wisdom requires the synthesis of at least two of these skill sets. Greene and Brown's (2009) Wisdom Development Scale (WDS) uses eight

dimensions: self-knowledge, altruism, leadership, judgment, life knowledge, life skills, emotional management, and willingness to learn. An alternative to these self-assessed scales is the Berlin wisdom paradigm, which began with the work of Baltes et al. (1992). Their explicit theoretical approach sees wisdom as an aspect of the cognitive pragmatics of intelligence in a “dual process” model of intelligence. According to them, intelligence comprises cognitive mechanics (processing speed, recall capability) and cognitive pragmatics, which is derived over one’s life through reflexivity, problem-solving, and critical thinking skills. Wise people display “expert knowledge in the fundamental pragmatics of life that permits exceptional insight, judgment, and advice about complex and uncertain matters” (Pasupathi and Staudinger 2001). More specifically, pragmatics incorporate rich factual knowledge, rich procedural knowledge, life-span contextualism, relativism, and the capability to deal with the uncertainty of life’s contingencies.

In a large study conducted by Jeste et al. (2010), 60 experts in wisdom used a Delphi method to determine what they considered wisdom to be. The initial survey of this group evaluated items from existing wisdom measures including Ardel (2003), Baltes and Staudinger (Baltes et al. 1992), Brown and Greene (Greene and Brown 2009), Webster (2003), and Sternberg (Sternberg and Hedlund 2002) but added items to deal with skepticism and spirituality. Although extremely worthwhile, the study can be criticized for its imbalance in terms of gender (37% women), culture (73% North American and most of the others European), and to a lesser extent, discipline (predominantly gerontology, psychology, and psychiatry). Notwithstanding this, concept differences among wisdom, intelligence (with a slight overlap), and spirituality (sharing prosocial attitudes and behaviors) were significant. Further, wisdom differed from intelligence and from spirituality on most items. Reduced to the three metacomponents of cognitive, reflective, and affective domains, the experts agreed on seven cognitive items, eight reflective items, and three affective items. Four other items were

considered descriptive of wisdom: emotional regulation, openness to new experience, a sense of humor, and maturity gained with experience. The experts also considered resilience and successful coping strategies to be significantly more important than intelligence and spirituality. Finally, they agreed that wisdom, unlike high intelligence and spirituality, is rare and that it is positively associated with aging.

Plainly, such studies are intended to define and measure individual wisdom. However, very little work has been completed on organizational wisdom. One attempt by Limas and Hansson (2004) has not been adopted in other research. In the first of a two-part study, they developed an instrument that considered the components of wisdom within a work context. The scale used the five criteria of the Berlin model as well as Sternberg’s (Sternberg and Hedlund 2002) three domains of reasoning ability, sagacity, and judgment. The study showed that of the four factors that account for wise organizational practice, being broadly integrative in perspective accounted for the largest variance. Wise people in an organizational context were identified as “highly observant, balanced, and strategic in their interactions in the organization. They consider many points of view, are fair in their judgments, and have learned from experience” (Limas and Hansson 2004, pp. 91–92). Other factors identifying wisdom in an organizational context included respect for human diversity, practical political acumen, and sensitivity to organizational culture. The second study, which looked for organizations that are most appropriate for wise leadership, found that the most supportive organizational cultures are those that value supportiveness and a team orientation, and the least supportive are those that value precise applications to rules, aggressiveness, and predictability.

### **Wise Organizational Members**

To be a wise organizational member, one must use their intelligence, creativity, and experience to produce a common good, according to wisdom researcher Robert Sternberg (Sternberg and

Hedlund 2002). Thus, an ethical dimension based on the common good is essential for organizational wisdom. Organizationally wise people extend their range of vision by balancing their own and institutional interests over the long and short terms and by making genuine efforts to understand other people's points of view and incorporating them into one's thinking.

### Wisdom and Intelligence

While intelligence is crucial to wisdom, the distinction between fluid and crystallized intelligence (Horn and Cattell 1967) is crucial. Fluid intelligence, the capacity to think in the abstract, is largely inherited. Crystallized intelligence, according to Sternberg, is practical intelligence based on experience that is used to solve everyday problems in one of three ways: purposefully adapting to, shaping, or selecting new environments. Of significance here is the temporal aspect of crystallized intelligence, which is increasingly used throughout life. That is, as one ages, the potential for developing crystallized intelligence obviously increases provided other factors discussed below are present. Also of importance in considering fluid and crystallized intelligence is the relationship of wisdom with highly intelligent people. It has been found that although there is a correlation between PW and fluid intelligence for those with higher fluid intelligence levels, there is an inverted-U-shaped relationship. This means that those scoring in the top 15% produced a marginally negative relationship with PW when controlled for age (Mickler and Staudinger 2008). While it is generally accepted that fluid intelligence begins a steady decline from our thirties, crystallized intelligence remains stable into old age: in fact, it is suggested that fluid intelligence is transformed into crystallized intelligence over time (Schaie 2005). A crucial element, with critical relevance to aging, is that there is a link between openness to experience, fluid intelligence, and crystallized intelligence. More specifically, openness to experience might explain some of the age-related differences in fluid and crystallized intelligence.

### Concepts

Given the importance of cognitive capability, affect, and moral reasoning as core components of wisdom, these are discussed in relation to aging. Because personality can affect the disposition for wisdom, this is also discussed before considering the notion of generativity in older people.

### Cognitive Capability

An excellent summary of the effect of age on cognition by Salthouse (2012) provides a clinical foundation. Although some studies, such as that by Hunt in 1995, estimated dramatic declines in fluid cognition, other studies confirm the decline but at a more moderate rate. Salthouse's (2012) own studies on more than 3,000 adults aged between 20 and 70 years indicated a decline in fluid cognition of about 0.02 of a standard deviation. These results were largely unaffected by education, self-rated health, depression and anxiety, SES, or levels of job complexity. The inverted U of cognitive functioning in relation to age revealing a rapid rise peaking at around age 30 followed by a gradual decline is now well established. While this is largely true across different disciplines and historical periods, it seems to be most pronounced where novel problem solving is important (e.g., lyric poetry, pure mathematics, and theoretical physics) with one study finding that whereas the peak age for mathematicians was 26.5, for historians, it was 38.5.

An emerging area of interest is the notion of neuroplasticity. Advances in neuroscience are considering how the brain physically responds to neural deterioration caused by aging. Results indicate that the brain can develop neural scaffolding to regulate cognitive function. Cognitive training has been shown to increase neural volume; however, it is uncertain whether this is the result of strategy change rather than neural plasticity (Park and Bischof 2013). Clearly, such findings have important implications for most organizations because seniority and experience is indubitably correlated with age.

These findings may seem gloomy. However, six other factors need to be taken into account in an organizational context. The first factor, which is elaborated more thoroughly below, is that while sound to strong cognition is important, wisdom is best understood not just as a late stage of cognitive development in a Piagetian sense but also necessarily incorporating a synthesis of dialectical thinking based on knowledge of self, others, and the world, as well as a combination of intrapsychic systems of cognition, emotion, and motivation (Kunzmann and Batles 2005). The other five factors specifically relate to an organizational context and are largely drawn from Salthouse (2012). The second factor to consider is whether productivity declines as one ages because in their later career, people are more likely to be involved in supervisory, mentoring, and collaborative work. A third factor to consider is the different information obsolescence rates in fields: e.g., bioengineering compared with the law. A fourth factor is that in some (perhaps most) professions, high reasoning ability is best tempered by experience. One study, for example, shows that about 53 is the peak age for favorable financial decisions. With experience, novel problem-solving capability may be increasingly superseded by the capacity to retrieve prior solutions. A fifth factor is the possible positive contribution to a positive organizational culture. For example, when considering the life-span relationship of traits and age (below), older workers may contribute strongly to corporate citizenship, a vague but important component of organizational functioning and wise culture. Among the positive attributes of an older organizational worker may be positive aspects of personality, particularly conscientiousness which tends to increase with age, emotional intelligence, practical intelligence (which is related to experience-based tacit knowledge), and process/analytic ability. In other words, an excessive focus on cognitive decrement can blind us to the many other factors that positively impact work performance (Sternberg and Hedlund 2002), particularly in old age. It is reasonable to surmise that these factors promote wise personal and cultural practices. This disagreement about the relationship between age and job performance, especially

in complex jobs, raises the question about the relevant criterion variables to be considered. The sixth and final factor that may limit the impact of age-related declines is the various forms of accommodations (e.g., restricting exposure to deficit-revealing situations, moving from excessively difficult jobs, and reducing the domains of expertise) that people use over time to adjust into an appropriate organizational role.

*Limitations of Rationality.* Before leaving the topic of cognitive capability, it is worth noting that there is considerable epistemological debate about the nature of contemporary knowledge, particularly that which is valorized in dominant social and organizational discourses. According to philosopher Nicholas Maxwell in his (1984) *From Knowledge to Wisdom*, the philosophy of wisdom is needed to overcome the damage caused by the rationality that inheres in the philosophy of scientific knowledge. Such knowledge is limited because it is the outcome of rational enquiry that falsely claims to be objective. In contrast, while wisdom incorporates knowledge, it goes beyond these rational answers to include values. The orientation of science must vitally deal with the pressing issues of poverty and injustice, says Maxwell. This inherent limitation may be overcome by a set of competencies understood as *wisdom meta-competencies* that are related to wisdom and complement and enhance knowledge activities.

### **Affect**

Because emotional regulation is an important component of wise action, the relation between affect and aging is another important consideration. From the broad perspective of socio-emotional selectivity (Carstensen et al. 1999), it is argued that the individual's perception of time strongly influences the selection and pursuit of social goals. If time is perceived as open-ended, then we tend to pursue knowledge acquisition goals, but if time is seen as limited, we tend to pursue emotional goals. The crossover occurs in middle age. The implication of this for organizational decision-making is that calculating gains and losses is likely to be influenced by individual temporal frameworks that, in turn, prioritize

knowledge or emotional goals. The work of Eva-Marie Kessler and Ursula Staudinger is particularly pertinent in supporting the importance of age in affect regulation in difficult situations. They found that, although the Big Five personality factors and health significantly reduces the effect of age on affect, age still has explanatory power over and above these variables. As a result, older participants' displayed greater efficiency in increasing positive affect in difficult situations and reducing negative affect after negative events and failures. Older people are more flexible in deploying problem-solving strategies in which emotion regulation is a part of the contextual features of a situation. The entry by Scheibe, Wisse, and Schulz in this volume identifies positive features of affect and emotion regulation in aging workers with outcomes such as lower burn-out, more favorable job attitudes, and satisfaction with the supervisor.

### **Moral Reasoning**

Moral reasoning is a core function of wisdom from both an Aristotelian perspective and most contemporary psychological accounts. Because of its core role, it is important to consider whether age impacts on moral reasoning. However, the research is inconclusive as to whether moral development, in the Kohlbergian sense, plateaus, develops in earlier adulthood, or declines in later adulthood. For example, a review of the *Journal of Business Ethics*, which is perhaps best aligned with moral reasoning in an organizational context, provides virtually no empirical work in this area since Ruegger and King's 1992 study. A study by Pasupathi and Staudinger (2001) showed that moral reasoning was positively associated with wisdom-related performance. Of note is that the association was mediated by personality, intelligence, and other factors. In relation to age, it was found that higher age was associated with higher levels of wisdom-related knowledge and judgment for those with high moral reasoning or cognitive capability.

### **Personality**

Although the positive personality traits of emotional stability, openness to experience,

agreeableness, and conscientiousness spike sharply between roughly 15 and 25, they also incrementally rise with age, with an optimum age of about 55 (Roberts et al. 2006). Three features are noteworthy in relation to aging and personality traits in the workforce. First, agreeableness appears to spike again at around age 45 with slight increments from 55. Second, conscientiousness spikes dramatically from age 20 and continues to rise strongly to age 65 before plateauing. These two features, along with optimum levels of emotional stability from 55 to 65, point to the potential positive organizational cultural influence of older workers. Agreeableness, conscientiousness, and emotional stability produce balance in humans and, of course, in their place of work. Balance is also evident in theories of wisdom ranging from Aristotle's notion of the mean (much misunderstood as the center between extremities) to Sternberg's (Sternberg and Hedlund 2002) Balance Theory of Wisdom. For Sternberg, balance that is likely to produce wise outcomes includes consideration of the common good in the intrapersonal, interpersonal, and extrapersonal domains. The third feature is less positive: that is, openness to experience tends to decline from the mid 50s. Given the importance of openness to experience in predicting wisdom, this is one variable that could potentially reduce the wisdom of older people.

### **Generativity**

Generativity, a concept first introduced by Erikson in 1950, has proved to be a robust concept that is strongly associated with successful aging, although there is no clear point at which it begins. Longitudinal aging researcher George Vaillant concludes from decades of research that mastering generativity is strongly correlated with successful adaptation to old age. The psychological features of generativity, according to McAdams and St. Aubin, are a personal inner desire to support the next generation based on the motivation of a conscious concern for their welfare and is associated with belief in human goodness. In an organizational context, a positive relationship between leader age and leader generativity was identified.

This same research (Zacher et al. 2011) also showed that leader generativity moderated the relationships between leader age and all the criteria of leadership success, the implication of which is that leaders who are high in generativity are better able to maintain high levels of leadership success at higher ages than leaders low in generativity.

Generativity is an important consideration in understanding the wisdom potential of older workers in an organizational context. A mentor is an older person who freely takes on responsibility for developing less experienced organizational members in three ways. First, mentors provide practical, experience-based advice related to applying professional knowledge in a field and by helping younger people build confidence to find their place within the profession. Second, successful mentoring provides moral guidance in difficult situations or where wider considerations (long-term perspective or relevant stakeholders) should be taken into account. Third, mentors, particularly given their heightened emotional regulation and conscientiousness, help to develop an appropriate disposition by dealing artfully and thoughtfully with highly charged situations or novel situations for the less experienced person.

## Applications

Turning the focus now to organizational wisdom reveals considerably less inquiry than there is on the relationship between aging and wisdom in an organizational context. Notwithstanding this paucity, a number of factors are generally agreed upon: the role of knowledge, reflexiveness, balance, and experience.

It is agreed that wisdom does not necessarily come with aging. Rather, there must be openness to experience; experience itself (see, e.g., Nada and Andrew Korac-Kakabadse's work) and reflexiveness. As explained above, the trait of openness to experience is strongly correlated with wisdom because it might explain the process by which fluid intelligence over time is reconstrued as crystallized intelligence. Providing the potential for wisdom from experience is

reflexiveness. The notion of reflexiveness in organizational theory and practice is not new: Donald Schön's reflection-in-action and Henry Mintzberg's reflexive practice are well established. However, as Keith Grint points out, practical wisdom that leads to positive humane outcomes combines reflection, action, and lived experience. This notion of lived experience lends itself to another emerging aspect of experience-based wisdom that philosopher Paul Ricoeur calls reflective mediation. A more useful recent development in this regard has been the emergence of the phenomenological perspective that considers the relationship between somatic experience and consciousness through a process of embodiment. This notion is extensively developed in the work of Wendelin Küpers, who understands the wise phenomenological practitioner as dynamically interrogating situated experiences and one's perceptions, receptive affectedness, emotions, cognitions, and actions. Thus, wisdom is understood in the broadest sense as not only knowing but doing within a moral universe.

Given the importance of knowledge, some organizational wisdom theorists such as Jennifer Rowley and Bierly, Kessler, and Christensen took up Ackoff's data-information-knowledge-wisdom (DIKW) "knowledge hierarchy" to elaborate the important distinction between knowledge and wisdom. Such a distinction resembles the distinction that Aristotle in *Nicomachean Ethics* made between *epistēmē*, *technē*, and *phronēsis*. *Epistēmē* is the theoretical knowledge needed to be a craftsperson or professional in a particular domain. Thus, early career-organizational members would demonstrate this level of knowledge; indeed, they may even have acquired new knowledge that older organizational members do not have. *Technē* involves the application of that knowledge to produce a good or service, as well as the capacity to explain the process of production in terms of that knowledge. However, *technē* is not directed to purposive social change; it merely reproduces existing practices and outcomes. Thus, a technically competent person is not necessarily a wise person. *Phronēsis*, on the other hand, according to Aristotle in his *Eudemian Ethics*, is not a form of knowledge but

an excellence that produces virtuous outcomes. It is an intellectual and an ethical virtue that is directed to living well, the eudaimonic existence that is selflessly directed to the greater good of all.

Phronetic leadership has become widely developed in the literature of management and leadership particularly since Bent Flyvbjerg introduced the notion of phronetic planning. Importantly, wisdom theorists such as Haridimos Tsoukas and Robert Chia incorporate moral capacity. For Tsoukas, phronetic leaders intuitively identify salient features in complex situations to produce responses that promote the common good. Chia sees phronēsis as a form of resourcefulness that produces appropriate responses that meet the common good. A vital element of this process is sophia. According to Richard Hawley Trowbridge, sophia incorporates intuitive knowing and a sense of cosmic unity. A wise person who incorporates sophia into their deliberative processes is not bound by the sensory awareness that produces established knowledge, and they admit intuitive understandings as a valid aspect of consideration. They also perceive the interrelatedness of all things, assuming a cosmic unity or total union with the infinite, according to Trowbridge. Thus, above knowledge are various meta-competencies including metacognitions and ethics that integrate to produce practical wisdom, according to Intezari and Pauleen (2013).

## Future Directions

Management, organizational, and leadership theory is increasingly adopting wisdom principles into its research and practice. The first significant instance of this was Eric Kessler and James Bailey's (2007) edited *Handbook of Organizational and Managerial Wisdom*. Rooney, McKenna, and Liesch's (2010) *Wisdom and Management in the Knowledge Economy* provided five characteristics of wisdom and applied these to various business subdisciplines such as strategy and international business. In applying wisdom principles to HRM, they looked at the potential wisdom value of an aging work force. Kinsella and Pitman's

(2011) *Phronē as Professional Knowledge* attempts to redress the instrumentalism of professional practice and the valorization of particular forms of knowledge by introducing phronēsis. Thompson and Bevan's (2013) edited volume *Wise Management in Organisational Complexity* includes a critique of the Global Financial Crisis as well as providing Chinese philosophical perspectives. Küpers and Pauleen's (2013) *A Handbook of Practical Wisdom* provides a range of theoretical orientations including phenomenology, Buddhism, and transcendence to guide practical wisdom in contemporary times.

Despite this growing trend in organizational wisdom theory, there is little that specifically deals with aging and wisdom in an organizational context. Clearly, there is much that can be done from psychological, sociological, and phenomenological approaches. While the concept of wisdom is not agreed, there are core features of cognitive and affective capability, reflectiveness, and an ethical commitment to the common and longer-term good. Thus, research on how these features vary, if at all, with age, will provide useful information about wisdom and aging. Because aging is biocultural, the sociology of older workers in the workplace would also shed light on organizational wisdom. Thus, the following questions would be of particular interest.

- Do cognitive decrements impair older workers' capacity for wisdom in an organization?
- Is intuitive knowledge largely built on experience?
- Does reflexive experience over time provide replicable heuristics to solve complex problems?
- Do older people, because of life-stage characteristics, help to produce a wise organizational disposition?
- Given the importance of the trait of openness to new ideas and to experience, what processes as well as personal and cultural changes would arrest the tendency for a decline of openness in older people?
- Are there new configurations of work patterns that would allow older people to provide wise mentorship and to pass on tacit knowledge?

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# P

## Pain and Pain Management

Thomas Hadjistavropoulos  
Department of Psychology and Centre on Aging  
and Health, University of Regina, Regina, SK,  
Canada

### Definition

The International Association for the Study of Pain (IASP) defines pain as “an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage.” Pain of short duration is considered acute pain, while pain that has persisted longer than the normal healing period is considered to be chronic (Turk and Okifuji 2001). Chronic pain is often operationalized as pain lasting longer than 3 months.

### Pain in Old Age

The prevalence of pain in older persons is high (Charlton 2005). Specifically, estimates of pain prevalence range from 25% to 65% of community-dwelling older adults and are as high as 80% for seniors residing in long-term care facilities. Of the older adults who report pain, 25% describe their pain as severe and 60% describe it as moderate (Langley 2011). This high prevalence of pain is largely due to a variety

of health conditions that become more frequent with aging (e.g., osteoarthritis, cancer, osteoporosis, postherpetic neuralgia, spinal stenosis, fractures) as well as injuries due to falls. As the list of conditions that increase with aging implies, older persons are affected both by nociceptive (i.e., pain resulting from activation of the nociceptors which are sensory neurons that respond to noxious tissue stimulation) and neuropathic (i.e., pain due to nervous system damage) pain. Examples of the former type of pain include musculoskeletal injury pain and osteoarthritis. Common sources of neuropathic pain in older adults include central poststroke pain as well as various neuralgias (e.g., herpetic neuralgia). Cancer pain can be neuropathic or nociceptive depending on the nature of the specific illness.

Persistent pain has negative consequences for quality of life and is often associated with negative mood states such as depression, anxiety, sleep disturbances, and increased use of mental health services (Hadjistavropoulos 2015). In the case of seniors with dementia and neurocognitive disorders (e.g., Alzheimer’s disease, vascular dementia, frontotemporal dementia), pain can also be associated with increased behavioral disturbance which can lead to pain patients being treated with psychotropic rather than analgesic medication.

Despite their high prevalence, pain problems are often undertreated in older individuals (Hadjistavropoulos 2015; Morrison and Siu 2000). This pain undertreatment has been attributed to a variety of factors including, but not

limited to, prevalent myths that pain is a normal part of aging and, as such, must be endured. While pain problems are frequent in old age, they are not normal but result from pathology that needs to be managed irrespective of a person's age. In the case of seniors who have dementia and limited ability to communicate due to cognitive impairment, pain undertreatment is often associated with challenges in effectively assessing pain in this population who have difficulty self-reporting their subjective experiences. Moreover, insufficient health-care staff education about effective approaches to the assessment of pain in dementia also contributes to pain undertreatment with pain problems often going undetected. In addition, despite good will, fiscal and resource challenges in many long-term care residential facilities have interfered with the implementation of adequate regular pain assessment/management programs.

The literature has also examined the possibility of pain threshold and tolerance changes as a function of old age, given the variety of age-related neurobiologic and psychosocial changes that occur. The results, however, have not been perfectly consistent across studies. Although, for example, some laboratory research has shown an age-related increase in pain thresholds, this effect has not been found consistently across a variety of pain stimuli (Hadjistavropoulos et al. *in press*; Gibson and Farrell 2004; Lautenbacher 2012). Studies of pain tolerance as a function of age tend to show the opposite effect. That is, pain tolerance appears to decrease with age (Hadjistavropoulos et al. 2014; Gibson and Farrell 2004).

Results on the effects of dementia in pain perception also vary across studies with inconsistencies possibly due to differences in the patient samples and/or methodologies. It has been, nonetheless, suggested that severe dementia may impair pain perception although more research is needed before such a conclusion can be reached with confidence (Hadjistavropoulos et al. 2014). That said, much of the research on pain threshold and tolerance utilizes psychophysical principles, and the age- and dementia-related changes shown in the laboratory may not have substantial clinical

significance. In fact, it has demonstrated that patients with dementia, compared to peers without dementia, often react with more vigor to painful stimuli in clinical settings (Hadjistavropoulos et al. 2000).

## **Pain Theory and Conceptualization**

The gate control theory of pain (Melzack and Wall 1965) is the most comprehensive and well-supported theory of pain. It postulates that a gating mechanism at the dorsal horn of the spinal cord modulates the ascending sensory inputs from the body. Ascending transmissions from large diameter fibers, representing sensory neural pathways (transmitting sensations such as touch), tend to close the gate by inhibiting competing potentially painful messages transmitted by smaller diameter fibers. As a practical example, rubbing a painful area may reduce the level of pain experienced through activation of large diameter fibers. More importantly, from a psychological standpoint, the theory postulates that descending cortical input (e.g., arising from cognitive and attentional processes) can also open and close the gate. Consistent with the gate control theory, the biopsychosocial model of pain elaborates on the manner in which biological, social, and psychological parameters interact with the pain experience. Indeed, the important role of psychological (e.g., catastrophic thinking about pain, coping strategies) and social parameters (e.g., social support) in the pain experience of older individuals is supported (e.g., Benyon et al. 2013) although the biopsychosocial model has been primarily investigated with younger persons.

## **Pain Assessment**

Effective pain management must be preceded by effective pain assessment. A comprehensive assessment of pain would not only include evaluations of pain intensity but also of a variety of other domains (e.g., functional ability,

psychological functioning, coping skills, physical pathology, etc.) (Hadjistavropoulos et al. 2007). Given the multidimensional nature of a comprehensive pain assessment, interdisciplinary approaches are often considered optimal. A variety of tools, validated for the pain assessment (and related domains such as functional ability and psychological sequelae) in samples of older adults, are often used by psychologists. For example, pain intensity can usually be assessed effectively using unidimensional scales including 0–10 numeric rating scales (NRS, anchored by polar opposites such as “no pain” and “pain as bad as it can be”) and/or verbal rating scales (VRS, involving the use of verbal descriptors such as “mild,” “moderate,” “severe,” etc.). VRS verbal descriptors can correspond to numeric ratings (e.g., “no pain” = 0; “extreme pain” = 10). Other dimensions of pain, including psychological sequelae, can be assessed through a wide variety of tools such as the Brief Pain Inventory, the Geriatric Depression Scale, the Multidimensional Pain Inventory, the Coping Strategies Questionnaire, and others [see Hadjistavropoulos et al. (2007) for more details on these assessment tools].

Seniors with mild to moderate dementia can often self-report pain using unidimensional rating scales (e.g., NRS or VRS). However, as dementia progresses, patients often become unable to effectively self-report pain. The American Geriatrics Society (AGS) recommended that the following domains be evaluated when assessing pain in dementia patients: (a) facial expressions, (b) verbalizations and vocalizations, (c) body movements, (d) changes in interpersonal interactions, (e) changes in activity patterns and routines, and (f) mental status changes. A variety of observational pain assessment tools have been validated for the assessment of the patient with dementia. These tools include items such as grimacing, rubbing the affected area, paralinguistic vocalizations (e.g., moaning and screaming), changes in sleep patterns, and others. Specific examples of observational tools include the Pain Assessment Checklist for Seniors with Limited Ability to Communicate (PACSLAC) and

PACSLAC-II, the Pain Assessment in Advanced Dementia (PAINAD), the Doloplus-II, the Abbey Pain Scale, and others (see Hadjistavropoulos et al. (2014) for a review and more complete listing of such tools). Clinicians can evaluate the extent to which specific observational pain tools allow for the assessment of the domains recommended by the AGS. Tools that can assess psychological dimensions of the pain experience of older adults with severe dementia are also available (e.g., Cornell Scale for Depression in Dementia, Alzheimer’s Disease-Related Quality of Life [ADRQL]; see Hadjistavropoulos (2015) for a more detailed discussion). These tools are reliant on caregiver report given the communication limitations that are frequent in patients with severe cognitive impairments.

Clinical approaches to the assessment of the older adult with and without dementia have also been described in the literature (Hadjistavropoulos et al. 2007, 2010). For example, in the case of the observational assessment of pain for seniors with severe cognitive impairments, an individualized approach to assessment has been recommended whereby pain behaviors are monitored over time (with assessments conducted across similar situations). Fluctuations from the regular pattern of a patient’s scores could be indicative of changes in pain levels requiring further investigation. Regardless, results of observational pain assessment should always be considered within the context of patient history, medical examination and test results, caregiver reports, and related information. Observational assessment tools are for screening and should not be considered, in and of themselves, to be definitive indicators of pain.

## Pain Management

Given the multidimensional nature of pain, its optimal management involves an interdisciplinary approach (e.g., psychology, medicine, physical therapy, pharmacy, nursing, occupational therapy). Psychologists, working within interdisciplinary and interprofessional treatment teams,

can offer psychological therapy to clients in an effort to improve quality of life (e.g., improve mood, reduce anxiety, increase social engagement) despite a person's pain condition. Cognitive behavioral therapy (CBT) approaches show some promise when used with older persons (Hadjistavropoulos 2015) and involve a variety of techniques including challenging maladaptive cognitions related to pain, encouraging appropriate pacing of activities, enhancing coping skills, behavioral activation, relaxation training, psychoeducation, and others. While CBT methods are also used in the treatment of younger persons, CBT tends to have a somewhat different focus with older individuals. Although CBT programs with younger chronic pain patients often have a return-to-work focus, for example, return to work is not an issue with retired older persons. Moreover, the types of stressors that older adults bring into therapy tend to be different (e.g., widowhood in late life, empty nest syndrome) as compared to other populations who may be more concerned about the pain problem's impact on ability to support a young family and related responsibilities. CBT with older adults may also focus on myths that may contribute to pain undermanagement (e.g., an older person not seeking physical therapy for pain because of the false belief that pain is normal and inevitable in late life). In addition, the nature of the psychoeducation may be different depending on the age of CBT patient (e.g., metabolic and other physiological changes that accompany aging may have an impact on how the body metabolizes medications). Recently, evidence has begun to emerge on the usefulness of acceptance and commitment therapy (ACT) for older persons with pain (McCracken and Jones 2012). ACT emphasizes acceptance of one's symptoms (rather than efforts to control them) and incorporates mindfulness (e.g., meditation-like) techniques.

In the case of seniors with advanced dementia, CBT and ACT pain management approaches would, generally, not be feasible. Long-term care staff continuing education in pain assessment and management has been shown to increase knowledge of best practices, although the extent to

which this increased knowledge translates to widespread clinical application is less clear (Gagnon et al. 2013). For changes in clinical practices to occur, change in facility policies and management support (e.g., changes in resource allocation) may be needed. Research has shown, however, that implementation of regular pain assessment in long-term care facilities leads to improved pain management practices (Fuchs-Lacelle et al. 2008). In addition, in terms of pharmacological management, the AGS has produced specific recommendations (American Geriatrics Society (AGS) 2009). Finally, psychosocial and behavioral programs (e.g., pleasant activity scheduling) to improve dementia patient mood have shown some promise (Teri et al. 1997).

Self-management approaches for pain in older persons have also been developed (Hadjistavropoulos 2012). These approaches vary with respect to the extent that they incorporate health professional support (e.g., facilitators) with some approaches involving regular group meetings with a health professional and other approaches involving less direct health professional support (e.g., use of a detailed pain self-management manual that encourages patients to consult with health professionals as necessary). Self-management programs offer psychoeducation, coping skills training, mood management approaches, pacing techniques, and other related methods. The results on the effectiveness of self-management approaches are generally mixed although programs specifically focused on people with arthritis seem to be especially promising (Hadjistavropoulos 2012; Du et al. 2011).

## Future Directions

Further investigation is needed to systematically clarify and explain the inconsistencies in studies of age-related changes in pain threshold and tolerance. A longitudinal approach to these types of investigations may be the most fruitful avenue. Given the limited access to services that many seniors have, either due to reduced mobility or because they live in rural areas, more research in

the delivery of pain management approaches via internet or other telemedicine and e-health initiatives is needed. In the area of pain assessment, more research is needed on the specificity of observational pain assessment tools for seniors with severe dementia and limited ability to communicate. While we know that such tools are quite sensitive to the identification of pain, their ability to discriminate pain from other distress states has not been studied adequately. Moreover, future research, including public policy research, should address the issue of barriers to widespread implementation of effective pain management programs for older persons and especially for individuals who reside in long-term care facilities.

## Cross-References

- ▶ [Acceptance and Commitment Therapy](#)
- ▶ [Alzheimer's Disease, Advances in Clinical Diagnosis and Treatment](#)
- ▶ [Cognitive Behavioural Therapy](#)
- ▶ [Dementia and Neurocognitive Disorders](#)
- ▶ [Mindfulness Approaches](#)
- ▶ [Widowhood in Late Life](#)

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## Palliative Care

Julia E. Kasl-Godley<sup>1</sup> and Kysa M. Christie<sup>2</sup>  
<sup>1</sup>Palo Alto VA Health Care System, Palo Alto, CA, USA

<sup>2</sup>Boston VA Healthcare System, Boston, MA, USA

### Definition

Palliative care is a broad term that refers to care provided at *any stage* of a serious illness to alleviate physical, psychosocial, or spiritual suffering; enhance quality of life; effectively manage symptoms; and offer comprehensive, interdisciplinary support to the patient and family throughout the course of illness, regardless of stage of disease (Dahlin 2013).

Palliative care ideally begins at the point of initial diagnosis of a serious, potentially life-limiting illness and can be delivered concurrently with other therapies that are intended to cure a disease or prolong life (see Box 1 and Fig. 1). If disease-directed therapy stops working, palliative care can become the main focus of care. Although the primary focus is enhancing quality of life, palliative care may even extend life. Individuals with advanced or terminal illness may face a myriad of treatment decisions such as choosing not to start life-prolonging interventions; withdrawing or discontinuing life-prolonging treatments; or completing advance directives. Individuals may be overwhelmed with the entire process and need a sounding board.

#### Box 1 Who Is Appropriate for Palliative Care?

Any one of the following situations may be sufficient to consult palliative care:

- *Surprise.* You would not be surprised if the patient died within 12 months.
- *Frequent admissions.* Repeated admissions for the same condition within several months.

(continued)

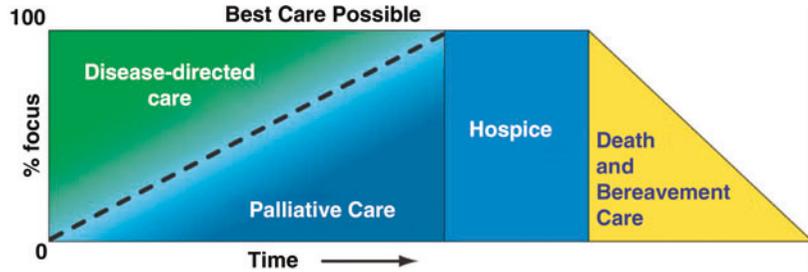
- *Complex symptoms.* Admission for difficult symptoms or psychological need.
- *Complex care requirement.* Functional dependence or complex home support needed.
- *Failure to thrive.* Decline in functional status, weight, or ability to care for self.
- *Advance care need.* No history of completing an advance care directive or having a discussion about end-of life care preferences (e.g., do not resuscitate, do not intubate (DNR/DNI).
- *Limited social support.* Family stress, chronic mental illness, lack of caregivers.
- *Limited prognosis.* Metastatic or locally advanced cancer, hip fracture with cognitive impairment, or out-of hospital cardiac arrest.

Excerpted from Weissman and Meier (2011)

Palliative care aims to help patients and families make difficult medical decisions that enable them to work toward their goals, especially as outcomes become more uncertain. These advance care conversations can include offering basic information about illness and the dying process, identifying medically ill persons' and their families' values and goals for living and dying, clarifying treatment options, obtaining advanced directives, and evaluating factors that can influence decision-making and decisional capacity (e.g., depression, pain, religiosity, value of quality of life, fear of dying process, cognitive impairment, and the influence of family members).

Palliative care also includes "end-of-life care," which might involve referral to a formal hospice program, as well as support of the family through the bereavement period. In the USA, hospice care is often linked to the specific programs offered under the Medicare Hospice Benefit and Medicare is the primary source of payment for hospice care. Individuals receiving hospice care must typically forgo active disease-directed therapy for the

**Palliative Care,**  
**Fig. 1** Model of Palliative  
 Care



terminal illness, though interventions intended to maximize quality of life are continued and individuals can receive disease-directed treatment for medical problems other than the terminal illness under Medicare. Furthermore, if an individual's condition stabilizes or improves, he or she can disenroll from hospice care and return to regular Medicare coverage. In addition, a new pilot program called the Medicare Care Choices Model allows Medicare beneficiaries who qualify for coverage under the Medicare hospice benefit and dually eligible beneficiaries who qualify for the Medicaid hospice benefit to receive palliative care services and disease-directed care simultaneously.

The overall number of patients and families served by hospice has increased over the years, as have the proportion of individuals served with noncancer diagnoses and those living in skilled nursing homes.

Palliative care can occur across the entire continuum of care: the treatment-intensive hospital setting, long-term care facilities, outpatient specialty medical clinics, and home-based programs. In addition, hospice services can be provided in the home, nursing homes, residential facilities, or inpatient units. However, few hospitals offer specialized outpatient Palliative Care services, and when they exist, providers are typically part time and focused primarily on cancer care, despite the growing evidence that outpatient palliative care can improve satisfaction with care, improve symptom control/QOL, reduce care utilization, and lengthen survival (Rabow et al. 2013). Similarly, although nursing homes may provide hospice/palliative care, the focus may be on end-of-life care, through a contract with community hospice agencies, rather than embedded throughout the fabric of care.

## Who Provides Palliative Care?

Palliative care can be provided as a specialty consult service or as part of basic primary medical care. Ideally, both primary care practitioners and specialists who care for seriously ill patients can provide basic palliative care (e.g., basic pain and symptom assessment and management, advance care planning) in the routine course of providing health care to patients at all stages of serious illness. In reality, not all medical providers are trained to provide even basic palliative care, although this situation is slowly changing. In cases where symptom management or family dynamics are more challenging, patients and/or family members frequently require the added services of palliative care specialists. Specialist palliative care providers are those clinicians who have received formal specialty training and appropriate credentialing in the field and whose work is primarily involved with palliative care. At present, physicians can be board certified in hospice and palliative medicine, and nurses can be certified in hospice and palliative nursing. Social workers and chaplains can obtain specialty credentials in hospice and palliative care. In the USA, to date, there is no formal certification for specialty practice in palliative care for psychologists, although there are a small number of postdoctoral fellowships that offer advanced training for psychologists in this area.

Most commonly, specialty palliative care is provided in hospital settings by palliative care consult teams composed of a physician, nurse/nurse practitioner, social worker, and chaplain, though the teams may be expanded to include a wider range of professionals or, in contrast, be reduced depending on resources and patient volume. For example, programs in nonhospital

settings or in smaller medical centers may have relatively few disciplines represented and are much less likely to include psychologists. Palliative care consult teams assist the primary treatment team with goals of care discussions, treatment planning, symptom management, emotional and spiritual support, and communication among and between medically ill individuals, family members, and health care providers. The palliative care consult team also may help initiate referrals with community hospice or home care agencies depending on treatment goals.

### **Beneficial Outcomes of Palliative Care**

Palliative care is associated with increased patient and family satisfaction with care; reduced symptom burden, improved bereavement adjustment; and sometimes longer lives than similarly ill patients who do not receive Palliative Care. Palliative Care also is associated with cost savings which are achieved through earlier intervention, reductions in emergency department visits, ICU stays, and hospital readmissions (Higginson and Evans 2010).

Despite these outcomes, many individuals do not experience comprehensive hospice and palliative care. This result is a function of financial disincentives, a fragmented care delivery system, time pressures that limit communication, lack of service coordination across programs, and limited training (Institute of Medicine [IOM] 2015). These issues can result in frustration among professionals at the mismatch between their training and the complex needs of patients; a high, escalating financial price, which includes costs for interventions that many people near end of life do not want; and a perception that the health care system is not designed to meet individuals' most pressing needs and priorities, many of which involve not medical care but social services.

### **Areas of Focus in Palliative Care**

#### **Physical Symptoms**

*Pain.* Adequate pain control is one of the greatest concerns of seriously and terminally ill patients, and fortunately, effective pharmacological

interventions exist. However, despite concerns about unmanaged pain, patients may be hesitant about pain control. Individuals may have particular beliefs about pain that affect its management, such as it should be experienced and tolerated because it is retribution for past misdeeds, a characterological deficit if one cannot bear it, or simply an indication of if/how the illness is progressing. In addition, physicians may underestimate pain, if there is a history of pain and/or substance use which can increase medication tolerance. Alternatively, physicians may overestimate the contribution of psychological factors to pain and thus undertreat pain. Non-pharmacological interventions seek to decrease individuals' perception of pain by reducing pain intensity and increasing tolerance, building self-efficacy and perceived control in managing pain, and decreasing anxiety. Effective interventions include exercise and positioning, massage, education, cognitive-behavioral therapy, mindfulness-based stress reduction, and meditation.

*Dyspnea.* Patients with dyspnea describe feeling like they are being smothered or suffocated, that their chest feels tight, their breathing is rapid, and they cannot get enough air or stop thinking about their breathing. The course of dyspnea fluctuates such that patients can have periods of increased or decreased difficulty breathing, and it is a symptom of chronic lung diseases (COPD), heart failure, advanced cancer, as well as diseases with significant muscle loss such as multiple sclerosis and amyotrophic lateral sclerosis.

Opioids are the most well-studied and used pharmacological treatment to manage dyspnea, and the evidence is largely supportive of their efficacy (Kamal et al. 2011). Nonpharmacological interventions also are effective. Using a fan to provide a cool breeze on a person's face reduces dyspnea. Psychoeducation about the feeling of suffocation compared to physiological risk of suffocating can be helpful. Cognitive interventions aimed at identifying and managing automatic thoughts related to suffocation that arise during periods of dyspnea, as well as relaxation strategies, particularly breathing retraining, can reduce the distress caused by breathlessness.

*Fatigue, Decreased Energy, Weakness.* Fatigue is characterized by weariness or exhaustion resulting from physical or mental exertion. It can cause emotional distress both from the significant functional changes and limited ability to engage in daily activities but also from the meaning attributed to the symptom – e.g., that one’s disease is progressing, that one is helpless and useless and no longer capable of doing anything one once did. Strategies to accommodate fatigue can focus on pacing activities, alternating physical activity with rest, trying to reduce the demands of everyday living, and modifying pleasurable activities or identifying new ones that can provide the same function with less physical demands.

*Delirium.* Delirium is a disorder of consciousness which presents as hyperactivity (increased arousal, agitation, hallucinations, day-night reversal), hypoactivity (withdrawal, lethargy, reduced arousal), or mixed. Delirium can be distressing for the individuals themselves, their family members, and treatment providers. Agitation can be particularly troubling to families, yet they may feel ambivalent about aggressively managing this symptom if it means sedating individuals and eliminating the possibility of meaningful communication.

Terminal delirium is highly prevalent in the advanced stages of dying and typically is refractory to intervention, which may be a function of nonreversible causes such as tumor burden, renal/hepatic failure, or vascular complications. However, the etiology of delirium often is multifactorial, and potentially reversible causes should be considered such as urinary tract infections, constipation, pain, or medications (e.g., opioid toxicities). Even in terminal delirium, delirious individuals may continue to have periods of relative lucidity, and family should be encouraged to take advantage of that time.

Nonpharmacological interventions include maintenance of structure/routine, presence of familiar belongings or people, reduction or elimination of noise or excess stimulation, and reassurance (e.g., that the patient is safe, being well cared for, not challenging or minimizing delusions or hallucinations).

## **Psychosocial-Spiritual Symptoms**

*Loss and Grief.* Individuals with advanced or terminal illness often experience a myriad of losses – loss of health, function, independence, autonomy, control, predictability, mental clarity, sense of purpose or meaning, status in the family, future hopes and dreams, and a sense of normalcy. Grief over these losses is normative and can manifest in waves of emotion, including anger, sadness, irritability, and distractibility. How individuals make sense of loss is critical to adjustment. Medically ill individuals and their families may benefit from exploring the meaning and impact of current or anticipated losses in order to help them create new meaning in the face of adversity. Even if new meaning cannot be found easily, sharing one’s sorrow and loss lessens the isolation of the experience.

*Bereavement.* Palliative care supports individuals and their family members throughout the disease process and into bereavement. Individuals may experience normal grief responses as distinguished from complicated or Prolonged Grief. Prolonged Grief is characterized by distressing and functionally disabling symptoms including intrusive thoughts and images of the deceased person; painful yearning for his/her presence; and some combination of shock and emotional numbing, mistrust, anger, diminished sense of self and meaning in life, difficulty accepting the loss, or avoidance of reminders of the loss. Risk factors for prolonged grief include secondary stressors (e.g., financial strains); multiple, concurrent losses; circumstances of the death such as lack of preparation or hospital death; interpersonal factors; and psychological vulnerabilities. Interpersonal factors encompass the degree to which family members feel close to, or dependent on, or define themselves by their relationship to, the ill person, or experience unresolved family issues. Factors that can be protective against complications in bereavement include an ability to make sense of loss, find personal meaning or compensatory benefit in the experience, an ability to regulate one’s emotional state, spirituality, and general resiliency characteristics such as self-esteem, hardiness, and positive expectancies.

Psychoeducation and support for normative grief (for those individuals seeking support) and referrals for specialized treatment when individuals experience complications in bereavement are helpful. Approaches include Complicated Grief Disorder treatment (Shear et al. 2005), narrative-based interventions (Neimeyer 2001), cognitive behavioral therapy (Boelen et al. 2007), grief therapy (Worden 2008), and Family Focused Grief therapy (Kissane and Bloch 2002).

*Existential issues.* Often as a result of the multitude of losses, individuals' basic sense of who they are is threatened. Many individuals with advanced illness experience a diminished sense of dignity, believe they are a burden to others, or express a waning will to live and a growing desire for death. Perceived burden is associated with loss of dignity, suffering, depression, and a desire for hastened death (McPherson et al. 2007). Individuals can experience spiritual or existential angst, crisis of faith or hopelessness, questions of meaning, or guilt. Medically ill individuals' tasks (which can be facilitated) include identifying aspects of their identity that transcend the illness or physical decline and seeing themselves for the individuals they have been, rather than the disease with which they live. Fruitful areas to explore include religious/spiritual beliefs, evaluations of self-worth, sources of meaning and purpose, ways to continue to contribute that accommodate the illness, things that the ill person values, and one's legacy. Ethical wills or legacy documents – a document in which the individual communicates personal values and beliefs, life stories and lessons and advice with the intention of passing them on to another generation – can be particularly useful to this end. Therapeutic approaches such as Life Review, Acceptance and Commitment therapy, Meaning-Centered Group Psychotherapy, and Dignity Therapy also can be useful. See LeMay and Wilson (2008) for a comprehensive review of treatments for existential distress in advanced illness.

### Family Systems

In palliative care, the family, defined as anyone with whom the patient shares strong emotional ties, whether or not they are biologically or legally

related, is the unit of care. Illness impacts families along the disease continuum, from diagnosis to death, and members must integrate the experience of the patient's illness into their ongoing lives. Illness can trigger changes in roles, relationships, communication, and finances, and family members may experience conflict over these changes. In addition, families may struggle with how to assist the ill person in maintaining his or her identity and place within the family system while also accommodating the individual's shifting roles and needs. Family members may have difficulty making sense of treatment, may have difficulty tolerating the ambiguity and uncertainty regarding prognosis, and may be avoidant of planning for life after the person dies. Moreover, families vary in their ability to communicate effectively about distressing issues, to make decisions collaboratively, and to remain committed to one another through transitions and crises. Some families are prone to conflictual patterns of interaction due to long-standing problems such as substance abuse, physical/sexual abuse, or untreated mental illness. These long-standing conflicts may be exacerbated by the stress of serious, life-limiting illness.

Palliative care often involves facilitating family meetings, and psychologists should be familiar with how to facilitate them. Palliative care requires being able to identify areas of conflict for the family, to discern the family's ability to tolerate and resolve conflict, and to modulate chronically conflictual patterns of interaction that may prevent the family from participating productively in collaborative medical decision-making on behalf of the patient. Family-centered treatment approaches such as Medical Family Therapy and Family Focused Grief Therapy, which capitalize on evidence-based family assessment in order to help families develop coping resources in the face of illness-related changes in the family, can be helpful.

Families also may be stressed by unfinished business – both practical – such as wills that are not updated, final arrangements that are incomplete – or emotional – such as unrepaired relationships or limited legacy-building activities. Individuals with advanced, life-limiting, or

terminal illness and their families can be assisted with saying what they still need to say and doing what is important to them. Byock (2004) offers a helpful framework for this work, building on the fundamental tenet that while people cannot undo the past, they can express forgiveness, gratitude, and affection, thereby increasing the likelihood of healing and reconciliation.

### Psychopathology

*Mood and Anxiety.* Major Depressive Disorder among persons with advanced disease ranges from 5% to 15% and varies depending on the patient population, type and severity of physical illness, and method and timing of assessment (Hotopf et al. 2002; Walker et al. 2013). When including clinically significant depressive symptoms or Adjustment Disorders, the rates increase to 20–50% among patients in palliative and hospice settings (Derogatis et al. 1983; Rayner et al. 2011).

Treatment of mood disorders at the end of life should include aggressive management of the underlying medical illness and associated physical symptoms as well as the mood disorder. The overarching goals are to manage the psychiatric symptoms, strengthen coping with the disease and associated changes, reduce helplessness and hopelessness, promote meaning-making, and improve quality of life. Cognitive-behavioral therapy (CBT) has been found to reduce depressive symptoms in patients with advanced cancer (Williams and Dale 2006) as has Supportive-Expressive therapy (Kissane et al. 2007). Cognitive therapy also has been found to reduce depressive symptoms as well as fatigue, insomnia, and anxiety in women with metastatic breast cancer (Savard et al. 2006). Mindfulness-based stress reduction meditation seems to be a useful approach in managing depressive symptoms in people with cancer (Garland et al. 2007).

Prevalence of anxiety disorders in individuals with advanced and terminal illness ranges from 2% to 30% (Kadan-Lottick et al. 2005; Roth and Massie 2007). Medically ill individuals often experience anxiety in response to symptoms of the disease as well as uncertainties and fears inherent in living with life-limiting or terminal illness.

They may fear medical interventions, treatment, or particular symptoms and may worry about their capacity to cope with those symptoms. They may fear incapacity, dependency, or disfigurement and may have specific fears about dying, engendered in part from past experiences with the death of significant others. They may fear past transgressions and being rejected or abandoned. They may be concerned about how their loved ones will cope after they are gone. They may worry about financial, legal, and practical matters and fear not having time to complete their affairs. They may fear nonexistence or the afterlife.

Assessment of anxiety in individuals with advanced or terminal illness is complicated by the fact that physical causes of anxiety can be difficult to distinguish from psychological ones. Physical symptoms used to diagnose anxiety and panic may be present as a part of the normal dying process. In addition, anxiety symptoms may reflect a diagnosable disorder, normative fears, or existential suffering and are likely to co-occur with depression and/or delirium. As with depression, it may be helpful to focus on cognitive symptoms such as derealization, depersonalization, and fears of going crazy, generalized worries or worries about future panic attack. Treatment of anxiety disorders includes aggressive management of symptoms associated with the underlying physical illness as well as anxiety. Cognitive restructuring, relaxation training, and coping skills rehearsal have been associated with reduced anxiety and psychological distress in individuals with advanced cancer. Supportive therapy and psychoeducation also are effective in reducing anxiety symptoms.

*Post-Traumatic Stress Disorders (PTSD).* Individuals diagnosed with a life-threatening illness may be at increased risk for developing PTSD, with estimates ranging from 0% to 35% (Kangas et al. 2002). PTSD can impinge on factors important to hospice and palliative care – emotional and practical support, communication, life review, and unfinished business. Many individuals with PTSD are used to being isolated and detached and are wary of interpersonal relationships, particularly those with people in positions of authority. They have a high need for control and are avoidant of

trauma reminders. They may have difficulty communicating with care providers as direct, clear communication requires effective affect regulation and trust of others, both of which are difficult for persons with PTSD. The normal process of life review and attending to unfinished business for persons with PTSD at the end of life may induce anxiety, guilt, anger, or sadness when key memories are trauma related. Thus, individuals with PTSD may avoid the life review process in order to avoid or suppress reminders or feelings.

Standard treatments for PTSD have limitations for individuals at the end of life, particularly length of time both in terms of duration of treatment and length of individual sessions (e.g., prolonged exposure) and the likelihood of increasing distress in the short term when individuals may have only a relatively short time to live. Pilot studies of prolonged exposure with older adults look promising but have not been replicated with individuals with advanced illness (Thorpe et al. 2012). A model proposed by Hyer and Woods (1998) for treatment of PTSD in older adults and adapted by Feldman (2011) also has potential application to the treatment of PTSD at the end of life. In this multistage model, treatment begins by addressing short-term concerns, then proceeds to longer-range concerns should the medically ill persons live long enough to benefit from addressing such issues. Supportive-expressive therapy in combination with psychoeducation has been associated with reductions in traumatic stress symptoms and mood disturbance in women with advanced breast cancer (Classen et al. 2001).

## Psychotherapeutic Approaches

Evidence-based psychotherapies for common mental health disorders (e.g., depression, anxiety, PTSD, substance abuse) are appropriate, but often the evidence available regarding the effectiveness of these approaches in palliative and hospice care settings is limited. Nonetheless, the evidence base supporting the use of Motivational Interviewing (e.g., Benzo et al. 2013; Brodie et al. 2008), Life Review (e.g., Ando et al. 2010),

Cognitive-Behavioral Therapy (e.g., Sage et al. 2008), and Acceptance and Commitment Therapy (e.g., Feros et al. 2013) in palliative care is building. Acceptance and Commitment Therapy is especially fitting given its focus on values-based living and living fully in the midst of suffering. Palliative care providers often find themselves needing to sit with and validate individuals' suffering while raising the possibility that life still can have meaning in the midst of suffering. Sometimes providers' greatest intervention is to bear witness to the suffering, validate the experience, and affirm the individual's humanity – complete with flaws, regrets, failings, goodness, resiliencies, and fundamental worth to others. Trying to "fix" or lessen the feeling can be invalidating in many circumstances.

Mental health providers will want to know about treatment approaches that address issues common to living with a life-threatening or advanced illness, such as existential distress (e.g., LeMay and Wilson 2008). Two promising approaches developed specifically for individuals with advanced illness to promote meaning-making, a sense of purpose, and a sense of self-worth are Meaning-Centered Group Psychotherapy and Dignity Therapy. Meaning-Centered group psychotherapy is based on the principles of Viktor Frankl's Logotherapy and seeks to enable individuals to make the most of whatever time they have remaining through an enhanced sense of meaning and purpose using a combination of didactics, discussion, and experiential exercises. Participants are assigned readings and homework tailored to specific meaning-centered themes. Dignity Therapy seeks to promote individuals' desire to go on living in the face of impending death by helping them identify and share meaningful, important aspects of their past and current lives, their hopes and wishes for their loved ones, and their life values and future goals. The content of sessions is recorded, transcribed, edited, and eventually compiled into a document that is then bequeathed to an identified loved one.

In addition to familiarity with specific psychotherapeutic approaches and the associated evidence base, psychologists also will want to be aware of some of the more unique or salient

aspects of providing psychotherapy with individuals with advanced or life-limiting illness. Psychotherapy typically demands cognitive flexibility, high distress tolerance, and a high tolerance for ambiguity. The pace can be rapid, and the manner in which issues unfold can be unpredictable. Rather than waiting to develop a therapeutic rapport with a patient, providers need to be comfortable “seizing the moment” and tackling difficult issues even when they have no prior relationship with a patient. Psychologists need to be able to critically evaluate and modify their practice to accommodate their patients’ medical status (e.g., fatigue, cognitive impairment, pain) and to help colleagues of other disciplines do the same. Like other forms of psychotherapy in medical settings, psychotherapy as part of palliative care will rarely follow the typical 50-min outpatient model in which individuals are self-referred and requesting assistance. Psychotherapy also may involve a greater pull for self-disclosure, though the guidelines for self-disclosure in the service of the patient still apply, and the potential for stronger emotional and countertransference responses is important to recognize. Psychotherapy in this setting necessitates reflective practice and a high degree of self-awareness, particularly because dying and death is a universal experience that evokes complex feelings in patients, families, and providers alike. See Qualls and Kasl-Godley (2010) for a discussion of psychotherapy at the end of life in the context of a broader discussion of roles for psychologists in end-of-life care.

### **Interdisciplinary Teams, Consultation, and Professional Self-Care**

Palliative care requires interdisciplinary collaboration, consultation, and good self-care. The needs of individuals with advanced, life-limiting, and terminal illness often are extensive and can exhaust the expertise and training of any one discipline. Thus, palliative care is interdisciplinary care. Providers need knowledge of types of teams – multidisciplinary, interdisciplinary, transdisciplinary – and models of team

development. It also helps to know about the function, structure, context, process, and productivity of these teams (Heinemann and Zeiss 2002).

Conflict is a normal aspect of interdisciplinary team function that must be brought to the surface and negotiated for the team to work effectively. Conflict can result from a variety of larger systems factors including scarcity of resources, the stress of large caseloads, and poorly managed organizational change. It can be exacerbated by problematic team dynamics such as deficiencies in team leadership, poor communication, or ambiguous team roles and responsibilities. If there is not adequate team communication, patients’ family dynamics can influence team dynamics, and vice versa, such that teams can unwittingly mirror or amplify family conflict.

Conflict can be negotiated effectively when providers have skills in managing team dynamics (Heinemann and Zeiss 2002) and knowledge about the factors that affect team organization, such as stages of team development, type of health care setting and its resources, professional training models and interdisciplinary roles, and attitudes toward palliative care and mental health. For example, when providers misunderstand each other’s qualifications and skill sets, or try to inappropriately constrain colleagues’ professional responsibilities, the team context (e.g., experience on the team), process (e.g., communication, navigating stressful situations), and productivity (e.g., coordinating patient care) often suffer. Another challenge for interdisciplinary teams is how to cover the salaries of all team members, especially in fee-for-service, noncapitated systems. Reimbursement for all services provided may not be possible, as not all members of a team may be able to bill for their work and having separate billing/reimbursement practices for every individual on the team is not viable.

In addition, palliative care providers need to be self-reflective, self-aware, and establish self-care practices; otherwise, they will not be able to sustain the work. Acting in ways that are inconsistent with values or having a chronic mismatch between providers’ expectations or needs and their work settings (e.g., regarding workload, control, values, fairness, interpersonal relationships)

may be a particular risk for burnout. Equally important is awareness of ways to maintain psychological health such as self-compassion and mindfulness/meditation practices.

## Summary

Palliative care is specialized care for people with a serious illness. It can be provided at any point in the trajectory of a serious illness and ideally begins when a serious illness is diagnosed. Palliative care also includes end-of-life care, which might involve referral to a formal hospice program, as well as support of the family through the bereavement period. Throughout the course of illness, the focus of palliative care is to alleviate physical, psychosocial, and spiritual suffering; enhance quality of life; manage symptoms; and offer comprehensive, interdisciplinary support to the patient and family.

With physical, psychosocial, and spiritual symptom relief at the heart of palliative care, it is imperative to understand trajectories of common diseases and symptoms experienced by palliative care patients (e.g., pain, fatigue, dyspnea, delirium) and be aware of approaches to symptom management, both medical and psychological. In addition, common psychosocial and spiritual challenges range from normative sadness about loss and change to existential angst about meaning and purpose to development or exacerbation of psychopathology, including major depression or anxiety. In addition to reducing distressing symptoms, palliative care also promotes well-being, through mobilization of support, resilience, perspective-taking, and meaning-making.

The comprehensive focus on patient, family, and medical and emotional symptoms leads to greater patient and family satisfaction with care, reduced symptom burden, improved bereavement adjustment, and sometimes longer lives than similarly ill patients who do not receive palliative care. Palliative care also is associated with cost savings which are achieved through earlier intervention, reductions in emergency department visits, ICU stays, and hospital readmissions.

## A Privileged Responsibility

Palliative care offers unique opportunities to change lives for the better, including our own. By helping seriously ill individuals and their families find connection and healing in the midst of medical suffering, we ourselves are privileged to find deeper meaning in our own lives, personally and professionally. We need to recognize the importance of establishing core competences in basic palliative care with the understanding that knowledge and skills are not enough. We must ask ourselves, "In what ways can we be a part of the change that we want to see happen?". "What can we do, in our respective disciplines, as researchers, clinicians, educators and policy advocates, to shape the field of palliative care such that reliable, accessible, quality palliative care is universally available?".

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## Parents' Retirement Processes, Role of Children

Marleen Damman  
 Netherlands Interdisciplinary Demographic  
 Institute (NIDI-KNAW), The Hague,  
 The Netherlands  
 University Medical Center Groningen, University  
 of Groningen, Groningen, The Netherlands

### Synonyms

Intergenerational relationships; Kids; Retirees; Withdrawal from employment; Work role exit process

### Definition

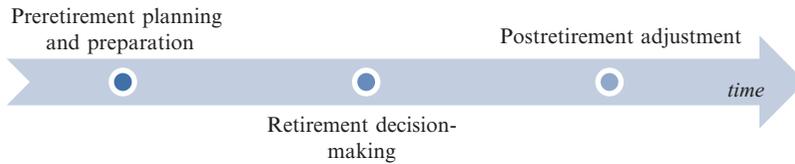
This contribution focuses on the role that children play in their parents' retirement processes. The central question is: To what extent and how do children affect the retirement processes of their parents? Theoretical approaches, empirical research findings, and potential directions for future research on children-retirement linkages are discussed.

## Introduction

The aging of populations in many developed countries and its consequences for public finances, pension systems, labor markets, and organizations has put the topic of retirement high on both policy and scientific agendas. Labor market policies in numerous countries are nowadays focused on mobilizing available labor reserves and prolonging the working lives of older individuals: "Live longer, work longer" is a commonly used expression (OECD 2006). In light of these developments, insights are needed into the factors that affect retirement-related decisions and experiences. Why do some people retire early and others continue working until – or even beyond – the public pension age? How do individuals experience this transition? Why is adjustment to retirement highly difficult for some and fairly easy for others?

The current contribution focuses on the role that children play in the retirement processes of their parents. Generally, two ways can be distinguished in which children can be of influence (Szinovacz 2012). Firstly, the life situations of children may serve as anchor points for the retirement decisions and experiences of their parents. For example, parents may decide to delay their retirement until their children are no longer financially dependent. Secondly, children may be actively involved in the retirement processes of their parents, thereby shaping their parents' decisions and experiences. Children could, for instance, talk with their parents about retirement or provide support in other ways to ease the transition into retirement. Even though children are important members of the social networks of older individuals, the role of children has only received limited attention in retirement research thus far.

This entry will start with a general discussion about retirement research, in which attention will be paid to the definition and conceptualization of retirement and its predictors. After that, the two ways in which children may influence retirement processes – i.e., because of their life situations or by being actively involved in these processes – will be discussed in separate paragraphs. Thereby, attention will be paid to both theoretical approaches and empirical research findings. The entry will



**Parents' Retirement Processes, Role of Children, Fig. 1** Schematic representation of the retirement process (Based on Shultz and Wang (2011))

conclude with a discussion of potential directions for future research.

### Understanding Retirement Processes

Retirement research is a multidisciplinary study field. Research on retirement has been reported in the economic, demographic, gerontological, psychological, and sociological scientific literature. The definition and measurement of retirement differs largely between studies and disciplines. As Ekerdt (2010) described in a recent overview of the literature, the “designation of the retirement status is famously ambiguous because there are multiple overlapping criteria by which someone might be called retired” (p. 70). Retirement can refer to receipt of retirement income, leaving the labor force completely (or partly) during late careers, leaving one’s main employer, self-assessment of being retired, or combinations of these various characteristics (Denton and Spencer 2009). Most researchers would agree, however, that retirement “relates to withdrawal from the paid labour force” (Denton and Spencer 2009, p. 64).

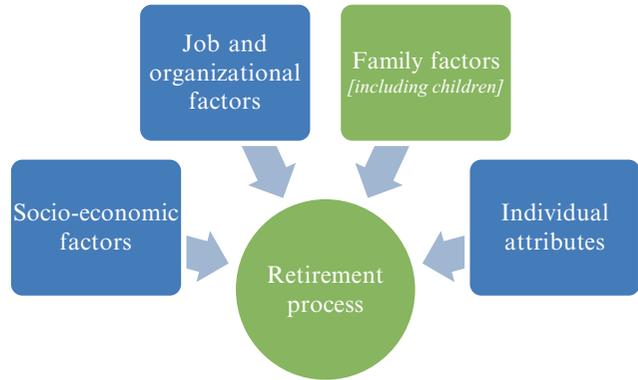
Generally, retirement is conceptualized as being a process taking place over a longer period of time (see Fig. 1). The retirement process starts with a rather distal preretirement planning and preparation phase, in which individuals start thinking, talking, and reading about retirement. After that, if retirement comes closer, older individuals start the retirement decision-making process, in which they decide how and when to retire. Finally, after making the transition into retirement, there is the postretirement adjustment process, in which individuals have to deal with the loss of the work role and need to develop a satisfactory postretirement lifestyle (Shultz and Wang 2011). Even though the consensus is that retirement is a longitudinal process, empirical studies often focus on just one aspect

of the retirement process. Where economic, demographic, and sociological studies often focus on explaining differences in retirement-related behaviors and states (e.g., actual retirement timing), psychological and social-gerontological studies often focus on more subjective processes surrounding the act of retirement (e.g., adjustment to retirement).

Traditionally, for understanding variation in retirement processes, retirement research has focused on older individuals’ own characteristics. For example, it is well known that the financial resources of older individuals and their health situation are crucial factors shaping retirement decisions (Jex and Grosch 2012). Increasingly, however, contextual factors are taken into account as well, which are related to the growing popularity of the “life course perspective” in the gerontological literature. The life course perspective proposes that life transitions – such as retirement – are contingent upon the social contexts in which the transitions occur (Settersten 2003). It takes a multilevel perspective on the individual life course: historical time and place, social norms, the lives of other individuals (i.e., “linked lives”), and earlier life experiences are all proposed to be contextual factors that shape life transitions and experiences. A recent review of the empirical retirement literature by Wang and Shultz (2010) detects – in addition to individual attributes – three central groups of empirically examined precursors of retirement processes: macrosocioeconomic factors (e.g., economic conditions, social security system, social norms about retirement), job and organizational factors (e.g., job characteristics, job attitudes, age stereotypes), and family factors (e.g., marital status, partner support, dependent children). The current entry focuses on this last group of factors – family factors – and more specifically on the role that children play in their parents’ retirement processes (see Fig. 2).

### Parents' Retirement Processes, Role of Children,

**Fig. 2** Predictors of the retirement process (Based on Wang and Shultz (2010))



### Impact of the Life Situation of Children on Their Parents' Retirement Processes

The first way in which children may affect retirement processes of their parents is by their life situations. Both states in the lives of children (e.g., being financially dependent) or events in the lives of children (e.g., having children themselves) might be of importance. To what extent and how can differences in retirement processes of parents be explained by the life situation of their children? Even though the life course perspective points out that children may affect retirement processes, it offers few concrete theoretical expectations about how or why this might be the case. Therefore, research on predictors of retirement often – either implicitly or explicitly – applies a rational choice or resource perspective to formulate hypotheses.

#### Theoretical Perspectives

From a rational choice perspective, individuals are assumed to make decisions regarding work and retirement based on information they have about their current situation and their expected future situation in retirement. Simply said, it means that “people will attempt to make decisions in such a way that they will maximize their long-term outcomes while minimizing their costs” (Jex and Grosch 2012, p. 275). The individual’s financial situation, health, work context, leisure activities, and also the family situation (including children) can all form important “costs” or “benefits” that either push individuals away from work or pull them into retirement. Also for explaining differences in adjustment to retirement, these various groups of resources can be expected to play

a role. From a resource-based dynamic perspective, the ease of adjusting to retirement is hypothesized to be the direct result of the access individuals have to resources and changes in these resources over time. The more resources older individuals have to fulfill the needs they value in retirement, the fewer difficulties they will experience adjusting to retirement (Wang et al. 2011).

Having children and events in the lives of children may shape the resources of their parents surrounding retirement. On the one hand, children might affect the financial situation of their parents and consequently their retirement decisions and experiences. Having children might negatively affect the acquisition of pensions over the life course – especially among women – and might therefore limit the financial opportunities to retire relatively early. Moreover, having financially dependent children during one’s late career might affect retirement processes, because it limits the financial leeway individuals have to make retirement decisions and to shape their lives in retirement in their preferred way. Financial dependence of children can therefore be expected to result in a delay of retirement timing, to make adjustment to retirement more difficult, and to increase the likelihood of engagement in bridge employment (i.e., paid work after retirement from a major/longer-term job).

On the other hand, the situation and events in the lives of children might shape the social situation of their parents during late careers, which could also affect retirement decisions and experiences. For instance, having relatively young children in the household might make adopting a

retiree identity not yet feeling appropriate and therefore might result in a delay of retirement timing. Becoming a grandparent can rather be expected to increase the relative attractiveness of retirement. Having grandchildren at a younger age might make individuals feel older than their peers without grandchildren, making the retiree identity more appropriate and attractive. Moreover, spending time with one's grandchildren might form an attractive outlet for activities in postretirement life. If early retirement options are present, care for grandchildren might therefore be a motivation for grandparents to leave the labor force relatively early.

### Empirical Findings

In empirical studies aiming to explain differences in terms of retirement timing, adjustment to retirement, or bridge employment, the role of children has only received limited attention thus far. Children's characteristics are often – if they are taken into account – included as control variables, especially in studies focusing on men. In studies on the retirement of women, children have traditionally received more attention, which is related to the traditional gender role division where paid work was central in the lives of men, and housework and care tasks were central in the lives of many women. Given the popularity of the life course perspective in the social-gerontological literature, attention for the role of children in retirement processes seems to be growing. Increasingly, for instance, the relationships between fertility histories and retirement also receive attention in studies including men (Damman et al. 2011; Hank and Korbmayer 2013).

The measures that have been used to incorporate information about children in the statistical models are rather diverse. Next to basic measures of whether the studied individuals have children, or their number of children, also whether older individuals have dependent children, or children still living at home, are factors that are frequently taken into account. More detailed measures of fertility histories, such as the timing of having a first child in the life course, are factors that recently have received more consideration in the empirical literature. Findings from these studies

are, however, still rather fragmented and difficult to compare and yield conflicting conclusions (Szinovacz et al. 2012). Another factor that also recently started to receive more attention in the retirement literature is the transition into grandparenthood. Also here, empirical insights are still rather scarce, and more research would be needed to draw general conclusions.

The most consistent finding with regard to the impact of children on retirement processes concerns the role of dependent children. Having dependent children has been found to affect retirement processes in many different studies and country contexts, and it appears to influence diverse aspects of the retirement process. Recent reviews of the literature show that not only retirement timing is influenced by having dependent children (Wang and Shultz 2010) but also the ease of adjustment to retirement (Wang et al. 2011) and engagement in bridge employment (Wang et al. 2014; Beehr and Bennett 2015). Having dependent children has generally been found to decrease the likelihood of retiring early, to have a negative impact on retirement adjustment quality, and to be positively related to the decision to take on bridge employment. This is an important finding, particularly given the trend that the transition into parenthood has increasingly been postponed during the last decades and having relatively young dependent children in one's fifties and sixties is no longer unusual.

### Involvement of Children in Their Parents' Retirement Processes

The second way in which children may affect retirement processes of their parents is by being actively involved in these processes. For example, by talking with their parents about retirement or by offering emotional support in the transition to retirement, children could shape their parents' retirement decisions and experiences. To what extent are children involved in the retirement processes of their parents and how can potential differences be explained?

### Theoretical Perspectives

In the literature on retirement, limited attention has been paid to the involvement of children in

the retirement processes of their parents and its potential predictors. In the literature on intergenerational relationships, however, theoretical starting points can be found regarding the exchange of support between parents and their adult children, which is often referred to as “functional intergenerational solidarity.” Provision of support can be instrumental/practical (e.g., helping with household work), financial, or emotional in nature. Two central theoretical perspectives can be distinguished that have been used to provide insights into the question why parents and children provide each other with support: one based on altruism and another based on exchange (Kalmijn 2014).

In the first theoretical perspective, based on the principle of *altruism*, it is assumed that within families, individuals are willing to provide support to each other, in case the other is needing support. The well-being of the other is perceived to be a benefit that is taken into account by the individual who is providing support. By assuming that “meeting another person’s need makes that other person happier” (Kalmijn 2014, p. 392), it is expected that children will respond to the need for support of their parents. When applying this notion to the case of retirement, it can be hypothesized that the more support parents need surrounding their retirement transition, the more support they will receive from their children. Older individuals might differ, however, in the amount of support they need. For example, factors like retiring involuntarily and not having a partner to share the retirement transition with, have been shown to make postretirement adjustment more challenging (Wang et al. 2011). This might increase the need for emotional support of the children surrounding retirement and consequently can be expected to be related to a higher level of support received.

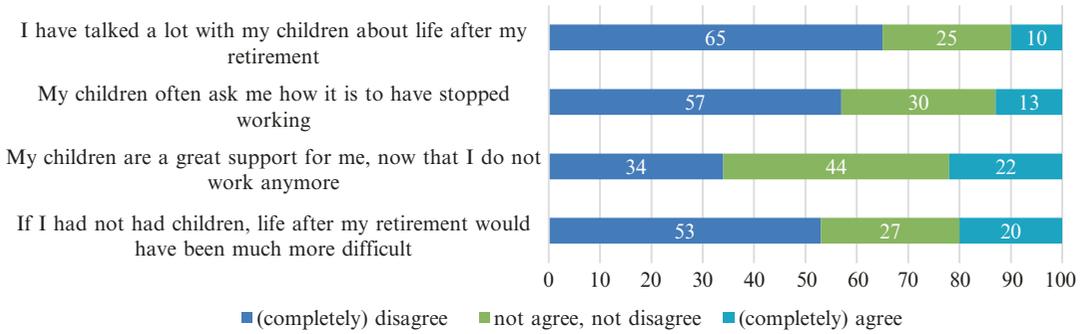
The second theoretical perspective is based on the principle of *exchange*. This theoretical perspective starts with the assumptions that (a) engaging in social relationships involves both costs and benefits for the individual and that (b) what individuals do in social relationships is motivated by the balance of these costs and benefits. Generally, it is argued that “the costs of

supporting someone else – in terms of time and energy – are compensated by the benefits of receiving support in return” (Kalmijn 2014, p. 390). The norm of reciprocity reduces uncertainty and ensures that individuals will receive something in return for the support they have given. This “payback” does, however, not need to take a similar form and does not need to take place immediately. When applying this theoretical perspective to the context of retirement, it can be expected that the more support parents provide to their children (e.g., by frequently taking care of the grandchildren), the more support they will receive from their children surrounding retirement.

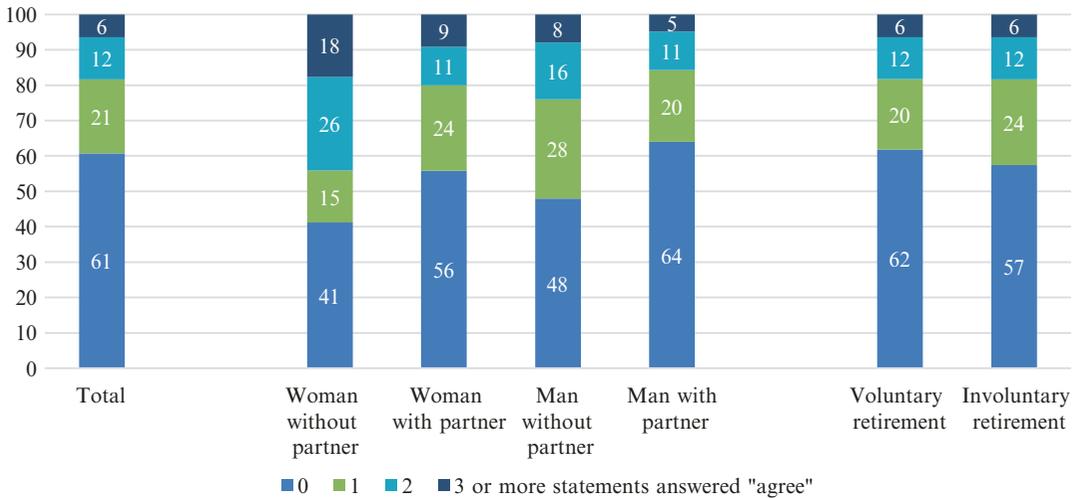
### Empirical Findings

Empirical insights on intergenerational support regarding retirement are limited. There are a few studies focusing on changes in terms of social contacts between parents and children surrounding retirement (Szinovacz and Davey 2001). Research that specifically focuses on the involvement of children in the retirement processes of their parents is still virtually absent, though. Data of the NIDI Work and Retirement Panel could, however, provide some insights regarding the extent to which parents talk with their children about retirement and perceive their children to be a major support in their retirement processes.

The NIDI Work and Retirement Panel is a three-wave panel study conducted in the Netherlands. Older individuals who were working in three private sector organizations and for the Dutch national government in 2001 were followed in their retirement processes over a period of 10 years. During this period, the majority of participants retired from work. In 2011, all fully retired participants who have at least one child – about 700 persons in total – were asked to respond to four statements about the role of their children in their retirement processes. The responses to these statements could provide an indication of the extent to which children are involved in the retirement transitions of their parents. It should be noted, though, that these responses only reflect the perceptions of parents in this respect. The mean age of the participants



**Parents' Retirement Processes, Role of Children, Fig. 3** Involvement of children in the retirement processes of their parents, responses of fully retired parents, *N* = 697 (percentages) (Source: NIDI Work and Retirement Panel 2011)



**Parents' Retirement Processes, Role of Children, Fig. 4** Involvement of children in retirement processes, level of agreement with four statements by gender, partner

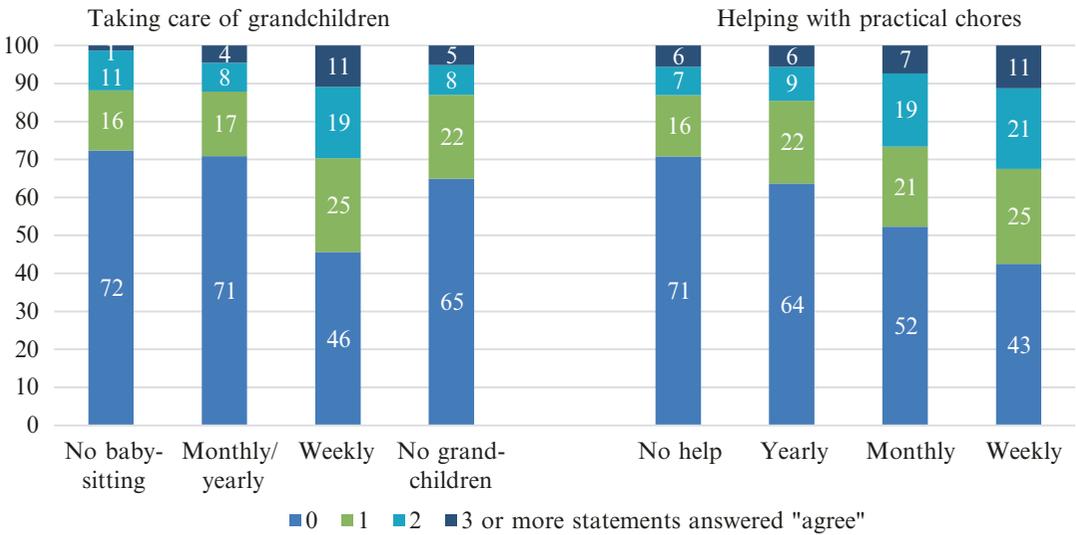
status, and voluntariness of retirement (percentages) (Source: NIDI Work and Retirement Panel 2011)

was 65 in 2011, and they were on average (early) retired for 5.5 years.

To what extent are children involved in the retirement processes of their parents? In short, only a minority of the studied retirees talk with their children about their retirement or experience their children as an important source of support in retirement. Figure 3 shows that only about 10% of the studied retirees have talked a lot with their children about life after retirement. A somewhat larger share, 13%, indicate that their children often ask about their experiences exiting the work role. About 22% of the retirees agree with the statement “My children are a great support for

me, now that I do not work anymore,” and one out of five retirees expects that life after retirement would have been more difficult if they did not have children. When combining the answers to the different statements, a similar conclusion can be drawn. Figure 4 shows the percentages of respondents that agree with none, one, two, or three/four of the statements. Only 6% of retirees agree with three or all four statements. About 61% did not agree with any of the statements, suggesting they do not receive much support of their children in their retirement processes.

Retirees appear to differ quite a lot in terms of the support they receive from their children in the



**Parents' Retirement Processes, Role of Children, Fig. 5** Involvement of children in retirement processes, level of agreement with four statements by frequency of

taking care of grandchildren, and helping with practical chores (percentages) (Source: NIDI Work and Retirement Panel 2011)

transition from work to retirement. How can these differences be explained? Interestingly, the amount of support received does not seem to differ much between men and women. What appears to play a role is whether the parent has a partner. Retirees who do not have a partner on average report a higher level of involvement from their children compared to parents who have a partner, as could be expected based on altruism theory. It might be the case that parents who do not have a partner need more support surrounding their retirement transition and that children respond to these needs. Other potential indicators of need for support surrounding retirement, such as involuntary retirement, are, however, not associated with involvement of children in their parents' retirement processes (see Fig. 4).

Additionally, as expected based on exchange theory, retirees who regularly take care of their grandchildren, or who often help their children with practical chores, are relatively likely to receive support of their children when transitioning into retirement (see Fig. 5). Especially retirees who are babysitting the grandchildren on a weekly basis report a higher level of involvement of the children regarding retirement as compared to those retirees who never

babysit. The differences between the other groups are relatively small, suggesting that babysitting only plays a role if it is done frequently. For practical chores, the responses also show the expected pattern: The more often parents help their children with household work or practical chores, the more likely they are to receive support in their retirement processes. It should be mentioned, however, that these results do not necessarily reflect the exchange principle. They can also be explained by other underlying factors such as the contact frequency between parents and children, family norms, or relationship quality.

Overall, this research example suggests that only a minority of retirees receive support from their children in the transition from work to retirement. It might be the case that children are not aware of the fact that retirement is an important life transition in which their parents might need some support. Alternatively, it might be the case that parents do not need much support during their retirement processes or do not need support from their children. They might rather search for support among individuals in a similar life phase, such as their partner, siblings, or friends. Further research is needed in this respect.

## Future Directions

The life course notion of “linked lives” proposes that close others in the social network of individuals – such as one’s partner, siblings, and children – will play an important role in shaping retirement processes. Whereas the role of the partner has received considerable attention in retirement research, the “field needs additional research about family-retirement linkages that extend beyond the marital unit” (Szinovacz et al. 2012, p. 480). To what extent and how do children affect the retirement processes of their parents? With regard to this question, retirement research has largely focused on the role of basic characteristics of children (e.g., having dependent children). Little is known about the active involvement and support of children in retirement processes. In this paragraph, four potential directions for future research will be discussed.

Firstly, the role of attitudes of children regarding retirement of their parents needs further examination. Even though prior studies have shown that feelings of the partner and the supervisor are important for understanding differences in retirement timing and the way in which retirement is experienced (i.e., being voluntary or involuntary), the feelings of children have received limited attention in empirical studies thus far. How do attitudes of children with regard to the retirement timing of their parents affect the retirement processes of the parents? And does this impact differ between parents who have children that still live at home, as compared to parents who have children that live on their own?

Secondly, the extent to which children are actively involved in the retirement processes of their parents requires further study, as well as its consequences in terms of postretirement adjustment and well-being. The empirical data of the NIDI Work and Retirement Panel suggest that only a minority of retirees talk with their children about retirement or receive emotional support from their children in the transition from work to retirement. Children seem to be likely to support their parents if support is exchanged and only seem to react to a limited extent to potential indicators of need for support surrounding retirement.

To what extent and how do the principles of altruism and exchange apply to intergenerational support provision during retirement processes? Further disentangling this puzzle in other research samples would be a valuable direction for future research.

Thirdly, the impact of the social context deserves more attention. The role that children play in retirement processes might, for example, differ between retirees that live alone or live with a partner, between individuals from different socio-economic groups, and between country contexts. Countries differ notably, for example, in the role that children play in retirement systems and cultures (Velladics et al. 2006), and therefore we should be careful with generalizing results from one specific country to other countries. Recent initiatives like the SHARE data (i.e., Survey of Health, Ageing and Retirement in Europe) offer opportunities to make between-country comparisons in terms of the role of children in retirement processes.

Fourthly, children might not only influence the retirement processes of their parents, but the retirement processes of the parents might affect the relationships with children as well (Szinovacz 2012), raising several questions for future research (Szinovacz et al. 2012). To what extent and how does retirement of the parents change the contact and quality of the relationships with their children? Do the expectations that children have about the support that parents provide to them (e.g., expectations about taking care of the grandchildren) change when their parents retire? Studying these questions would require a longitudinal and multiactor research design, in which older workers and their children are followed over a longer period of time.

Retirement is an important transition in the lives of older individuals, which “does not occur in a social vacuum” (Szinovacz 2012, p. 167). It can be influenced by the family and social network context and may shape the individual’s family context and social network too. Overall, research has shown that including family-related factors in models predicting retirement does not largely diminish the effects of well-established correlates of retirement but

rather improves model predictions (Matthews and Fisher 2012). For achieving a better understanding of retirement processes, children might therefore be important network members to take into account.

## Cross-References

- ▶ [Motivation to Continue Work After Retirement](#)
- ▶ [Retirement Planning and Adjustment](#)
- ▶ [Timing of Retirement](#)

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## Parkinson's Disease

Sarah E. Cook  
Duke University, Durham, NC, USA

Parkinsonism is a clinical syndrome involving problems with voluntary motor function, including development of a resting tremor, muscle rigidity, and slowed down motor movements. Parkinsonism as a syndrome can be present in multiple different neurological diseases. It can also result from the use of certain medications. Parkinsonism, when idiopathic or not due to any other cause, is called Parkinson's disease (PD), which will be the major focus of this entry.

While Parkinson's disease (PD) can develop in mid- to late adulthood, age of onset peaks around age 60 (Gunzler et al. 2011). PD affects approximately 1 out of 100 individuals over the age of

65 (Noyce et al. 2012). A meta-analysis of risk factors for developing PD conducted by Noyce and colleagues (2012) concluded that family history of PD confers the greatest risk, with history of pesticide exposure also increasing risk. This meta-analysis also suggested that history of smoking tobacco, consuming coffee, and consuming alcohol may reduce the risk of PD, although the mechanism by which they protect against PD is not well understood.

This entry will provide a broad overview of Parkinson's disease for nonphysician health service providers. First, the relevant pathology will be discussed briefly, including neuroanatomy, neurotransmitters, and neural circuitry involved in the clinical presentation of PD. This will provide a framework for understanding the common clinical presentation of PD, including both the neurological and cognitive signs and symptoms, which will be presented in the second and third parts of this entry, respectively.

## Parkinson's Disease Pathology

### Structures in the Basal Ganglia

Dysfunction of the basal ganglia, and to a lesser extent the cerebellum, is implicated in producing the neurological signs and symptoms associated with Parkinson's disease and other movement disorders that present with parkinsonism. The basal ganglia is a set of gray matter structures deep within the brain (i.e., subcortical), including the striatum (including the caudate nucleus and putamen), the globus pallidus (which is further divided into the globus pallidus interna and globus pallidus externa based on their position within the brain), the substantia nigra (which is further divided into the substantia nigra pars compacta and substantia nigra pars reticulata), nucleus accumbens, ventral pallidum, and subthalamic nucleus (Gunzler et al. 2011).

There is a typical order in which pathological central nervous system changes occur in individuals with PD (Williams-Gray et al. 2009), starting with subcortical changes and then cortical changes occur much later in the disease process. The initial noted change is loss of dopaminergic

neurons in the substantia nigra. This process is slow and according to Galvan and Wichmann (2008) may develop over the course of decades, with dysfunction of the substantia nigra projections to the putamen likely to occur prior to changes in the connections to other association areas. This progression may mirror the clinical presentation, as motor changes occur prior to non-motor changes, which will be described in more detail in the next section of this entry.

### Other Neuropathological Findings in Parkinson's Disease

In addition to the noted changes in the substantia nigra, there is also deposition of Lewy bodies in subcortical and brainstem structures, including the substantia nigra, locus ceruleus, nucleus basalis of Meynert, dorsal medial nucleus of the vagus nerve, and hypothalamus. However, the presence of Lewy bodies is not specific to PD, as Lewy bodies can be present in asymptomatic individuals (i.e., individual passed away prior to any clinical manifestation) and co-occur in 10–40% of individuals with pathologically confirmed Alzheimer's disease, and importantly some patients with PD do not have Lewy body deposition (Gelb et al. 1999). In addition, there are changes in the amount of available acetylcholine in the brain due to alpha-synuclein accumulation in the basal forebrain and ascending cholinergic pathways, which interferes with cognition and has been shown to be associated with onset of dementia in PD discussed in more detail in the last section of this entry (Kehagia et al. 2010).

### Function of the Basal Ganglia

Many of the basal ganglia structures are part of multiple important parallel neural circuits connecting different parts of the cortex; some of its function includes the initiation of and control of voluntary motor movement. This entry will only review in depth the motor circuit, which is involved in motor control and provides a framework for understanding the pathological changes that cause the clinical presentation of PD. Galvan and Wichmann (2008) and Wichmann and DeLong (2015) provide much more detailed summaries about the connections along with helpful

figures of the motor circuits, neurotransmitters, and structural issues related to PD if more comprehensive information is desired.

In the motor circuit, the putamen and caudate nucleus (striatum) receive excitatory inputs via glutamate from the cortex (primary motor cortex, premotor cortex, and the supplemental motor areas in the frontal lobes). There are two functionally distinct circuits at this point, the direct and indirect pathways. In the direct pathway, the projections from the caudate and putamen are inhibitory via  $\gamma$ -aminobutyric acid (GABA) and head to the globus pallidus pars interna and subthalamic nucleus pars reticulata which further project to the thalamus via GABA and back to the motor cortex via glutamate. The net effect of this is excitation, or an increase in motor activity, in a healthy individual. However, if there is a lack of dopaminergic neurons in the substantia nigra pars compacta firing excitatory dopamine on the striatum (caudate and putamen), as is the case in PD, the net activity in the direct pathway is reduced and therefore causes a reduction in motor activity (Wichmann and DeLong 2015).

In the indirect pathway, the projections from the caudate and putamen are inhibitory via GABA and head to the globus pallidus externa, then have inhibitory projections to the subthalamic nucleus via GABA, and then go to the globus pallidus pars interna and subthalamic nucleus pars reticulata with excitatory glutamate which further project to the thalamus via GABA and back to the motor cortex via glutamate. The net effect of this pathway is a reduction of motor activity in a healthy individual. However, if there is a lack of dopamine excitation in the substantia nigra firing on the striatum due to PD, the effect of the indirect pathway is an increase in activity in the indirect pathway, meaning *increased reduction* in motor activity. Taken together, the result of losing the excitation from dopamine in both the direct and indirect motor circuits causes the hypokinetic symptoms seen in PD, such as slowed movement (bradykinesia; 7).

While the motor circuit dysfunction provides understanding of what causes the slowed motor movements in PD, the two other parallel circuits that have projections to the striatum and

substantia nigra are responsible for the non-motor features of PD. The disruption of the prefrontal circuit is responsible for the cognitive changes, including problems with attention, working memory, and sequencing. The disruption of the limbic circuit is what can lead to problems with emotional regulation including impulsivity, compulsive behavior, and mood changes (Wichmann and DeLong 2015).

## Neurologic Presentation of Parkinson's Disease

### Diagnosis

While the pathological features of PD are loss of dopaminergic cells in the substantia nigra, the cardinal clinical features of PD include akinesia/bradykinesia (absent or slowed voluntary movement), resting tremor, muscle rigidity, and eventually postural instability later in the disease course (Gelb et al. 1999). There are some other characteristic motor signs that frequently are present in individuals with PD, including hypophonia (very soft voice), masked facies (blank or reduced facial expression), micrographia (small handwriting), shuffling gait, absence of arm swing when walking, and stooped posture (Gunzler et al. 2011). Clinical symptoms often appear only after a very large proportion (50–80%) of dopaminergic neurons is lost. Onset of symptoms is often asymmetrical, typically in an upper extremity, but usually eventually spreads and becomes bilateral. However, it should be noted that the asymmetric onset is not sensitive or specific for PD as other movement disorders can present this way (Gelb et al. 1999). In addition to the motor symptoms, there are non-motor symptoms that often occur in PD as well, including symptoms of depression or apathy, cognitive changes, autonomic disturbance, and/or sleep disturbance. The course of PD is slowly progressive but individually variable, with younger patients often seeing slower progression (Gunzler et al. 2011). Severity is often gauged by neurologists with one or both of the standard rating scales, the modified Hoehn and Yahr Scale or the Unified Parkinson's Disease Rating Scale (UPDRS).

Clinical diagnosis is made with history as well as physical and neurological examinations, usually by a neurologist. Careful attention to exclude any alternative explanations for the parkinsonism is necessary, as there are many other conditions that can present with parkinsonian features, including cortical basal degeneration (unilateral apraxia and reflex myoclonus often present), multiple system atrophy (prominent autonomic symptoms and ataxia), progressive supranuclear palsy (problems with vertical eye movement, falls early in disease course), Wilson's disease (dystonia, liver disease, Kayser-Fleischer rings in the eyes are present), and Huntington's disease (choreiform movements and family history). Once PD is suspected and treatment begins, confidence in diagnosis often increases, as idiopathic PD responds well to typical (levodopa) treatment, while symptoms often do not remit in conditions mimicking PD (Gelb et al. 1999).

In addition to these neurologic syndromes that can present with parkinsonism, patients may present with the same symptoms only to later discover that the symptoms are functional (i.e., psychogenic) and do not have a physiological cause, such as a somatoform or conversion disorder (Gunzler et al. 2011). Parkinsonism can also be drug induced by dopamine antagonists (drugs that block the action of dopamine), including neuroleptics. Many drugs that are used to treat psychotic disorders, such as clozapine (Clozaril) and quetiapine (Seroquel), can cause parkinsonism, with about half of cases showing symptoms in the first month of being exposed to the drug. It occurs more often in older adults and more likely in women than men. Drug-induced parkinsonism is more likely to present with bilateral symptoms rather than the typical asymmetrical onset, and most often symptoms will not progressively worsen as in the case with idiopathic PD. In drug-induced cases, the majority of individuals recover once the offending medication is stopped, although the time to recovery is variable and may take more than a year (Sustatia and Fernandez 2009).

Definitive diagnosis has traditionally only been available with examination of the brain post-mortem to look for the characteristic neuropathological changes described earlier. According

to Seifert and Wiener (2013), only about 80% of individuals with a clinical diagnosis of PD are found to have the diagnosis confirmed by post-mortem examination. In very recent years, the development (and US Food and Drug Administration approval) of an imaging technique has shown to be particularly useful in the differential diagnosis of movement disorders. The imaging technique is called DaTscan, a dopamine transporter single-photon emission computerized tomography (SPECT) scan in which I-123 ioflupane is injected which binds to dopamine. During the scan, the amount of transporter present in the striatum is visualized. As outlined in Seifert and Wiener (2013), there is a strong relationship between an abnormal scan and autopsy confirmed parkinsonian syndromes. However, while it has been proven to be useful in distinguishing essential tremor and drug-induced parkinsonism from PD (as there is not a loss of dopaminergic neurons in either), the DaTscan does not differentiate between the parkinsonian syndromes (e.g., PD, multiple system atrophy, progressive supranuclear palsy).

### Treatment

The gold standard treatment for PD is medication, which provides symptom relief but does not reverse the pathological changes that have already occurred (substantial loss of dopaminergic neurons in the basal ganglia) or prevent further deterioration. Medication is sometimes not started until PD symptoms, often tremor, begin to significantly interfere with functioning and quality of life as some individuals with PD develop dyskinesia (abnormal involuntary writhing movements) with long-term use of levodopa, the most commonly used class of medications for symptomatic relief of PD. However, recent research by Parkkinen and colleagues (2011) has concluded though that there is not a relationship between chronic use of levodopa taken during life and number of dopamine neurons found in the substantia nigra post-mortem, nor was there a relationship between levodopa and amount of Lewy body pathology. Therefore the medication is not suspected to increase or hasten the pathological process.

Several classes of medications are used to treat PD, including dopamine agonists (which increase the level of available dopamine in the brain, such as levodopa, ropinirole, pramipexole), beta blockers (propranolol), catechol-O-methyltransferase (COMT) inhibitors (which block the metabolism of levodopa, such as entacapone, tolcapone), and MAO-B inhibitors (which block an enzyme in the brain that breaks down levodopa, such as selegiline, rasagiline) (Gunzler et al. 2011). Further discussion regarding medication selection for particular symptoms is beyond the scope of this entry, but it is important to know that each type of medication class confers at least some physical side effects that can impact functioning (e.g., constipation, sedation, sleep problems, hyperkinetic movements such as dyskinesias or choreiform movements). Many also have psychiatric side effects. Most notably, the dopamine agonists can cause significant problems with impulse control (such as gambling or compulsive sexual behavior) and/or cause psychotic symptoms (hallucinations and/or delusions) (Gunzler et al. 2011). On the other hand, some of these medications can have a positive impact on cognition, which will be discussed more in depth in the last section of this entry.

Over time with disease progression, individuals with PD often find that their medication(s) is not providing the same benefit. Despite individuals with PD often having to take medication every few hours due to the short half-lives of many of the common drugs used to treat PD symptoms, usual complaints include wearing off of medication causing increasingly prolonged off periods between doses, sudden on/off changes in motor symptoms, and problems with hyperkinesia (e.g., choreiform movements, dyskinesias) during peak dose times (Gunzler et al. 2011; Massano and Garrett 2012). Due to these issues that disrupt functioning and quality of life, regimens may need to be frequently updated to increase symptomatic relief.

There have been non-medication approaches to PD treatment as well. Back in the mid-1900s, some ablative techniques targeting the basal ganglia were explored, and later thalamic targets were used. In more recent decades, for individuals

with PD who no longer gain adequate symptom relief with traditional medications and/or experience rapid wearing off of medications, the possibility of deep brain stimulation (DBS) surgery is often considered. DBS is a neurosurgical procedure that was approved by the US Food and Drug Administration in 2002 for treatment of PD in which the patient has an electrode that provides continuous electrical stimulation placed either unilaterally or bilaterally in the subthalamic nucleus or globus pallidus interna that is connected to a device implanted in the chest used for programming. This has been a favorable evolution in treatment as it is a less invasive treatment than ablations and can be modified as needed based on patient response; however, it does not appear to modify disease progression (Gunzler et al. 2011; Bronstein et al. 2011).

However, not all individuals with PD who have disabling symptoms that are treatment refractory with traditional medications will be deemed an appropriate candidate for DBS. Extensive research in recent decades has assisted with understanding what factors are important for good clinical outcomes, which has informed patient selection for DBS surgery. In a recent consensus statement on DBS (Bronstein et al. 2011), experts in this field agreed that a multidisciplinary approach to patient selection is indicated, including neurology, neurosurgery, neuropsychology, internal medicine, and sometimes psychiatry and/or other specialties. Those with the best outcome have advanced PD whose symptoms have responded very well to levodopa (dopamine agonist), are of younger age (but an exact age cutoff has not been established), are not cognitively impaired (presence of dementia is the most frequent exclusion criterion, but no exact test battery or score cutoffs have been established as guidelines), and have no or well-controlled psychiatric symptoms.

Outcomes of DBS are not universally positive. Some research has found differential outcomes depending on site of electrode, with patients having DBS implanted within the subthalamic nucleus (STN) demonstrating more problems than those with globus pallidus interna implants. According to the consensus review (Bronstein

et al. 2011), individuals with STN DBS have increased falls and can worsen speech. Apathy and impulsivity may worsen with STN DBS. In addition, verbal fluency and executive efficiency may be differentially worse in those with STN DBS, although the research to date has been equivocal (Massano and Garrett 2012). Furthermore, the benefit gained from DBS may not be permanently sustained even with regular programming adjustments because DBS does not alter the disease course, although Bronstein et al. (2011) suggest that multiple studies have generally shown effects for up to 5 years.

### **Neuropsychological Presentation of Parkinson's Disease**

Due to replacing dopamine with medication, some individuals with PD who consistently take levodopa may see mild cognitive benefit. Such research has compared newly diagnosed drug naïve and individuals with PD that are treated with dopaminergic medications or by temporarily withdrawing randomized patients from their medication regimens. Skills that have been shown to benefit from medications that increase available dopamine include cognitive efficiency, thinking flexibly, holding information in mind while manipulating it (i.e., working memory), and inhibiting a prepotent response. Other cognitive skills seem resistant to the effects of increasing dopamine (Kehagia et al. 2010).

### **Mild Cognitive Impairment in Parkinson's Disease**

Despite the potential cognitive-enhancing benefit of dopaminergic medications, many patients with PD complain about problems with focusing attention, multitasking, and sustaining attention over long periods. As the disease progresses, individuals with PD can experience increasing attention and memory problems which become more evident to those around them. As noted earlier, such changes are likely related to the neuropathological changes in PD. Specifically, the dopaminergic dysfunction leads to a dysexecutive syndrome while cholinergic changes can lead to changes in

memory and visuospatial skills (Kehagia et al. 2010).

One issue with defining criteria for cognitive deficits in PD is that as a group, the clinical presentation is heterogeneous, with often very little findings in those earlier in the disease, but then some have mild impairments and some have a clear dementia. Furthermore, assessment and interpretation of findings of individuals with PD is complicated by disease- and medication-related effects. For example, individuals with PD very often present with slowed motor movements (bradykinesia) and/or upper extremity tremor that impacts performance on speeded tasks, more so for motor responses, but also can be present for verbal speeded responses as well. Some medications used to treat PD can have sedating effects or have negative cognitive side effects, such as amantadine or the benzodiazepines. As discussed earlier, there are also non-motor features that individuals with PD can present with that could negatively effect cognition, including psychiatric features (such as depression or apathy) and/or sleep disturbance. It is optimal to have individuals with PD complete neuropsychological testing while in their usual medicated state, and therefore careful watch of the time by the neuropsychologist is necessary so that medications are taken as usual to attempt to prevent testing during an "off" time (Litvan et al. 2012). York and Strutt (2015) provide an excellent review of the common assessment measures used in the neuropsychological evaluation of individuals with PD.

While there has been some controversy regarding the use of the term mild cognitive impairment (MCI) for individuals with PD, the Movement Disorder Society (MDS) convened a task force in 2010 to discuss cognition in PD, which led to a systematic review of the literature (Litvan et al. 2011) as well as a set of criteria for what they termed PD-MCI (Litvan et al. 2012). The task force developed inclusion and exclusion criteria for PD-MCI so that there is a uniform criterion to assist with provider communication, patient care, and clinical trial outcomes research. Once the PD diagnosis has been formally established, the task force recommends formal neuropsychological evaluation early in the course

of the disease to establish a cognitive baseline. With that resulting data, the deficits can be examined to determine where on the continuum of cognitive status the individual patient falls.

In order to meet the criteria for PD-MCI, the individual with PD must have a noted gradual decline in cognition either by self-report, other reports, or observed by the health provider. Cognitive deficits on formal testing must be present. If only a brief cognitive screening was complete (e.g., the Montreal Cognitive Assessment or MoCA), the individual with PD must score in the impaired range. If a formal, comprehensive neuropsychological evaluation was completed, the individual with PD must demonstrate impairment on at least two tests, either both in one cognitive domain or at least one test in multiple cognitive domains. The definition of impairment is rather liberal, defined as either 1–2 standard deviations below same age peers, significant decline demonstrated on serial (longitudinal) evaluation, and/or significant decline from estimated level of premorbid functioning. Patients are excluded from PD-MCI if the cognitive impairment is likely best explained by another factor, such as delirium, stroke, depression, brain injury, or medication effects. Further, the neuropsychologist must determine that PD-associated features (e.g., bradykinesia, severe depression, fatigue) did not significantly interfere with performance on the neuropsychological evaluation (Litvan et al. 2012).

Individuals with PD are twice as likely to develop mild cognitive impairment (MCI) as healthy older individuals, with up to about 50% expressing mild cognitive deficits within the first 5 years after diagnosis (Kehagia et al. 2010). There has been a dearth of research examining cognition longitudinally in a well-characterized PD sample. From the review of the literature by the MDS task force (Litvan et al. 2011), there were only eight studies that met the inclusion and exclusion criteria that were included in the review. The mean cross-sectional prevalence of mild cognitive deficits was 26.7% with a range of 18.9–38.2%. This work also showed that the frequency of cognitive impairment increased with age and disease duration. Other research has also

demonstrated that there is a relationship between PD-MCI and late onset of disease as well as lower educational level. The search for biomarkers for cognitive impairment in PD is still in an early stage, although one study did find that the tau MAPT H1/H1 genotype was found to be a risk factor for PD-related dementia (Litvan et al. 2011).

### **Dementia in Parkinson's Disease**

Not surprisingly, having mild cognitive impairment in PD is a risk factor for later development of PD-related dementia. PD-related dementia is considered when significant cognitive deficits occur in two or more cognitive domains, and the deficits cause significant interference in everyday activities. Accompanying the significant cognitive changes, there can be problems with visual hallucinations (which may be a sign of more rapid cognitive decline and may have associated visuospatial and perceptual deficits on formal testing), depression or apathy, or anxiety (Kehagia et al. 2010). Dementia in PD is now more widely accepted as part of the disease process. However, dementia preceding motor changes or very early in the disease process should alert the clinician that another diagnosis should be considered (Aarsland and Kurz 2010), particularly with dementia with Lewy bodies on the differential.

A study by Janvin and colleagues (2006) found that 62% of PD-MCI patients converted to dementia within the 4-year follow-up compared to 20% of individuals with PD that did not have cognitive impairment at baseline. Sixty-nine percent of those with single-domain, non-amnesic cognitive impairment converted to dementia, while only 40% of those originally with an amnesic impairment alone converted. They also found that increased severity of depression was a risk for later development of PD-related dementia. In a review on the epidemiology of dementia in PD, Aarsland and Kurz (2010) conclude that the point prevalence of dementia in PD is about 30%, with incidence about four to six times that of healthy controls. Notably, they also suggest that the cumulative prevalence suggests that about 75% of those with PD who survive 10 years will develop dementia.

In one population-based longitudinal study examining incidence of cognitive impairment in PD (Williams-Gray et al. 2009), the authors concluded that posterior cortical neuropsychological findings were more related to PD-related dementia, while more frontal-striatal neuropsychological findings were not related to dementia. This implies that there could be two distinct cognitive phenotypes in PD with possibly unique features including etiology, pathology, and/or disease course. Kehagia and colleagues (2010) reported that in neuroimaging studies, compared to controls, individuals with PD and PD-MCI have reduced cerebral glucose uptake in the temporal lobe and occipitoparietal junction. In those with PD-related dementia, there is also cerebral atrophy in the frontal, temporal, and occipital cortices, as well as changes in the subcortical structures. The visual hallucinations that can be seen in PD-related dementia were associated with Lewy body accumulation predominantly in the temporal lobe as well as loss of cholinergic neurons in the basal forebrain (Kehagia et al. 2010).

In terms of treatment of cognitive symptoms in PD, there has been some research investigating cholinesterase inhibitors (e.g., donepezil) and NMDA receptor antagonists (e.g., amantadine, memantine). There has been modest benefits identified (Kehagia et al. 2010), but as with any drugs, the risks and benefits need to be weighed for each individual patient. For example, amantadine can cause hallucinations and confusion and thus may not be the best choice for all patients. In addition to pharmacotherapy, some individuals with cognitive impairment secondary to PD may benefit from a therapeutic intervention. Some neuropsychologists and speech therapists specialize in providing such interventions aimed at identifying specific problems in daily life as a result of cognitive impairment and teaching ways to compensate for the specified deficit in very concrete ways.

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## Personality and Aging, A Historical Review of the Research

Eric Cerino and Karen Hooker  
School of Social and Behavioral Health Sciences,  
College of Public Health and Human Sciences,  
Oregon State University, Corvallis, OR, USA

### Synonyms

Dispositional traits; Individual characteristics; Life stories; Personal action constructs; Self-narration; Self-regulatory processes; States

### Definition

The construct of personality encompasses individual characteristics as well as the active processes of the individual's interactions with the environment. This includes relatively enduring characteristics of one's thoughts, feelings, and actions (i.e., traits), as well as dynamic interplays of social-cognitive processes (i.e., personal-action constructs, self-narration). Under a lifespan developmental approach, research on personality now involves both personality stability and change, growth and decline and recognizes the heterogeneity of development due to processes of adaptation across the lifespan.

### Overview

Throughout the aging process, individuals encounter unique age-related challenges that have stimulated a myriad of health-related investigations from lifespan researchers in the last 50 years. Incorporating the study of personality

development within the realms of gerontology has provided valuable insight on the interactions between individual characteristics and health-related behaviors expressed throughout the lifespan. Studying one's personality can reveal, on multiple levels of analysis, the particular behaviors that are of importance to optimal aging (e.g., social support, coping strategies, exercise, and nutrition). Personality research has tremendous value in gerontology because of the capability for aspects of one's personality to demonstrate positive growth in late adulthood (Bolkan et al. 2009). The integrative and comprehensive approaches taken today highlight the value of studying personality in aging research, and this historical review underscores the essential progress made throughout the years that have brought the field to where it is now.

### The Early Years

In 1890, William James, founder of American psychology, argued that "personality is set like plaster by age 30" (James 1981, p. 126). Sigmund Freud's work marked the beginning of theorizing about personality development by supporting James' claim with his theory on psychosexual development. However, Freud's theory limited the stages of development to childhood and adolescence. It was not until major theoretical frameworks from Carl Jung and Erik Erikson that the focus of personality development was broadened to be studied throughout adulthood as well. Self-preoccupation and self-discovery are two essential age-appropriate developmental tasks of Jung's theory that extend beyond childhood. In Erikson's theory of psychosocial development, age-related tasks and resolutions of their corresponding psychosocial crises are thought to arise throughout the lifespan in an eight-stage model. Erikson also pioneered the investigation of adults' concern for and commitment to supporting the well-being of future generations, creating the now well-known term of *generativity* (Bolkan et al. 2009).

Bernice Neugarten provided empirical evidence for why personality theories explaining adult development and aging must not be based

on studies of children alone. She became a pioneer in the study of personality and aging through her work with the Kansas City Studies of Adult Life, a set of studies she launched with Robert Havighurst. Results from this project denounced the idea that there is no change in adult personality. Instead, Neugarten argued for more investigation into the relationships between heterogeneity and age which paved the way for future research to focus on processes of both stability and change, and person-environment fit, throughout the lifespan (Bolkan et al. 2009).

### Controversies Dividing the Field

Before the integration of stability and change was generally accepted, these distinct views separated the field into either arguing for internal processes or environmental forces directing behavior. The psychodynamic perspective can be seen in Freud's argument for personality structure's stability due to behavior in early childhood being governed by internal struggles from contradicting drives. Behavioral theorists opposed these claims by arguing for the plasticity of personality across the lifespan. In the 1970s, these critics stimulated the field's divide by positing environmental factors influence personality variables, thus explaining human behavior. This debate exposed the limitations of the existing theoretical accounts, which dampened public interest in personality science (Bolkan et al. 2009).

In addition to these opposing views, personality in general is a broad and abstract construct that has historically been difficult to define. Over the decades, researchers have defined the elusive construct in various ways – applying different theoretical frameworks and utilizing various research methods. This led to dozens of different definitions and little communal agreement on what constituted an individual's personality and how it should be measured. Difficulty in interpretation and understanding of research findings can result from this uncertainty. With this definitional inconsistency and a lessened interest in personality science threatening, little advancement occurred until the reinvigorating contributions from

dispositional trait researchers. The empirical evidence from studying personality traits united the field and may arguably be one of the most substantive contributions of personality science (Bolkan et al. 2009).

### The Power of the Trait Framework

The trait level of one's personality involves a structural approach to studying the relatively enduring characteristics of one's thoughts, feelings, and actions generally known as personality traits. These traits are the most fundamental features of an individual and are the foundation of individual differences across the lifespan. The trait framework of personality rose to prominence after multiple factor analytic studies revealed five main traits that were thought to best define personality. At the heart of this research epoch were widely accepted models known as the "five-factor" and "Big Five" models of personality (Goldberg 1993; Costa and McCrae 1992) The "Big Five" model, for example, identifies openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism (OCEAN) as the five main traits of personality (McAdams and Olson 2010). These models provided clarity and a universal language among personality researchers.

While traits are known to be generally consistent over time and context, there is considerable fluctuation in traits based on gene-environment interactions, age, and ways in which researchers measure change. Temporal stability, or the rank-order consistency of individual differences in traits, generally increases from adolescence until a peak in middle adulthood, followed by a slight decline in older adulthood. Mean-level changes, or actual increases or decreases in a trait over specific ages and time periods, show more personality change across the lifespan compared to rank-order consistency (Roberts et al. 2013). Mean-level changes in traits from adolescence to middle adulthood include increases in conscientiousness and agreeableness, and decreases in neuroticism and extraversion. This patterning of socially desirable traits, known as the "maturity

principle,” is influenced by both *genes* and *context* presumably through an increase in responsibilities related to an increase in social roles in family, the work place, and community engagement (McAdams and Olson 2010).

This maturity principle peaks in middle adulthood and is followed by increases in neuroticism and decreases in agreeableness in older adulthood, though studies on very late adulthood are relatively sparse. According to the lifespan developmental perspective, the decreased capability of proficient biological plasticity results in age-related declines in the physical, cognitive, and social dimensions of health. As a result, older adults face challenges in their ability to sustain the positive characteristics displayed in middle adulthood. Increases in depression, neuroticism, and negative effects from stress suggest the possibility of a decline in the positive aspects of personality traits with aging (McAdams and Olson 2010).

While the power of the trait framework is elegant in its simplicity, it is limited in its coverage of the dynamic nature of personality and investigation of differences within the individual, known as intraindividual variability. Ways in which personality predicts various outcomes in aging populations is best understood when taking a holistic approach that involves both personality traits and processes (Hooker and McAdams 2003).

### Traits Predict Many Outcomes

Personality traits are related to countless intra- and interpersonal outcomes across the lifespan and are fundamental pieces in establishing and maintaining healthy or unhealthy trajectories in life. In aging populations, particular interest is placed upon the traits that predict physical and mental health, well-being, longevity, cognitive ability, and meaningful engagement in society amid age-related declines and mortality risks. Each trait from the “Big Five” model, especially conscientiousness and neuroticism, and other dispositional characteristics have primary and moderating roles in age-related outcomes in older adults (Friedman and Kern 2014).

Being conscientious, defined as dependable, organized, dedicated, and sensible, is instrumental in creating healthy trajectories across the lifespan. Higher levels of conscientiousness have been related to lower mortality risk due to consistent healthy behaviors and decision-making. Individuals high in conscientiousness pursue environments that promote health and well-being rather than place them at greater risk. For example, conscientiousness has been related to less smoking, better diet, seat belt compliance in cars, pursuit and achievement of education goals, marriage stability, and personal friendships at home and the workplace with other conscientious individuals. In union with these healthy lifestyle patterns, conscientious individuals assess health problems with better coping strategies and other studies have found relationships with the trait and reduced disease development and less symptoms. Possessing conscientious qualities may be important for cognitive health as well, as some research has found low levels of the trait to predict cognitive impairment and diseases such as Alzheimer’s disease (Friedman and Kern 2014).

Having high levels of conscientiousness can also moderate the unhealthy trajectory high levels of neuroticism predicts across the lifespan. Neuroticism is characterized by being insecure, emotionally unstable, worrisome, and anxious, and predicts negative feelings, health complaints, higher stress, and lower levels of subjective health. Being conscientious may reduce these trait expressions amid health problems through effective emotion regulation strategies that help individuals recover from detrimental emotional stressors (Friedman and Kern 2014). There has been conflicting evidence related to neuroticism, with some studies showing neuroticism levels predicting higher mortality risk, some showing lower mortality risk, and some report no substantive prediction of mortality risk. The lowered mortality risk association with neuroticism seems to be characteristic of “healthy neuroticism,” defined as individuals who utilize worry and concern in beneficial ways (e.g., going to the doctor’s office for a checkup). This inconsistency in the literature brings a greater awareness to the importance of studying multiple personality traits

together to see if other factors are contributing to symptom expression or health trajectories (Friedman and Kern 2014).

Lower levels of neuroticism and higher levels of agreeableness, extraversion, conscientiousness, and openness to experiences have been related to lower risks for various diseases and possessing a greater sense of purpose in life, which is associated with positive outcomes such as life satisfaction and self-esteem. Personality traits provide a way to better understand what contributes to healthier lifestyles in older adults, and intervention research is growing with aims to increase healthier trait expressions across the lifespan (Friedman and Kern 2014).

## Personality Disorders and Aging

In addition to general health-related outcomes, aging may play an important role in symptom expression of personality disorders. The DSM-5 generally defines a personality disorder as “an enduring pattern of inner experience and behavior that deviates markedly from the expectations of the individual’s culture, is pervasive and inflexible, has an onset in adolescence or early adulthood, is stable over time, and leads to distress or impairment” (American Psychiatric Association 2013). Organized into three clusters, there are ten types of personality disorders (PDs): Cluster A (odd) includes paranoid, schizoid, and schizotypal; Cluster B (dramatic or erratic) includes antisocial, borderline, histrionic, and narcissistic; and Cluster C (anxious or fearful) includes avoidant, dependent, and obsessive-compulsive. Personality disorder not otherwise specified can be diagnosed when symptoms do not fit within a specific type. An alternative approach to classification is featured in the DSM-5 as well. Based on personality functioning and the individual’s pathological personality traits, this emerging model is an attempt to address the existing approach’s shortcomings of unclear diagnoses based on individuals showing symptoms of multiple PDs (American Psychiatric Association 2013).

The median prevalence for any type of PD ranges approximately from 10% to 14% of the

general population (Oltmanns and Balsis 2011). This approximation is most likely an underestimate of the true number due to invalid diagnostic criteria for older adults, as criteria are based on young adults, which may result in missed diagnoses in an older population (Edelstein and Segal 2011). Convenience samples of young adults and lack of longitudinal studies or valid measures for older populations create a need for more appropriate methodology. Utilizing lifespan approaches that incorporate later life environmental demands and an openness to the variability of symptom expression in different age groups may provide a clearer understanding of PD in older adults (Oltmanns and Balsis 2011).

Due to limited longitudinal research on PDs in aging populations, age-related changes in PD symptom expression are not well understood. Cross-sectional analyses comparing prevalence of PD in younger and older adults limit developmental interpretations, but provide some valuable information. There is some support for Cluster A (paranoid, schizotypal, and schizoid PDs) and Cluster C (dependent, avoidant, obsessive-compulsive PDs) increasing in prevalence or remaining stable, with Cluster B (narcissistic, histrionic, borderline, and antisocial PDs) decreasing in prevalence into later adulthood (Oltmanns and Balsis 2011). Recognizing specific age-related stressors is key to examining why symptom expression and traits of PDs may change with aging. Factors to consider include physiological and mental decline, social dynamics (e.g., smaller networks, death of peers, caregiving responsibilities), and life events (e.g., adjustment to retirement, divorce, surgeries, and hospital stays; Oltmanns and Balsis 2011).

PDs have shown comorbidity with other mental and physical health outcomes such as anxiety, depression, substance, and eating disorders (Clark 2007). Borderline PD has been related to greater risk of obesity and diabetes, and schizoid, avoidant, and obsessive-compulsive PDs have been related to coronary heart disease (Oltmanns and Balsis 2011). Treatment programs can be successful if the treatment plan is considerate of the specific qualities of each individual’s diagnosis and involves a comprehensive approach of the structure of personality. Unfortunately,

individuals with PDs very rarely seek treatment for themselves because they generally possess a lack of introspection and concern for societal aid. There is no medication that specifically treats PD, but medications are used to lower comorbid symptoms like anxiety and depression (Segal et al. 2011).

## Toward a More Integrative Approach

Dispositional trait research has brought the field to a much greater understanding of personality development and health-related outcomes across the lifespan. However, trait research alone does not fully capture the dynamic nature of personality. Individuals cannot be simplified to the embodiment of their expressed traits. Researchers should aim to analyze individual characteristics as well as the active processes of the individual's interactions with the environment. In this way, a more *whole*, accurate depiction of the individual's personality can be examined. Researchers recognized the importance in this and have called for a more comprehensive framework to apply to these aims (Hooker and McAdams 2003). The study of personality in recent years has adopted a general lifespan developmental approach as a result of this need. Personality theorists now study both personality stability and change, growth and decline, and recognize the heterogeneity of development due to processes of adaptation across the lifespan (Bolkan et al. 2009).

Instead of researchers fueling old debates over "stability versus change," the field has accepted the two can coexist in tandem, with longitudinal evidence for the concurrency of the two conceptually and empirically independent aspects of personality. This shift in understanding requires new personality models that incorporate both stability and change. Hooker and McAdams aimed to answer this need with their *six foci of personality* model of personality development (Hooker and McAdams 2003). Integrating both personality structures and processes in a three level framework, this model enables researchers to study stability and change in personality structures and processes simultaneously. By incorporating multiple trait and social-cognitive approaches, this model examines

the entire complexity of personality. The person as a dynamic *whole* is able to be studied as an individual embedded within relationships and social institutions throughout time and space. In line with lifespan developmental psychology, this model is founded in Developmental Systems Theory, with assumptions including plasticity, multidirectionality, and the organizing characteristics of the individual (Bolkan et al. 2009).

## The Six Foci Model of Personality Development

Incorporating literature from lifespan development and personality psychology, Hooker and McAdams identified six essential indicators, or foci, of personality and personality development (Hooker and McAdams 2003). These six foci include *dispositional traits*, *personal action constructs (PACs)*, *life stories* rooted in trait approaches, *states*, *self-regulatory processes*, and *self-narration* rooted in social-cognitive approaches. Each focal point represents a crucial element of either a personality *structure* (i.e., traits, PACs, life stories) or *process* (i.e., states, self-regulatory processes, self-narration) in linked pairs (i.e., traits and states, PACs and self-regulatory processes, life stories and self-narration) that correspond with each other on distinct analytical planes (i.e., one on the structural plane and one on the processes plane).

The structure-process pairs represent the three levels of analysis this model integrates and demonstrates a personality framework that features both idiographic and nomothetic approaches. Together, the model suggests that *all* individuals can be placed upon a continuum of a relatively universal set of traits (Level I); that *some* individuals may find specific goals and developmental tasks important (Level II); and that life stories are *unique* among all individuals (Level III; Bolkan et al. 2009; Hooker and McAdams 2003).

### Level I: Traits and States

As noted earlier, the structural construct of dispositional traits accounts for broad patterns of behavior across time and different situations. The parallel process construct of states accounts

for the intraindividual processes that explain dynamic change (e.g., emotions, mood, hunger, fatigue). Since states are transient processes that involve short-term change and significant variability, researchers utilize rigorous, repeated measurement designs to capture the intraindividual variability. Together, traits and states explain the individual differences between and within individuals (Bolkan et al. 2009).

### **Level II: Personal Action Constructs (PACs) and Self-Regulatory Processes**

*Personal action constructs* are specific goals, developmental tasks, and motivations that are uniquely contextualized by time, place, and social roles. These constructs can be various strategies, plans, and defenses employed by an individual aimed to attain or avoid a particular outcome. Different person-environment interactions throughout one's lifespan can reveal substantial variability in PACs that expose dynamic interplays between cognition, emotion, and the environment. The investigation of *possible selves* or the individuals' ideas of what they would like to become (*hoped-for selves*) and what they are afraid of becoming (*feared selves*) has been a rich area of study in PAC research. For example, across the lifespan, younger adults exhibit possible selves related to occupations and older adults exhibit more possible selves related to health. Through research in PACs such as possible selves, researchers have found a potential for growth in older adults who find ways to selectively optimize and compensate for normative age-related declines (Bolkan et al. 2009).

PACs are parallel with self-regulatory processes that individuals must invoke to reach their goals, such as self-efficacy and sense of control. These processes are typically investigated in particular domains such as work or family and demonstrate how people actively control their own lives. Research has shown an association between mortality rates in institutionalized older adults and sense of personal control. In addition, possessing a sense of mastery has been related to successful stress reduction strategies employed by adults amid midlife challenges. Clear age differences can be seen when studying processes associated with resilience, such as self-evaluation, emotion

regulation, and goal setting. This is due to individuals typically improving in maintenance of subjective well-being and adjustment to life tasks as they age, as well as the use of compensatory strategies and adaptive behaviors amid age-related loss (Bolkan et al. 2009).

The maintenance of self-regulatory processes across the lifespan can be explained through the SOC model of lifespan developmental psychology. In short, the three processes of selection, optimization, and compensation make up the universal principles of developmental regulation. An individual selects goals or outcomes, optimizes the means to achieve the goals or outcomes, and compensates for loss so that the goals or outcomes remain attainable. An example of the SOC model in older adults' goal processes toward social relationships was presented by Baltes and Carstensen (1999). Older adults tended to select goals related to preserving family relationships. They optimized these goals by devoting more time in family relationships compared to other relationships. Finally, they compensated for the loss of friendships by maximizing their most important family relationships (Baltes and Carstensen 1999).

Adults encounter potential resource gains (e.g., practical knowledge, material possessions) and potential resource losses (i.e., physical decline) with increased age. Therefore, incorporating PACs and self-regulatory processes are critical when studying personality in aging populations because researchers must be aware of the selection and pursuit of goals that maximize gains and minimize losses. Including an individual's personal goals and desires and the ways in which they are attained are vital to the study of personality development and optimal aging.

### **Level III: Life Stories and Self-Narration Processes**

Life stories can be defined as the constantly evolving narrative understanding of one's self. A life story is made through remembering the past and anticipating the future with a sense of meaning, unity, and purpose. Middle-aged and older adults have life stories with themes of "giving birth to" a new generation and overall qualities of generativity. These life stories featuring

generativity aid in creating the individual's identity. Being able to preserve a positive view of oneself amid age-related changes is critical for optimal aging (Bolkan et al. 2009).

The parallel process of self-narration can be defined as the social cognitive processes employed while constructing a life story, such as remembering, reminiscing, and storytelling. Age differences can be seen in autobiographical memories or subjective depictions of an individual's past. For example, older adults tend to retain self-relevant and emotionally intense memories compared to younger adults. In this third level of analysis, the structural life story and the parallel self-narration processes shed light on the individual's uniqueness and ways in which personality identity is constructed across the lifespan.

### **Summary of the Six Foci Model of Personality Development**

This model has provided the field of personality development a comprehensive and dynamic framework that can examine stability and change concurrently across multiple foci of personality. The integrative nature of the levels in the model speak to its value in the fields of personality development and aging. For example, traits and states can manifest in infancy (but can change throughout adulthood), while PACs and life stories manifest in later childhood and adolescence and continue to develop throughout the lifespan (Hooker and McAdams 2003).

Staudinger and her colleagues have written about positive personality functioning following two trajectories: growth and adjustment (Staudinger and Kessler 2009). A structure and process approach is also presented in this framework, and the authors draw on the lifespan developmental literature to identify indicators of adjustment and indicators of growth or maturity along structure and process dimensions.

### **Structures and Processes in Today's Research**

The integration of the structures and processes of personality in the Six Foci model is a foundational

stepping stone toward today's research studying the underlying mechanisms that drive dispositional traits. The trait framework has been instrumental in identifying the traits that predict important outcomes across the lifespan, but it does not extend into the explanatory processes that are responsible for these trait-outcome associations. Under a lifespan developmental perspective, today's research features integrative analyses and elaborate methodology aimed to better understand personality in its entirety. This involves investigating not only if personality traits predict certain outcomes but identifying the processes responsible for personality's contribution to individual and interpersonal outcomes in specific contexts across the lifespan (Hampson 2012).

Personality processes are typically identified as either a moderating factor indirectly influencing an outcome known as reactive personality processes or a mediating factor directly influencing an outcome known as instrumental or self-regulative processes. In both types of processes, these mechanisms influence the trait-outcome associations and provide clearer explanation for why certain relationships exist (Hampson 2012). Both moderating and mediating processes have been identified for specific traits including neuroticism, anger, extraversion, happiness, and conscientiousness.

Typically, individuals with higher trait levels of neuroticism and anger are more emotionally reactive. It is the negative emotional responses to situations that moderate the relationship between having higher levels of neuroticism and more adverse consequential outcomes. Extraversion moderates social activity's relationship with happiness such that individuals taking part in social activity will report greater happiness if they are more extraverted than individuals who are less extraverted. Conscientiousness has been found to moderate many predictors and health outcomes by either decreasing or increasing the magnitude of relationships. Specifically, individuals who exhibit conscientiousness are typically making direct efforts to inhibit responses and produce healthier behaviors (Hampson 2012).

Mediating processes have substantive value in intervention research, as these processes require

direct effort. Health behaviors and niche selection are two mediational pathways found in neuroticism's relationship with different outcomes. Happiness' relationship to extraversion is mediated by social participation, although other mediating processes for happiness and extraversion remain to be understood. Further, various health behaviors mediate the relationship between conscientiousness and health outcomes (Hampson 2012).

Each of these processes aids in understanding what characteristics are most beneficial under what context. Researchers can utilize personality processes to put behaviors in context and follow developmental patterns depending on the situation. This is made possible through better longitudinal methodology, including efficient daily diary and measurement burst study designs that can follow various processes in each context experienced. Further, technological advancements have made it possible to unite personality dispositions and processes with brain mapping equipment to follow corresponding brain region activation. Uniting structural traits and various personality processes in today's research provides the field a more comprehensive understanding of the ways in which personality impacts the aging process throughout the entire lifespan (Hampson 2012).

## Conclusion

The historical underpinnings of personality and aging, the transitional migration into more integrative approaches, and the current investigations into the comprehensive *whole* of an individual's personality across the lifespan have been reviewed. Studying personality under a lifespan developmental approach and integrative framework allows researchers to uncover optimal aging strategies and the potential for growth in older adults amid age-related declines. By acknowledging the concurrency of personality stability and change and the dynamic nature of personality, researchers can continue to extend the field's understanding into the many roles personality plays across the lifespan.

## Cross-References

► [Personality Trait Change in Old Age](#)

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## Personality Disorders in Older Adults

Silvia D. M. van Dijk<sup>1</sup> and S. P. J. van Alphen<sup>2</sup>

<sup>1</sup>University Center for Psychiatry, University Medical Center Groningen, Groningen, The Netherlands

<sup>2</sup>Department of Clinical and Life Span Psychology, Vrije Universiteit Brussel (VUB), Brussels, Belgium

### Synonyms

Character; Nature; Disposition; Temperament; Make up; Persona; Psyche; Identity; Inadequate; Maladaptive; Coping

### Introduction

Older adults are growing in numbers and meet a higher age as well as a better quality of life. We all have a certain personality with its strengths and limitations. It is however hard to see where an adaptive personality transforms into a maladaptive personality or even a personality disorder. From a clinical perspective, the presence of personality disorders in older adults is typically manifested through a complex presentation of symptoms as well as a complicated course of symptoms and increased risk of relapse, challenging both assessment and treatment.

### Definition and Synonyms

A personality disorder can be defined as an enduring pattern of inner experience and behavior that deviates markedly from the expectations of the individual's culture, is pervasive and inflexible, has an onset in adolescence or early adulthood, is stable over time, and leads to distress or impairment. Frequently used synonyms of personality (disorders/pathology) are character, nature, disposition, temperament, makeup, persona, psyche, identity, inadequate, or maladaptive coping.

### Personality

Personality can be defined as a stable pattern of feeling, thinking, and acting as a form of adaptation to the environment. In general it is assumed that personality characteristics can be explained by hereditary, upbringing, and the interaction with the surroundings. There are various psychological theories which describe personality due to changes in different domains of psychological and physical functioning in older adults. Sigmund Freud was one of the most influential persons of the twentieth century, and his legacy still has a great influence on the view of personality. Freud explored the human mind more thoroughly than anyone before him. His contributions to the concept of personality are vast. Freud believed that when we explain our own behavior to ourselves or others (conscious mental activity), we seldom give a true account of our motivation. This is not because we are deliberately lying. Human beings can be great at deceiving others; they are however even more adept at self-deception. The rationalizations of our conduct are therefore disguising the real reasons. Freud's lifework was dominated by his attempts to find ways of penetrating this often subtle and elaborate camouflage of the hidden structure, thoughts, and processes of personality. Freud was an id psychiatrist. Another theory on personality (which stems from Freud's ideas) comes from Erikson who was an ego psychologist. He emphasized the role of culture and society and the conflicts that can take place within the ego itself. Freud on the other hand emphasized the conflict between the id and the superego. According to Erikson, the ego develops as it successfully resolves crises that are distinctly social

in nature. The idea was to establishing a sense of trust in others, developing a sense of identity in society, and helping the next generation to prepare for the future (Erikson 1959). A theory from the eighties comes from Botwinick who described personality as a way to see things more in perspective with aging which may lead to more pragmatic solutions instead of purely rational thinking and problem solving (Botwinick 1984). The Big Five personality traits, also known as the five-factor model (FFM), is a widely examined lexical approach of five broad dimensions used by psychologists to describe personality. The five factors have been defined as openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism (acronyms: CANOE and OCEAN). Beneath each proposed global factor, a number of correlated and more specific primary factors are claimed. In a literature review, the stability of the Big Five personality domains of Costa and McCrea (1988) (Costa and McCrae 1988) was evaluated. The mean-level stability revealed a concave curve for neuroticism with an increase seen after the age of 80, a decrease for extraversion, and an increase for agreeableness (Debast et al. 2014). Personality can thus be defined in various ways. Some of the described theories show the occurrence of changes during the course of life. The relationship between personality and aging is complex due to the interactions between biological, psychological, and social aspects of aging such as cognitive changes (memory and attention abilities), changes in the role or purpose, impulse regulation, loss of health, relationships, and autonomy. The importance of each aspect usually varies within the different phases of life. The described personality theories however share the common view that personality consists of the combination of unique and stable aspects over various situations over time.

### Personality Disorders

The clinical concept of a personality disorder has changed dramatically over the last 60 years. In the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5), a personality disorder has been defined as “an enduring pattern of inner experience and behavior that

deviates markedly from the expectations of the individual’s culture” (American Psychiatric Association 2013). There are only a modest number of studies that have focused on personality disorders in adults aged 65 years and older. This indicates a limited scientific interest in late-life personality disorders which can be seen as a discrepancy with the high prevalence rates and the negative impact on quality of life as well as the successful treatment of psychiatric and somatic disorders. The suitability of the DSM-5’s definition of personality disorders is limited for older adults. There are personality criteria which focus on work and relationships that are often not or limited present in the older adults’ life. Besides, the late-onset personality disorders and the personality disorder due to another medical condition raise some questions which will be discussed later in this chapter. Although the DSM-5 criteria have been subject to debate in literature (Agronin and Maletta 2000; Segal et al. 2006), this psychiatric classification model is still frequently used in the clinical field of geropsychology. We will discuss the assessment and treatment of personality disorders as well as medical options and close with some recommendations to pay more attention to the specific characteristics of older adults with personality disorders which will become even more important given the global aging.

### DSM-5

In the DSM-5 (American Psychiatric Association 2013), there are four core defining aspects of personality disorders which are:

1. Distorted thinking patterns
2. Problematic emotional responses
3. Over- or underregulated impulse control
4. Interpersonal difficulties

These four aspects are common to all personality disorders. Before a diagnosis is made, a person must demonstrate significant and enduring difficulties in at least two of those four core aspects. These four core aspects combine in various ways to form ten specific personality

disorders identified in the DSM-5. Each disorder lists a set of criteria reflecting observable characteristics associated with that disorder. In order to be diagnosed with a specific personality disorder, a person must meet the minimum number of criteria established for that particular disorder. To meet the diagnostic requirements for a psychiatric disorder, the symptoms must cause functional impairment and/or subjective distress. This means the symptoms are distressing to the person with the disorder and/or the symptoms which makes it difficult for them to function well in society. The ten different personality disorders can be grouped into three clusters based on descriptive similarities within each cluster (see Table 1):

Cluster A (the “odd, eccentric” cluster)

Cluster B (the “dramatic, emotional, erratic” cluster)

Cluster C (the “anxious, fearful” cluster)

### **Personality Change Due to Another Medical Condition**

The former DSM-IV (American Psychiatric Association 1994) incorporated “Personality change due to another medical condition” under the section “Psychological Disorders due to Another Medical Condition.” In the DSM-5, however, this disorder appears in the “Personality Disorders” chapter of section II (Diagnostic Criteria and Codes) under the subheading “Other Personality Disorders.” However, the general criteria for a personality disorder in the same chapter assert; it is confusing that personality change due to another medical condition should be excluded in order to diagnose a personality disorder. A point of concern is that there seems to be a confusion between two constructs, a personality disorder and a change in personality. A change in personality can be defined as a permanent behavioral change due to a direct pathological consequence of the medical condition (e.g., cancer, Huntington disease). The personality changes are persistent behavioral (often negative) changes like apathy or sexual oriented behavior. These medical and neurological conditions, however, have a different etiological construct compared to the etiology of

personality disorders which derive from complex biological, psychological, and social aspects into adulthood. The treatment methods for these personality changes are also very different compared to personality disorders. The treatment of behavioral problems such as disinhibited behavior as a result of a brain compromising disease can, for example, be conducted in a medical rehabilitation center, for example, where the family will be included in a treatment program. Behavioral Problems, such as impulsivity as an essential feature of the borderline personality disorder, can be treated with introspective psychotherapy. It is arguable whether the next edition of the DSM-5 may remove the personality change due to another medical condition from the chapter of personality disorders.

### **Late-Onset Personality Disorder**

In the DSM-IV and the DSM-5, the chapter on personality disorders argues that a personality disorder can worsen later in life: “A personality disorder may be exacerbated following the loss of significant supporting persons or previously stabilizing social situations.” The experimental DSM-5 model for personality disorder however emphasizes the “relative stability” in the general criteria for a personality disorder. Expert opinions point to the existence of late-onset personality disorders. They present the idea that an underlying personality constellation and coping limitations can lead to the development or manifestation of a personality disorder for the first time later in a person’s life. Looking more closely to the late-onset personality disorders, it shows that later in life, changes in the individual’s living circumstances may lead to a decrease in adaptation due to aging (loss of physical fitness, retirement, loss of spouses and friends). The coping limitations and personality maladaptive functioning then become more manifest. An example from the clinical practice is the loss of role and appraisal among previous narcissists when losing their job and appraisal. Another example is the loss of control due to physical or mental decline which can increase rigidity among older adults with pre-morbid obsessive-compulsive traits. Some of the specific criteria of the aforementioned

**Personality Disorders in Older Adults, Table 1** DSM-5 personality disorders

Cluster	Personality disorder	Description
A	<b>Paranoid personality disorder</b>	The paranoid personality disorder is characterized by a pervasive distrust and suspiciousness of other people
A	<b>Schizoid personality disorder</b>	The schizoid personality disorder is characterized by a pervasive pattern of social detachment and a restricted range of emotional expression. For these reasons, people with this disorder tend to be socially isolated
A	<b>Schizotypal personality disorder</b>	Persons with schizotypal personality disorder are characterized by a pervasive pattern of social and interpersonal limitations. They experience acute discomfort in social settings and have a reduced capacity for close relationships
B	<b>Antisocial personality disorder</b>	The antisocial personality disorder is characterized by a pervasive pattern of disregard for the rights of other people that often manifests as hostility and/or aggression
B	<b>Histrionic personality disorder</b>	Persons with histrionic personality disorder are characterized by a pattern of excessive emotionality and attention seeking. Their lives are full of drama (so-called drama queens)
B	<b>Narcissistic personality disorder</b>	People with narcissistic personality disorder have significant problems with their sense of self-worth stemming from a powerful sense of entitlement. This leads them to believe they deserve special treatment and to assume they have special powers, are uniquely talented, or are especially brilliant or attractive
B	<b>Borderline personality disorder</b>	Borderline personality disorder is one of the most widely studied personality disorders. People with borderline personality disorder tend to experience intense and unstable emotions and moods that can shift fairly quickly. As a result, they frequently have angry outbursts and engage in impulsive behaviors such as substance abuse, risky sexual liaisons, self-injury, overspending, or binge watch and eat
C	<b>The avoidant personality disorder</b>	The avoidant personality disorder is characterized by a pervasive pattern of social inhibition, feelings of inadequacy, and a hypersensitivity to negative evaluation. People with this disorder are intensely afraid that others will ridicule them, reject them, or criticize them. This leads them to avoid social situations and to avoid interactions with others. This further limits their ability to develop social skills
C	<b>Dependent personality disorder</b>	The core feature of the dependent personality disorder is a strong need to be taken care of by other people. This needs to be taken care of, and the associated fear of losing the support of others often leads people with dependent personality disorder to behave in a “clingy” manner and to submit to the desires of other people
C	<b>Obsessive-compulsive personality disorder</b>	Persons with obsessive-compulsive personality disorder are preoccupied with rules, regulations, and orderliness. This preoccupation with perfectionism and control is at the expense of flexibility, openness, and efficiency. They are great makers of lists and schedules and are often devoted to work to such an extent that they often neglect social relationships
<b>Other personality disorders</b>	<b>Personality change due to another medical condition</b>	A persistent personality disturbance that represents a change from the individual’s previous characteristic personality pattern. This disturbance is the direct pathophysiological consequence of a medical condition, such as temporal lobe epilepsy, head trauma, and cerebrovascular disease
	<b>Other specified personality disorder</b>	When people do have a personality disorder, however, they do not meet the criteria for any specific personality disorders mentioned in clusters A, B, or C The clinician chooses to communicate the specific reason that the representation does not meet the criteria of any specific personality disorder
	<b>Unspecified personality disorder</b>	In contrast with the category of “other specified personality disorder,” the clinician chooses not to specify the reason that the criteria are not met for a specific personality disorder because of insufficient information

AXIS II personality disorders show an overlap with AXIS I disorders, as well as other personality disorders and changes due to (normal) aging. The 11th edition of the *International Statistical Classification of Diseases and Related Health Problems* (expected 2018) may include the diagnosis of late-onset personality disorder (Tyrer 2013).

## Epidemiology

### Prevalence, Course, and Etiology

The prevalence rates of personality disorders in later life are very diverse because of the different methods, tools, and resources used in research. An integrative review on late-life personality disorders shows that the prevalence of one or more personality disorders among older adults in the general population ranges from 3% to 13% (Van Alphen et al. 2012a). These wide ranges are partly explained by the fact that almost one third of the DSM criteria for personality disorders are not applicable for older adults. In the largest study on the prevalence of personality disorders in later life, data was drawn from the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC), focusing on a large subsample of 8205 adults aged 65 years and older. Among these community-dwelling older adults, the prevalence rate of at least one personality disorder was 8% (Schuster et al. 2013). The highest rates were found for the obsessive-compulsive personality disorder. Analyses showed that personality disorders were highly associated with disability as well as medical and mental disorders. For the decline in the prevalence of cluster B personality disorders with advancing age, the explanation that aging is accompanied by a decrease in expressive, impulsive, and aggressive behavior is often given. The idea of temporal stability of personality disorders and personality traits is less than an original thought (Debast et al. 2015), particularly for the borderline, antisocial, narcissistic, and histrionic personality disorders (cluster B); a higher degree of improvement and even recovery was reported while aging. Unhealthy life choices, violence, and addiction results in a shorter life expectancy among older

adults with cluster B personality disorders. Unfortunately, there are limited course studies in older adults. An item response theory (IRT) analysis among almost 37,000 respondents aged between 19 and 98 years in the general population showed that in older persons, fewer diagnostic criteria of the DSM-IV personality disorders were identified compared to younger persons. A second IRT analysis on this sample revealed measurement errors in 29% of the diagnostic criteria of DSM-IV PDs (Balsis et al. 2007). Although the most common etiologies for personality disorders are multifactorial, these conditions may also be secondary to biologic, developmental, or genetic abnormalities. Personality disorders can be aggravated by stressors, external or self-induced. In clinical practice it is shown that stressful situations (e.g., loss of a loved one or physical decline) can result in decompensation, revealing a previously unrecognized personality disorder. Also the loss of a social role, relational problems, and existential worries can play a role in a late-life personality disorder. Informant information (e.g., spouse or children) often shows a pattern of premorbid vulnerability and/or maladaptive coping strategies.

## Assessment

The assessment of personality disorders consists of patient information including a medical history, autobiography, self-description, informant information (to complete and/or verify patient information), behavioral observation by the clinician, and preferably the use of (semi-) structured interviews or personality questionnaires. The use of (semi-) structured interviews and personality questionnaires among older adults is however subject to a number of limitations. The main problem is the often lacking normative data for the various population groups of older adults. Due to generational beliefs, the introspective abilities of older adults are often limited. The (often cluttered) layout of self-report score sheets and the use of small fonts can lead to problems particularly among adults aged 75 and over who have to deal with physical decline. In the recent years, a few personality measures have been validated for

**Personality Disorders in Older Adults, Table 2** Validated personality tests for older adults

Type	Test	Validated in older adults	Remarks
Self-report	NEO-PI-R	✓	Psychometric data for clinical populations of older adults are lacking
	NEO-PI-3	✓	–
	NEO-FFI	✓	–
	NEO-PI-R-SF	✓	–
Informant report	HAP	✓	–
Screeener	GPS	Sensitivity specificity patient version around 70%	Sensitivity and specificity informant version are somewhat lower

older adults which can be divided into three categories: self-report questionnaires, informant-report questionnaires, and screening instruments. The self-report questionnaires that are validated among older adults are Neuroticism Extraversion Openness Personality Inventory Revised (NEO-PI-R), NEO Personality Inventory 3 (NEO-PI-3), and two abbreviated versions, the NEO Personality Inventory Revised Short Form (NEO-PI-R-SF) and the NEO Five Factor Inventory (NEO-FFI) (Rossi et al. 2014). These tests are mostly useful for assessing adaptive personality traits among older adults in the general population. The HAP (a questionnaire for family members or caregivers to assess maladaptive personality traits of the patient) is an example of an informant questionnaire for use in older adults in mental healthcare and nursing home residents. In order to try to prevent bias resulting from a current psychiatric condition or somatic comorbidity, the HAP retrospectively tries to map the patient’s personality features. Another 16-item screening instrument for personality disorders among older outpatients in mental healthcare as general practice has been validated named the Gerontological Personality disorder Scale (GPS) (Van Alphen et al. 2006). The GPS contains a patient and an informant version. Age-neutral measurements are necessary to derive valid and reliable conclusions of the presence of personality disorders across different age groups. An age-neutral instrument implies that items work the same for different measured age groups. A number of studies have examined the age neutrality of personality questionnaires: the Assessment of DSM-IV Personality Disorders (ADP-IV), the NEO-PI-R, the

**Personality Disorders in Older Adults, Table 3** Differential item functioning

Test	DIF <sup>a</sup>	Differential test functioning
ADP-IV	4.3%	–
NEO-PI-R	7.1%	Extraversion scale
YSQ	3%	Entitlement scale
PID-5	13.6%	Withdrawal, attention seeking, rigid perfection, unusual beliefs

<sup>a</sup>DIF differential item functioning

Young Schema Questionnaire (YSQ), and the PID-5 (Rossi et al. 2014) (see Tables 2 and 3). The age neutrality of test and specific items and its implications are still in progress. Studies have been often conducted in either the general population or highly specific clinical populations which limits generalization to the older adult populations.

**Treatment**

**Treatment Levels**

Research of the treatment of personality disorders in older adults is still at its infancies. The number of publications on this subject is also very limited. This may come from decades of therapeutic nihilism regarding the treatment results of personality disorders in older adults. Looking at treatment that focuses a distinction between (1) personality-changing, (2) adaptation-enhancing, and (3) supportive-structuring treatments can be made (Videler et al. 2015):



1. **Personality-changing treatment:** At this level, the therapy focuses on changing the dysfunctional aspects of the personality. This is usually a lengthy therapy. Examples of personality-changing treatment are schema-focused therapy (SFT), dialectical behavior therapy (DBT), mentalization-based treatment (MBT), and transference-focused therapy (TFT). (Meta-) cognitive behavioral therapy, brief psychodynamic therapy, and marital therapy are situated at the transitional level of personality-changing and adaptation-enhancement treatments.
2. **Adaptation-enhancement treatment:** This kind of treatment is for older adults who are motivated for treatment, yet are limited in their abilities to change, for example, because of limited introspection and empathy. Treatments in this category include interpersonal psychotherapy, social skills training, or other brief psychotherapies specifically addressing the interpersonal functioning of the patient such as relational therapy or cognitive behavioral therapy. A promising adaptation-enhancing therapy is the problem-solving therapy (PST) which consists of limited (six to eight) sessions where older adults learn to break down problems that affect well-being and develop strategies to address them (Gustavson et al. 2016). The treatment shows a more directive approach to change the critical environmental circumstances.
3. **Supportive-structuring treatment:** When a patient is not able to change; or cannot benefit from direct psychological treatment because of severe cognitive disorders, interventions such as supporting the patient and advising him how to make the best of his environment. Also mediation interventions, such as psychoeducation of the patient's informal or formal (i.e., professional) care providers and social support system.

See Table 4 for (contra)indication criteria for personality-changing, adaptation-enhancing, and supportive-structuring treatment of personality disorders in older adults (Van Alphen et al. 2012b).

## Treatment Studies

It was long thought that personality-changing psychotherapy was not feasible in older adults. Clinical evidence is slowly growing for the treatment of personality disorders. There have been four promising treatment studies published that have examined personality-changing therapy in older adults (Table 5). Two of these studies however were conducted without proper personality assessment in older adults with depression. Although a significant proportion of the patients with depression in mental healthcare institutions suffers from personality disorders, these two studies can only indicate that the measured dialectical behavioral therapy (DBT) and schema-focused therapy (SFT) are feasible in older patients. Two studies have examined personality-changing psychotherapy in older adults with (features of) personality disorders and/or long-standing mood disorders. Despite small and heterogeneous populations, these studies, one on SFT and one on DBT, showed promising results among older patients. The SFT study that showed a medium treatment effect on the reduction of depressive symptoms, dysfunctional schemata, and schema modes was found, which was comparable to results previously found in adults (Videler et al. 2014). The DBT showed that antidepressant combined with DBT was significant superior with respect to improvement on interpersonal sensitivity and on interpersonal aggression at both posttreatment and 6-month follow-up compared to antidepressants alone. Addition of DBT did not significantly improve the depressive symptoms in comparison with antidepressants alone (Lynch et al. 2007). These results may suggest that the diagnosis of the personality disorders has been confounded by the comorbid depression (Van Alphen et al. 2015). The two studies suggest that the effectiveness for older adults with severe mood and personality disorders are comparable with younger age groups; given the small and heterogeneous study populations, the generalizability is limited. Up until today, there are no effect studies on MBT and TFT in older adults. Treatment studies should focus more on the added value of “geropsychological topics”

**Personality Disorders in Older Adults, Table 4** (Contra-) indication criteria for personality-changing, adaptation-enhancing, and supportive-structuring treatment of personality disorders in older adults

Indications	Contraindications
<b>Personality-changing treatment</b>	
The individual is willing to enter a therapy focused on complaints originating from the personality disorder, or there is some estimate that this willingness will emerge during the initial phase of the treatment The individual possesses sufficient discipline and persistence to participate in therapy The personality issues are the primary factors causing and/or maintaining psychological and/or relational problems The individual is capable of self-reflection on a reasonable level The individual is able to tolerate the disorganizing effects which can derive from the treatment	Moderate to serious cognitive disorder Florid psychotic disorder Serious depressive episode Unstable bipolar disorder Serious inability to achieve a therapeutic alliance. Drug abuse demanding detoxification. Presence of acute psychosocial or somatic factors which are the exclusive focus of the individual's attention
<b>Adaptation-enhancing treatment</b>	
The involved individual has (some degree of) willingness to change his or her behavior or feels enough pressure enter treatment Especially the age-specific factors in interaction with personality issues lead to psychological complaints and/or social dysfunctioning The involved individual is not willing or not able to enter a long-term therapy focused on changing personality aspects	Moderate to serious cognitive disorder Florid psychotic disorder Serious depressive episode Unstable bipolar disorder Drug abuse demanding detoxification
<b>Supportive-structuring treatment</b>	
Serious inactivity Exceptionally limited social support system Overloaded (professional) support system	Noncompliance with nearly all kinds of care

**Personality Disorders in Older Adults, Table 5** Summary of outcomes of personality-changing treatment studies

Author	Year	Country	N	Mean age	Treatment method <sup>a</sup>	Mood disorder	PD assessed	Outcome
Lynch TR	2003	USA	68	66	DBT	Depression	No	DBT is feasible in older adults
Kindynis S	2013	FRA	51	75	SFT	Depression	No	SFT is feasible in older adults
Lynch TR	2007	USA	37	61	DBT	Depression	Yes: SCID-2	Medication + DBT significantly improve outcome 6 months later
Videler AC	2014	NLD	31	67	SFT	Depression	Yes: SCID-2	Change in dysfunctional schemas

<sup>a</sup>DBT dialectical behavior therapy, SFT schema-focused therapy

like the loss of health and autonomy, generational cohort beliefs, sociocultural context, missing out on the digital evolution, and changing life perspectives.

**Case Vignettes**

The following three case vignettes describe the aforementioned treatment approaches (personality changing, adaptation enhancing, or



supportive structuring) from a specific clinical geropsychological perspective.

#### Personality-Changing Treatment:

##### Schema-Focused Therapy (SFT)

Mr. X, a 76-year-old man, was referred by his general practitioner with a depressive episode. He was diagnosed a decade ago with traits of an avoidant and dependent personality disorder but only treated for his mood disorder. At the start of the therapy, Mr. X reported he was inactive again and felt depressed. Mr. X was diagnosed with a major depressive episode and also with avoidant and dependent traits. In the recent years, Mr. X lost his wife and also a good friend and neighbor. His anxiety about losing another loved one was still tangible. The deaths activated his suppressed core cognitions "I will lose everyone, I can't do it alone." The loss of his wife and other loved ones activated and manifested maladaptive cognitive schemata. From these core cognitions, Mr. X avoided intimacy with others, which maintained his depression. Mr. X was motivated to overcome his depression, but more so he wished to work on the underlying relapse risk factors. Mr. X showed the motivation to invest in personality-changing psychotherapy. Because of the significant invalidating core beliefs, SFT was started. The goal of SFT is to change the dysfunctional core belief, or so-called early maladaptive schemata, about the self into a functional core belief. After 41 weekly sessions and five follow-up sessions, Mr. X no longer met the criteria for avoidant and dependent personality disorder, and his depressive mood was in remission. He started to do charity work which gives him a new purpose in life as well as a daily routine where he met other people.

#### Adaptation-Enhancing Treatment:

##### Problem-Solving Therapy (PST)

Mrs. B, a 70-year-old woman, developed a panic disorder with agoraphobia after her daughter and her family moved to another country. The patient reports that her daughter was her main support person. Since the daughter went to live elsewhere, Mrs. B reports being unable to do normal daily

activities such as preparing a meal. Mrs. B reported problems in going grocery shopping or visiting friends. In addition, she reported feeling depressed and had been neglecting her usually nice appearance. She complains of depressed mood and indicates that there is little reason for her to continue to live. Mrs. B was, in addition to the panic disorder, diagnosed with a late-onset avoidant personality disorder. Although she had functioned relatively well in life as a librarian, after interviewing the husband and daughter, it was shown that the daughter had to drive her mother to her work for years, because Mrs. B was too afraid to take the bus. Adaptation-enhancing treatment was selected and given by means of PST. This relatively brief PST treatment, which took eight weekly sessions and two follow-up sessions, led to an improvement in her daily functioning. After a few practice sessions together with the nurse, she now goes grocery shopping every weekday and started to do voluntary work in a nearby nursing home. She now speaks regularly with her daughter and grandchildren via social media. Note that the treatment of the personality disorder itself is not the goal of adaptation-enhancing treatment.

#### Supportive-Structuring Treatment: (Mediation)

##### Behavioral Therapy

Mr. F, who was 87 years old, was referred because of suicidal behavior after the loss of his spouse 6 months earlier. On the one hand, Mr. F longed for rest and wanted to be admitted to a nursing home. He also was very negative whether he could be treated and often expressed his wish to die. Mr. F disposed of many belongings that reminded him of his wife in order to avoid thinking about her. According to one of Mr. F's brothers, Mr. F was described as vulnerable and often claiming others' attention and then dismissing them. The brothers had stopped having contact decades ago after a dispute but stayed in touch after the funeral of Mr. F's wife. Mr. F was diagnosed with a borderline personality disorder and a depressive disorder with agitation. Mr. F lacked activities and was suicidal; his older brother was worried but limited in his resources. Mr. F was not

motivated to engage in any kind of therapy. The only option was to try a supportive-structuring treatment. Goals of the treatment were to prevent suicidal behavior and to acquire some rewarding activities. In addition, his brother was given psycho-education of the borderline PD and support. The supportive-structuring treatment led to a better relationship between the two brothers. The personality disorder in itself was not treated. However, as a result of the behavioral changes of the brother and the support Mr. F received, the suicidal and agitated behavior declined which made it possible for Mr. F to mourn the loss of his wife.

When assessing behavioral disorders as a personality disorder in older adults, differential diagnostics show that similar behavioral disorders can also derive from a cognitive impairment (i.e., due to a delirium). Assessing older adults implies a broad approach in which biological, psychosocial, and somatic (comorbid) disorders have to be considered.

### Pharmacological Treatment

There is some preliminary evidence that medication may be of value in the treatment of personality disorders. In these studies, there are many methodological uncertainties. The studies of the borderline personality disorder are the most promising, although it is one of the most difficult personality disorders to disentangle whether enduring (i.e., trait) versus potentially short-lived (i.e., state) changes to the symptoms have been made. There is reasonable evidence that antidepressants, especially the serotonin reuptake inhibitors (SSRIs) and monoamine oxidase (MAO) inhibitors, have beneficial effects independent of antidepressants. There is also some less favorable evidence that antipsychotic drugs and mood stabilizers may be of some value. Specific drug effects are difficult to identify in the studies of personality disorders because of the high comorbidity rates. The effects found can only indicate that medication can have a place in the treatment of personality disorders (Newton-Howes and Tyrer 2003).

### Future Challenges

A patient can be diagnosed with more than one personality disorder. The experimental model for understanding personality disorders (section III, “Emerging Measures and Models”), proposed for further study in the DSM-5, focuses on reducing this overlap among personality disorders by using a dimensional approach versus the present categorical one. Six prototypes of personality disorders (schizotypal, borderline, antisocial, narcissistic, avoidant, and obsessive-compulsive) were maintained to address diagnostic overlap, based on two criteria. Criterion A refers to the significant disturbances in personal and interpersonal functioning and criterion B to the presence of one or more of the five pathological defined personality traits (negative affectivity, detachment, antagonism, disinhibition, and psychoticism) and the 25 facets associated with these traits. Today there have been only two empirical studies on the dimensional DSM-5 model conducted in older adults, both focusing on criterion B using the personality inventory for DSM-5 (PID-5) (Van den Broeck et al. 2013, 2014). Research in older populations is essential for the further development of especially section III of the DSM-5. This is in order to limit the risk, as was seen in the previous editions of the DSM, that the criteria remain inadequate for older adults (Van Alphen et al. 2015).

### Conclusions

Older adults with personality disorders are a relatively large and vulnerable growing group with a high healthcare consumption. The assessment and treatment process is complicated because of the limited studies and age-neutral items and questionnaires. With regard to the clinical practice, (DSM-5) personality questionnaires and interviews used in adult care must be adapted and validated for the diverse older patient populations. Especially for the hospitalized older populations in mental healthcare centers or nursing homes, studies are needed.

## Cross-References

- ▶ [Cognitive Behavioural Therapy](#)
- ▶ [Problem-Solving Therapy](#)
- ▶ [Psychological and Personality Testing](#)

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## Personality Trait Change in Old Age

Mathias Allemand<sup>1</sup> and Patrick L. Hill<sup>2</sup>

<sup>1</sup>Department of Psychology and University Research Priority Program “Dynamics of Healthy Aging,” University of Zurich, Zurich, Switzerland

<sup>2</sup>Department of Psychology, Carleton University, Ottawa, ON, Canada

### Synonyms

Dispositions; Individual tendencies; Individuality; Personality characteristics

### Definition

Personality traits are relatively enduring patterns of thoughts, feelings, and behaviors, which are expected to remain stable over time and consistent across situations. Theories and research, however, demonstrated that personality traits could change over longer time periods across the lifespan into old age.

### Old Age and Personality Trait Change

This contribution gives an overview of theoretical and empirical work on personality trait change in old age. Old age is a unique period of the lifespan that is characterized by environmental changes in the primary social contexts and social roles such as loss of the spouse or other important interaction partners. Old age is also characterized by complex individual changes and processes in multiple domains of functioning such as declines in cognitive and physiological functioning and ultimately physical health or inclines in chronic illnesses. Regardless of these changes in old age, individual differences exist in how older adults move through the later years of life. As a result of diverse and specific environmental experiences, individual abilities and competencies, and a

variety of adaptive processes and behaviors to maintain or improve well-being and health, each individual may demonstrate unique patterns of developmental change in old age.

Understanding the malleability of personality traits in old age is important for several reasons. First, personality trait change may predict a variety of important life outcomes in old age. For example, research demonstrates the ability of personality trait change above and beyond the trait level to predict mortality and other health-related aspects (Mroczek and Spiro 2007). Second, personality traits may be changed or modified by age-related environmental and individual changes in old age. For example, research suggests that a specific functional impairment such as hearing impairment may affect socially oriented personality traits because it reduces the capability to participate in social activities (Berg and Johansson 2014). Third, environmental and individual changes in old age require adaptive dynamic regulation processes to maintain or improve individual and social well-being and health. Personality traits may contribute to these processes either in adaptive or maladaptive ways. For example, research suggests that older adults tend to engage in strategies and processes that optimize positive social experiences and minimize negative ones by avoiding conflicts and showing greater willingness to forgive others (Fingerman and Charles 2010). In sum, changes in personality traits can be conceptualized and studied as predictors, mechanisms, or consequences of the aging processes.

This contribution focuses on four primary topics when discussing the past literature on personality trait change in old age. The first part defines personality traits and developmental change by considering several meanings of change. The second part discusses the cross-sectional and longitudinal research literature on personality trait change in old age. Specifically, it focuses on normative and differential perspectives of personality change. Normative change refers to change based on group averages, whereas differential change means that there are interindividual

differences in individual change. The third part discusses several mechanisms of personality trait change. The final section discusses the important future directions with respect to the role of personality traits in the aging process.

### **Defining Personality Traits and Developmental Change**

Personality traits are relatively enduring patterns of thoughts, feelings, and behaviors that are relatively consistent across a wide variety of situations and contexts. Traits describe the most basic and general dimensions upon which individuals are typically perceived to differ. These individual differences are often organized within the prominent conceptual frameworks of the Big Five or Five-Factor Model and include five broad traits (see John et al. 2008): neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness. Briefly, neuroticism, or conversely, emotional stability, contrasts even-temperedness with the experience of anxiety, worry, anger, and depression. Extraversion refers to individual differences in the propensity to be sociable, active, assertive, and to experience positive affect. Openness to experience refers to individual differences in the proneness to be original, complex, creative, and open to new ideas. Agreeableness refers to traits that reflect individual differences in the propensity to be altruistic, trusting, modest, and warm. Finally, conscientiousness reflects the propensity to be self-controlled, task and goal directed, planful, and rule following.

In general, personality traits are thought to be relatively stable over time, and thus they are not assumed to change at a rapid rate but rather reflect slow processes. Studying personality change in old age thus requires longitudinal data over longer periods of time to capture the long-term developmental processes. In contrast, one can study more dynamic and fluctuating manifestations of traits such as states over shorter time periods. Unlike traits, states reflect more dynamic processes of personality that show temporary changes in response to internal aspects such as motives and

goals and external situations such as stress in a given situation (Hooker and McAdams 2003). States reflect the ways how individuals think, feel, or behave in a given situation. In other words, states are the manifestations of the traits. They are transient and involve change and variability over short periods of time. In other words, a person with a high average level of emotional stability may still demonstrate a neurotic behavior in a given situation such as on a day when he or she faces a difficult challenge. Typically though, an individual thinks, feels, or behaves in ways consistent with that person's average standing on the trait level. Studying personality dynamics in old age requires (very) intensive longitudinal data over short periods of time to capture the short-term processes in daily life and the fluctuations over short time intervals. Such an approach provides information about the underlying processes of change or maintenance as they occur in addition to longer developmental change processes. This contribution does not further discuss empirical evidence for age-related changes in personality dynamics in old age (see Nofhle and Fleeson 2010, 2015 for details).

There are several ways to define developmental change. Each way offers a unique perspective on change. This article focusses on four conceptually and statistically different forms of change (see Roberts et al. 2008 for other forms). First, differential or rank-order change implies that individuals change their relative standing on a trait dimension relative to others over time. Second, mean-level change implies that the average level of a personality trait changes over time and/or across different ages. Third, structural change refers to change of the patterns of correlations among traits, or items on a personality scale. Structural change implies that the associations between the traits change over time and/or across different ages. Fourth, individual differences in change refer to the fact that although the average level of a personality trait may change over time, not every individual demonstrates the same amount of change. Some individuals may increase, whereas others decrease over time, or even show stability. This perspective holds that personality change is itself an individual-differences variable. In sum, there are several

conceptually and statistically distinct ways of framing and answering questions about the malleability of personality traits.

### **Current Evidence for Personality Trait Change in Old Age**

There are two common research designs to address personality trait change, and each design provides unique information. Cross-sectional designs consist of at least two samples of different ages drawn from different cohorts and measured simultaneously. They provide information about age-group differences or interindividual differences but cannot easily separate the effect of age from the effects of belonging to a particular age cohort. Longitudinal designs consist of at least a sample of participants of a given age and from a given cohort that are followed through time. They provide information about age-related changes or interindividual differences in intraindividual change. The next paragraph discusses empirical evidence for age differences and age-related changes in personality traits.

#### **Cross-Sectional Evidence**

Evidence for age differences in personality traits in old age comes from cross-sectional studies. Several large-scale, cross-sectional lifespan studies with broad age ranges included older adults aged 65 years and older, whereas some studies contrasted older with younger adults and other studies focused exclusively on samples of older adults and the oldest olds. These relatively recent investigations observed age effects in personality traits in terms of mean levels even during older adulthood, when most researchers in the past thought there was not much possibility for change in later life. For example, mean-level age differences in all of the Big Five traits from ages 16 to the mid-80s were observed using two large national datasets from Britain and Germany (Donnellan and Lucas 2008). In the two countries, there is evidence that older adults were less extraverted and open to experience but they were more agreeable than younger age-groups. Average levels of conscientiousness were either highest

for middle-age participants or even showed an increase up to old age. The results were more mixed for neuroticism. Substantial nonlinear age effects from ages 15 to 99 were observed in a methodologically sophisticated study using a large nationally representative dataset from Britain (Marsh et al. 2013). The big picture of the results has led Marsh and his colleagues to suggest a “*dolce vita effect*” of personality traits in old age. Specifically, in later years, individuals become happier (more agreeable and less neurotic), more self-content and self-centered (less extroverted and open), more laid back and satisfied with what they have (less conscientious, open, outgoing, and extroverted), and less preoccupied with productivity. Due to the cross-sectional nature of the findings, though, it is possible that age and cohort effects are confounded.

In contrast to cross-sectional lifespan studies like these, which typically include a large number of younger adults in comparison to older adults, Weiss and colleagues included a significant sample of participants in their 80s and older in their investigation of personality trait trends (Weiss et al. 2005). Specifically, they examined age differences in personality traits in Medicare patients aged 65–100 years and divided the sample into a young-old group (65–79 years) and an old-old group (80–100 years). With the exception of higher levels of agreeableness in the oldest-old as compared to the young-old group, this study found little evidence for age differences among those in the last decades of life.

Whereas age differences were repeatedly observed for personality traits across the lifespan into old age at the mean levels (with some exceptions), the results for structural change show a different picture. Previous research demonstrates relatively high levels of structural stability in personality traits across different age-groups (Allemand et al. 2008a). For example, in large national datasets of individuals aged 25–74 years from the United States, equal factor correlations between the traits were found in 10 age-groups comprising equivalent age bands of 5 years, implying a stable factor structure across adulthood into old age (Zimprich et al. 2012). These findings are in line with the conclusion that, at least

cross-sectionally, the Big Five personality structure seems to be invariant at different ages. In sum, evidence from cross-sectional studies suggests age differences in personality traits in old age with respect to mean levels but rather stability with respect to the structure. However, studies focusing on older and very old age-groups are still rare, and it is unclear whether the structure is stable in very old age or in older adults with declines in cognitive and physiological functioning and physical health.

### Longitudinal Evidence

Evidence for age-related change in personality traits in old age comes from an increasing number of longitudinal studies. However, previous longitudinal work differs with respect to the targeted age-group and the time intervals. Several longitudinal studies with broad age ranges also included older adults aged 65 and older and followed these individuals over several years and decades. In addition, a few studies focused exclusively on personality trait change in old age. The general picture of this work suggests that while personality trait change may not be as dramatic in older adulthood as it is in infancy, childhood, and emerging adulthood, there is evidence that even during the later years subtle changes in personality can occur that are not simply error of measurement. However, the different ways of defining developmental change offer distinct answers to the question of whether and to what degree personality traits change in old age.

First, personality traits tend to become more stable with age. A meta-analytic review summarized 3,217 test-retest correlations for a wide range of personality traits reported in 152 longitudinal studies on differential change of personality traits (Roberts and DelVecchio 2000). They used statistical methods to equate the different test-retest correlations to a common interval of about 7 years. This allowed them to compare results from studies of differing lengths of time because not all studies followed participants for the same interval of time. The main finding was that differential stability increased with age. The correlations increased from 0.31 in childhood to 0.54 during the college years to 0.64 at age 30 and

reached a plateau around 0.74 between ages 50 and 70. The finding of differential stability in old age also illustrated that the degree of stability does not prevent changes occurring within personality traits as age progresses. A study with older adults observed relatively high levels of differential stability in two older age cohorts, indicating that instability engendered by aging processes does not necessarily affect older adults' standing within an age cohort (Möttus et al. 2012). In contrast, other work found decreases in the rank-order stability of the Big Five traits after the age of 60 except for conscientiousness (Specht et al. 2011).

Second, personality traits are malleable in old age. A meta-analytic review (Roberts et al. 2006) summarized the results of 92 longitudinal studies to provide meta-analytic overview of mean-level changes in personality traits at various ages across the lifespan. The general results were that average levels of social dominance (a facet of extraversion with attributes that are linked to self-confidence and independence), agreeableness, and conscientiousness appear to increase with age, whereas neuroticism appears to decrease with age. Openness also declines with age, especially after mid-life. These changes are often viewed as positive trends given that higher levels of agreeableness and conscientiousness and lower levels of neuroticism are associated with desirable outcomes such as greater success in work and family and better health and longevity (Roberts et al. 2007). However, less is known about personality trait changes in older adults and the oldest-old.

Third, regarding personality structure, previous longitudinal work on structural change in personality traits converges with cross-sectional findings and demonstrates a stable personality structure in older adults over a few years (e.g., Small et al. 2003). However, a study with older adults (Allemand et al. 2008b) reported these patterns of correlations among the Big Five traits to be less stable over longer time periods in old age. As such, it is an open question whether and to what degree structural stability declines in old and very old age.

Fourth, personality trait change in old age is characterized by significant individual differences

in change. Regardless of typical mean-level changes in old age, several studies evidenced significant interindividual differences in individual personality trait change, implying that not every individual demonstrates the same amount of change; some individuals may increase, whereas others decrease over time, or even show stability (e.g., Allemand et al. 2008b; Mroczek and Spiro 2003). Hence, older adults may demonstrate unique patterns of developmental change in the patterns of thoughts, feelings, and behaviors as they move through the later years of life. Individual differences in change could be the result of diverse environmental experiences, age-related physical changes, and a variety of adaptive processes and behaviors that older adults utilize to maintain or improve well-being and health. In sum, evidence from longitudinal studies suggests age-related changes in personality traits in old age. This implies that personality traits are malleable even in old age. However, compared to younger ages, less is known about personality change in old and very old age.

### **Mechanisms of Personality Trait Change in Old Age**

Given this potential for malleability, the next question to consider is: what leads older adults to differ in their patterns of personality development? Though old age may be characterized more by stability than change, further research is needed to understand what catalyzes trait change in older adulthood. On this front, it may prove valuable to consider previous theoretical work on the mechanisms influencing adult personality development, which point to the importance of considering social role investments and expectations (e.g., Roberts et al. 2008).

The adult years are characterized by transitions in and out of culturally framed social roles. These roles come with clear duties and expectations, which in turn can influence individuals' daily actions and responsibilities, allowing them new contexts for self-reflection and personal change. In turn, research suggests that adults who commit to socially prescribed roles often tend to report

higher levels on personality traits deemed socially preferable, such as agreeableness, conscientiousness, and emotional stability (Lodi-Smith and Roberts 2007). Though researchers often focus on the transition into the workplace, marriage, and community early in adulthood, it is equally important to consider the influence of transitions *out* of these roles later in life. One particularly important role transition for older adults is the decision, forced or voluntary, to retire from work. The years following retirement are among the most vulnerable for health concerns of any point in the lifespan (Moon et al. 2012) and appear to coincide with a diminished sense of purpose for older adults. Similarly, it appears that retirement coincides with a greater likelihood for declines in conscientiousness compared to unretired adults (Specht et al. 2011).

Another important transition in older adulthood is how married individuals deal with the increasing potential for losing a spouse. Given that the death of a family member (e.g., child, spouse) is one of the most stressful life events one could experience during the life course, this event also might influence personality development. Indeed, widowers appear to score lower on openness to new experiences (Specht et al. 2011). Interestingly, this research also suggests that males and females appear to react differently to the death of spouse, insofar that it may lead to declines on conscientiousness among females but actually *increases* for males. One possibility is that widowed males are now required to take on more of the responsibilities within the home, which may require them to become more conscientious with time.

Though this literature is relatively nascent, it bodes well for considering social role commitment and decommitment as influences on personality later in the lifespan. As noted earlier, additional research though is needed that provides intensive longitudinal assessments with multiple measurement occasions, which would allow researchers a better idea of how transitions in and out of social roles and relationships influence trait change for older adults. Theories point to the enhanced value of intimate social relationships during old age (e.g., Carstensen et al. 1999), which only further underscores the potential for social roles to provide

important mechanisms of change. Indeed, recent research does suggest that older adults who perceive greater social support appear more likely to gain in conscientiousness over time (Hill et al. 2014). Further work though is needed to fully examine the rationale behind these potential social role effects, particularly given the importance of personality trait change during older adulthood.

### **Implications of Personality Trait Change and Future Directions**

Even modest changes in personality traits clearly have strong implications across the lifespan, given the known potential for traits to predict a wide variety of important life outcomes (Roberts et al. 2007). As noted earlier, research even points to the possibility that trait changes can influence mortality risk (Mroczek and Spiro 2007). Given this point, in old age, personality trait changes could hold profound consequences, exacerbating or attenuating the health risks conferred by the aging process. However, research is still needed to understand why and when trait changes hold health consequences for older adults, in order to best determine whether interventions should target promoting increases on seemingly positive traits or to scaffold personality stability during older adulthood.

Another important consideration returns to the prominence placed on intimate social ties by older adults. People prefer friendships with individuals higher on socially adaptive traits (e.g., more conscientious, agreeable, and emotionally stable). As such, changes away from these desirable characteristics could prove particularly deleterious for older adults, given their emphasis on maintaining social relationships (Carstensen et al. 1999). Future research is needed though to better understand whether personality trait changes in old age lead to poorer relationships with close others or if such intimate relationships, given their generally longer duration, are more resistant in the face of presumptively negative trait changes.

Finally, though the factor structure of the Big Five appears relatively consistent across adulthood (Allemand et al. 2008b), further work is

needed to understand whether researchers should revisit the item content of common Big Five inventories when sampling older adults. Researchers may wish to write additional items or edit existing inventories to better address how personality traits manifest in the contexts relevant to older adults. For instance, conscientiousness scales often discuss actions in the workplace implicitly or explicitly, which may make responding to these items more difficult for retired adults. Similarly, inventories may need to account for the potential that older adults are dealing with physical and cognitive limitations, which can attenuate their capability to manifest dispositions such as openness to new experiences. Investigations along this front can help researchers more accurately capture the trait changes that do exist later in life. Just as research has begun to demonstrate the potential for traits changes in old age, studies also need to better account for how the contexts in which traits manifest differ during this developmental period.

### **Conclusion**

Old age is an important developmental period in the lifespan. The goal of this article was to discuss the role of personality traits in the context of aging processes and to give an overview about theoretical and empirical work on changes in personality traits in later life. First, personality traits are enduring characteristics that describe individual differences in behavioral, cognitive, and emotional patterns. Several conceptual and statistically distinct ways define developmental change. Second, current empirical evidence suggests both change and stability in personality traits in old age partly on the definitions of developmental change one considers. However, research on personality trait change in old and very old age is underrepresented in the literature. Third, different mechanisms are responsible for individual differences in personality trait change in old age. One important approach to investigate mechanisms of change relates to social transitions in old age. Finally, changes in personality traits may have important consequences for older adults.

## Cross-References

- ▶ [Age, Self, and Identity: Structure, Stability, and Adaptive Function](#)
- ▶ [History of Longitudinal Statistical Analyses](#)
- ▶ [Individual Differences in Adult Cognition and Cognitive Development](#)

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## Person-Centered Care and Dementia Care Mapping

Dawn Brooker<sup>1</sup> and Claire Surr<sup>2</sup>

<sup>1</sup>University of Worcester Association for Dementia Studies, Institute of Health and Society, University of Worcester, Worcester, UK

<sup>2</sup>Faculty of Health and Social Sciences, Leeds Beckett University, Leeds, UK

### Synonyms

Holistic approaches; Observational measures of quality of care; Relationship centred care

### Definition

Tom Kitwood, a UK academic, was a key figure in the theoretical development of person-centered approaches in dementia during the 1990s. He developed Dementia Care Mapping (DCM) as an observational tool to test his theories empirically and as a means of improving care practice. Kitwood died at the age of 61 in 1998 just as his theories (and DCM) were really beginning to gain traction in Europe, North America, and Australia. In this chapter the origins and relationship between person-centered dementia care and DCM are explored. DCM is described in detail alongside more recent developments around person-centered care.

### Personhood and Person-Centered Dementia Care

It is nearly 30 years since the late Professor Tom Kitwood first used the term *person-centered*

*approaches* in relation to the long-term care for people living with dementia. In an attempt to move away from a reductionist medical model, the term was first used to bring together ideas and ways of working that emphasized communication and relationships. The term was intended to be a direct reference to Rogerian psychotherapy with its emphasis on authentic contact and communication. Kitwood's work was part of the ground swell of psychosocial approaches to dementia during the 1980s and 1990s. Writing throughout this period, Kitwood published a continuous stream of articles in prominent journals, bringing these ideas together in 1997 in his most well-known book *Dementia reconsidered: The person comes first* (Kitwood 1997).

Kitwood focused on the maintenance of personhood as being central to person-centered care. He defined personhood as “A standing or status that is bestowed upon one human being, by others, in the context of relationship and social being. It implies recognition, respect and trust” (Kitwood 1997, p. 8). Kitwood proposed that people living with dementia have the capacity to experience relative well-being and ill-being and that their behavior has meaning. He proposed that high levels of challenging behavior, distress, or apathy would occur more commonly in care situations that are not supportive of personhood. It would also follow that when personhood was supported then a greater preponderance of well-being and social confidence would be observed. Kitwood's view of person-centered care for people with dementia was that it took place in the context of relationships. He theorized that as verbal abilities are lost, the importance of warm, accepting human contact through nonverbal channels become even more important than before. With the onset of dementia individuals are vulnerable to their psychological defences being radically attacked and broken down. It becomes increasingly important that the sense of self is held within the relationships that the person with dementia experiences. These relationships are a key part of the social psychological milieu. He described personhood as being undermined when individual needs and rights are not considered, when powerful negative emotions are ignored or

invalidated, and when increasing isolation from human relationships occurs.

Kitwood described the various common ways that he had observed personhood being undermined in care settings, coining the phrase *Malignant Social Psychology (MSP)* as an umbrella term. MSP includes episodes where people are intimidated, outpaced, not responded to, infantilized, labeled, disparaged, blamed, manipulated, invalidated, disempowered, overpowered, disrupted, objectified, stigmatized, ignored, banished, and mocked. Kitwood was at pains to say that episodes of MSP are very rarely done with any malicious intent. Rather, this way of responding becomes interwoven into the care culture. New staff members learn how to communicate with people with dementia from existing staff. If the staff communication style is one that is characterized by the infantilization and outpacing of people with dementia, then the new member of staff is likely to follow their lead. The malignancy in MSP is that it eats away at the personhood of those being cared for and it also spreads from one member of staff to another very quickly. Kitwood also coined the term *Positive Person Work* to describe different forms of interaction that would maintain personhood. These included recognition, negotiation, collaboration, play, stimulation (engagement through the senses), celebration, relaxation, validation, holding, and facilitation.

## The Origins and Development of DCM

DCM was developed as an observational tool that could test this theory empirically and to assess the impact of the social and psychological environment for people living with dementia. The method and coding system were developed through ethnological observations of many hours in nursing homes, hospital facilities, and day-care in the UK. Kitwood described DCM as “a serious attempt to take the standpoint of the person with dementia, using a combination of empathy and observational skill” (Kitwood 1997, p. 4).

DCM has been through a number of changes since its inception. The current version DCM8

was launched in 2005 following a period of systematic international development and validation against DCM 7th edition (Brooker and Surr 2006). DCM training has been available in the UK since 1991. The worldwide spread of DCM has been remarkable. This growth necessitated a need to have formalized structures around DCM to maintain quality, led by the University of Bradford in the UK, who hold the copyright of the method. The DCM tool is only available through undertaking a registered course delivered by licensed trainers using standardized training methods. Those undertaking the basic DCM training course do not need any formal qualification although the complexity of the method requires reasonable numeracy and literacy skills. Worldwide there are currently 13 centers that have a Strategic Partnership with the University of Bradford to provide DCM training. The DCM tool and training materials have been translated into ten different languages. It is estimated that up to 12,000 practitioners have been trained in DCM since the early 1990s.

## The DCM8 Tool and Process

DCM training covers the tool itself and also the process by which the tool can be used to improve practice. This process involves five phases.

1. *Briefing/preparation*: During the briefing phase the trained DCM users (mappers) meet with staff in the facility (ward, care home) where the DCM process (mapping) will be implemented. They explain what the mapping process will involve and answer any questions or concerns staff may have about what this entails.
2. *Mapping Observation*: In the observation phase each mapper observes usually up to five people with dementia (participants) continuously over a time period. The period of observation chosen will depend upon the purpose of the map. It may, for example, include maps of 30 min to an hour at certain times of day over a few days (e.g., if the focus is on improving the mealtime experience, or

participant well-being in the hour after lunch), or for longer periods of 4–6 h or more on one or more days (e.g., if a picture of the waking day is required). Observation only takes place in communal areas of care facilities and personal or private care is never observed. Guidelines are provided during training about how to observe in a way that does not increase the ill-being of people with dementia. The observations are divided into continuous time periods (time frames) of 5 min. At the end of each 5-minute time frame two codes are used to record the experience of each participant. The Behaviour Category Code (BCC) describes the participant behavior that has occurred, from a choice of 23 alphabetical codes. To accompany each Behavior Category Code a judgment is also made about the participant's relative state of mood and engagement called the Mood/Engagement Value (ME Value). This is coded using a 6-point scale ranging from  $-5$  (extreme negative state) to  $+5$  (extreme positive state). ME values are averaged over the mapping period to produce a well- and ill-being score (WIB score), which gives an index of relative well-being for a particular time period for an individual or a group. Two additional data items are recorded as and when they occur. Personal detractors (PDs) and Personal Enhancers (PEs) are staff behaviors that have the potential to undermine (Malignant Social Psychology) or enhance (Positive Person Work) the personhood of those with dementia respectively. There are 17 types of PEs and PDs, which are coded according to their type and degree of severity.

3. *Data Analysis*: The analysis phase involves processing the raw DCM data into a format that can be used in a feedback session with staff. At a most basic level this involves showing the percentage of time spent in each BCC or ME and showing the numbers and types of PDs and PEs recorded. However, further processing of the data can produce indicators of agitation, distress, engagement, occupation, and social engagement. Once processing of the data is complete, the mappers produce a

feedback report, which will be used in the feedback phase with staff.

4. *Feedback to staff*: The feedback phase involves holding at least one feedback meeting with the staff team to share with them the findings of the map, to identify examples of good practice and areas for practice development.
5. *Action planning and quality improvement*: Following on from the feedback session a series of action plans and points is developed by the staff team for them to implement over an agreed period of time. This practice development cycle is repeated on a regular basis (every 4–12 months) to monitor progress and identify new action plans.

### **The Efficacy of DCM as a Practice Development Tool**

Practitioners use DCM in many different settings, for many different purposes, primarily because they report that DCM provides an effective vehicle for systematically moving dementia care from a task-focused, custodial model into one that focuses on the experience and well-being of people living with dementia. There are very few other tools that fulfill a similar purpose or that have been shown to be effective in doing so. There is no data available regarding how many care providers actually use DCM in practice, or how many of those trained in the method use it regularly as a practice development tool. However, anecdotal feedback, surveys of DCM users (Douglass et al. 2010), and formal intervention studies (Chenoweth et al. 2009) have all highlighted implementation difficulties for DCM following training, with rates of use reported as being between 30% and 60%. Formal surveys (Douglass et al. 2010) report that attendance at DCM training is a transformative experience that leaves those trained feeling empowered and inspired to make positive change back in their workplace. Feedback suggested that even those who had never used the tool felt that attending the training alone had had a positive impact on their own practice. However, both surveys were

based on small samples (<150 respondents) and their recruitment methods mean there was potential for bias. They were also conducted only in the UK and USA and therefore it is unclear how representative these figures are of the actual picture of DCM implementation worldwide. The most commonly cited difficulties for practitioners in implementing DCM are a lack of time and management support (Douglass et al. 2010). This is a serious barrier to widespread use in an increasingly resource-impooverished field.

Whether DCM has had a sustained impact on practice is difficult to assess and there still remains a fairly limited body of robust evidence about its efficacy as a tool for practice change over time (Chenoweth et al. 2009). Practice implementation studies report the benefits of DCM include the improvement of well-being for the person with dementia and helping staff to understand the perspective of the person with dementia, and to use this to develop evidence-based action plans that motivate staff and increase their confidence in implementation of person-centered care. However, these studies have a number of methodological weaknesses (Brooker 2005). To date only a handful of studies have examined the benefits of using DCM for improving clinical outcomes for people with dementia using robust designs. These pilot or full cluster randomized controlled trial studies conducted in care home settings report several benefits of DCM compared to usual care control homes. Such benefits include reduction in resident agitation, anxiety (Chenoweth et al. 2009; Chenoweth and Jeon 2007; Rokstad et al. 2013), falls (Chenoweth et al. 2009), depression (Chenoweth and Jeon 2007), neuropsychiatric symptoms (Rokstad et al. 2013), improved resident quality of life (Rokstad et al. 2013), improved quality of staff interactions with residents (Chenoweth and Jeon 2007), and reduced emotional exhaustion and staff burnout (van de Ven et al. 2013).

There is very limited available evidence on the cost-effectiveness of DCM as a practice development tool. A Dutch randomized controlled trial in nursing homes (Van de Ven et al. 2014) found that in the DCM intervention group, significantly lower costs associated with hospital outpatient

use were observed, but no other overall cost differences were seen between DCM intervention and usual care control. They concluded that DCM is a cost-neutral intervention. However, an Australian study (Chenoweth et al. 2009), comparing implementation of DCM to implementation of a staff training intervention in person-centered care and to usual care, found that DCM cost more than four times the amount than implementation of person-centered care training per site. Thus they concluded that DCM may be too costly in terms of funding training and then the additional staff time required for conducting mapping cycles, for many care homes to implement.

DCM has received criticism for not being suitable for gaining a detailed understanding of the experiences of people with very advanced dementia, with multimorbidities, or those who may be at end of life (Perrin 1997). The length of the time periods for coding (5-min) and restrictions of using DCM only in public areas can result in production of data that lacks the richness needed to plan care for those with very high levels of dependency. Alternative observational tools such as PIECE-dem (Brooker et al. 2013) have been developed specifically for people with advanced dementia and so may be used alone or alongside DCM when conducting practice development or research with this population. Dementia care staff are sometimes concerned that DCM observations may in themselves diminish the quality of life of people with dementia by making them feel intimidated. However, much of the content of the training in DCM provides various ways to ensure that the process of DCM is inclusive both of the people living with dementia and the care staff so they do not feel marginalized or intimidated.

DCM has also provided the foundations for an observational tool designed specifically for inspection and regulation of health and social care (Brooker et al. 2007). The Short Observational Framework for Inspection (SOFI) was developed in England as an observational component to the inspection toolkit used by the Care Quality Commission in its regulation of health and social care services. SOFI, like DCM, collects data on the experience of care from the point of view of the person using the service and gathers

information about service user mood, engagement, and the quality of interactions with staff. This information is triangulated with other data to help inspectors/assessors form judgments about care practices. SOFI is now being used in Wales, Scotland, Australia, and the Netherlands in the regulation of health and/or social care services.

## DCM in Research

A recent review of the psychometric properties of DCM as a research tool (Cooke and Chaudhury 2012) concluded that it has acceptable face validity but unclear content validity particularly in terms of recommended length of observation periods and numbers of participants included. Nevertheless, published studies and reviews of DCM as a research tool suggest that it is acceptable for use as a research outcome measure, providing careful consideration is given to its applicability to the study aims and outcomes, and to its implementation within the research through careful study design and method development. A number of studies have examined the psychometric properties of DCM as a research tool.

### Validity as a Quality of Care and Quality of Life Measure

There is limited published evidence for the concurrent validity of DCM as a quality of care measure, but there is available evidence exploring its concurrent validity as a quality of life measure. Evidence suggests DCM appears to have the same biases as proxy rated measures, compared to self-report (Cooke and Chaudhury 2012). However, one of the key features of DCM is that it aims to help assess the quality of life of people who would otherwise be unable to provide this information via self-report. Therefore, it may provide an additional, alternative measure to proxy staff/carer evaluations, where self-report is not possible, and a complimentary rather than alternative measure, where self-report is possible. A number of studies report correlation between higher dependency levels and lower well-being in people

observed using DCM, suggesting DCM is measuring dependency-related factors rather than quality of life (Brooker 2005). However, this is not universal to all studies and one US study comparing DCM to quality of life measures reported that dependency levels accounted for less than 12% of the variance in well-being/quality of life (Edelman et al. 2005). This suggests DCM may measure additional components of quality of life that are not captured by other quality of life measures.

### Reliability

There is insufficient evidence to draw conclusions regarding internal consistency and test-retest reliability (Brooker 2005; Cooke and Chaudhury 2012). A number of studies have reported on the inter-rater reliability of DCM that indicate it is possible for mappers to achieve acceptable levels of inter-rater reliability for use of the tool in both practice (above 70% concordance) and research (above 80% concordance) situations (Brooker 2005). However, other studies have reported issues with consistent achievement of inter-rater reliability between mappers (Cooke and Chaudhury 2012). It is not possible to be confident in the inter-rater reliability of DCM across or between studies, or between mappers on a national or international level, as there are currently no approaches to ensuring inter-rater reliability for DCM observations beyond local concordance checks.

## The VIPS Model of Person-Centered Dementia Care

Since Kitwood's early writing there has been a significant change in how people with dementia are treated in their relation to being active agents in their own lives. The right to be aware of diagnosis and treatment options have come to the forefront. The recognition that the voice of the person with dementia needs to be heard directly in shaping and developing services has become an accepted way of working. More and more direct accounts of what it is like to live with dementia are

available. Self-advocacy groups are becoming more prominent in the Alzheimer charities. Even in long-term care facilities, where people have significant cognitive impairments, their voice is now frequently heard in qualitative research reflecting directly on their perspective.

The concepts in person-centered care are not easy to articulate in a straightforward manner. In a review of definitions of person-centered care (Brooker 2004) it was noted that person-centered care was being interpreted as meaning individualized care, and that the emphasis on relationships that Kitwood promoted had been lost. In addition, since Kitwood's original writing, there is a stronger recognition that the societal and organizational context in which care is delivered impacts upon the quality of care. If care is to shift from task-focused to person-focused, then society and care providers need to prioritize the human rights of those living with dementia. Changing the skills of front-line care workers is not enough in itself.

The VIPS definition of person-centered care (Brooker 2004) is an attempt to introduce the notion of organizational responsibility while maintaining the sophistication of Kitwood's original work. Put simply, the VIPS definition of person-centered care encompasses a **value** base that asserts the absolute value of all human lives (**V**); an **individualized** approach, recognizing uniqueness (**I**); understanding the world from the **perspective** of the person living with dementia (**P**); and the promotion of a positive **social psychology** in which the person living with dementia can experience relative well-being (**S**).

The VIPS definition has been used in the English NICE/SCIE Guideline on Dementia (NICE/SCIE 2007) as the underpinning value base for best practice and defined the principles of person-centered care as asserting the human value of people with dementia, regardless of age or cognitive impairment, and those who care for them; the individuality of people with dementia, with their unique personality and life experiences among the influences on their response to the dementia; the importance of the perspective of the person with dementia; and the importance of

relationships and interactions with others to the person with dementia, and their potential for promoting well-being.

In addition to DCM, complementary tools for assessing person-centered care delivery and services have been developed, which draw on contemporary definitions of person-centered care and provide a richer picture of the elements a service needs in place to provide person-centered care. For example, the VIPS definition was used as the structure for the evidence base for developing a tool to assess good practice in person-centered care (Brooker and Latham 2016), which provides a set of concrete indicators that care providers can benchmark their services against. Around 50 care providers and service user organizations worldwide arrived at a detailed description of what a person-centered care provider should have in place. This list of 24 indicators is grouped around the 4 elements of the VIPS definition and has become known as the *VIPS framework*. Person-centered care requires sign-up to working in this way across the whole care provider organization if it is to be sustained over any length of time. Particular elements require leadership at different levels (i.e., from those responsible for leading the organization at a senior level, from those responsible for setting care standards and procedures within the organization, and from those responsible for day-to-day management and direct provision of care). The data gathered through use of DCM can provide evidence toward assessment against a number of the indicators within the VIPS framework. These are next provided:

**V: Does this service actively show that the experiences of people with dementia and their families are valued and respected?**

1. Is the service actively welcoming to people with dementia and their families?
2. Is the service valuing of good-quality direct care for people with dementia and their families? Is there a management ethos that fosters the best direct care?
3. Is the staff empowered to act in the best interests of people with dementia and their

families? Is there a management ethos that empowers staff to act in this way?

4. Is the workforce skilled in person-centered dementia care at all levels from frontline to leaders?
5. Generally are the physical and social service environments designed to be easy for people with dementia and their families to use?
6. Does the service know about and act upon the needs and concerns of people with dementia and their families?

**I: Are systems in place to enable staff to get to know the person, to provide continuity of care, and to ensure the person feels like a unique individual?**

1. Do staff know each person's strengths and needs across physical, social, and psychological domains?
2. Are staff alert to changes in these strengths and needs over time?
3. Do staff know what personal possessions and relationships are important to each person to help them feel calm?
4. Do staff know each person's likes and dislikes and preferred everyday routines and are these utilized in everyday care?
5. Do staff know each person's history and key stories and are these utilized in everyday care?
6. Do staff know how to engage each person in enjoyable activities?

**P: Is care taken to understand the perspective of the person with dementia and their family?**

1. Do staff check out preferences, consent, and opinions using verbal and nonverbal means?
2. Can staff empathize with how each person is feeling and show this in their everyday care?
3. Do staff regularly ensure that the physical environment is as comfortable as possible for each person?
4. Is the staff vigilant about physical health needs that the person may not be able to tell them about directly?
5. If the person is showing "challenging behaviour" do staff try to understand why

and what the person may be trying to communicate?

6. Do staff treat the rights of the individual with dementia as important as the rights of other people?

**S: Does this service provide a Supportive Social Psychology to enable the person with dementia to feel socially confident and that they are not alone?**

1. Do staff help the person feel included and not "talked across"?
2. Do staff treat each person respectfully and not use a "telling-off" tone or derogatory labels to describe people?
3. Do staff come across as warm and caring and not cold and indifferent?
4. Do people know that staff take their fears seriously and that they won't be left alone for long periods in emotional distress?
5. Do staff help people to be active in their own care and activity as far as possible and not just do things to people without communicating with them?
6. Do staff facilitate to help the person keep important relationships and make sure that they stay in touch with people and activities they value?

In the USA, the VIPS framework was utilized to develop a series of workshops on improving communication skills of care workers in a large for-profit long-term care facility (Passalacqua and Harwood 2012). The VIPS framework has been adopted as a means of internally benchmarking the person-centeredness of practice within a number of service settings, particularly within the care home sector. Baker (Baker 2014) describes utilizing VIPS as an organizing principle for an internal quality improvement program in a large "for-profit" care homes provider in the UK. In Norway, Røsvik and colleagues have developed the VIPS Practice Model as a means of improving quality of care for care-home residents (Røsvik et al. 2013). Rokstad et al. examined the impact of the VIPS Practice Model and DCM when compared to usual dementia education sessions and found that nursing home residents who were cared

for by teams using the VIPS practice model showed significantly less depressive symptoms over time.

## Conclusion

The development of person-centered dementia care and DCM are intertwined. Both have continued to develop as drivers for improving dementia care internationally. Person-centered care has developed into a set of guiding principles to help care providers support personhood. It is not necessary to undertake DCM in order to deliver person-centered care. DCM as a practice development tool may help to evidence whether person-centered care is occurring and can highlight ways in which practice can be developed. It can therefore serve as an evidence-based driver for person-centered practice change. DCM was developed in an era when it was thought that people with dementia could not provide reliable accounts of their own experience. The motivation for its development, however, was so that the standpoint of the person with dementia was represented. The development of DCM and subsequent guidance for its use in practice and research has emphasized the centrality of people with dementia in this process and has thus helped to drive forward the central tenet of person-centered care – the primary focus on the experience and needs of the individual with the condition.

Observational methods such as DCM provide the opportunity to provide the perspective of those who cannot speak out for themselves. DCM provides evidence of what happens to people with dementia in communal areas of formal care settings. DCM provides evidence of how people spend their time, their observed well-being, and how they are treated by staff and professionals. When people are very dependent on care services, quality of life becomes inextricably linked with quality of care. Within more advanced dementia, quality of life may be the most important goal. As dementia progresses, the ability of individuals to secure help in their own right or to assert their best interests in the face of poor service quality becomes increasingly difficult. Unless the person

with dementia is blessed with a strong family support structure they may have very few advocates who will act solely in their best interests. Because of this, their citizenship rights are easily violated. This renders them extremely vulnerable to abuse – be it financial, physical, sexual, or psychological. Individuals living with dementia are likely to find it difficult to complain directly about poor quality of care because of the nature of cognitive disability that is part and parcel of dementia. In addition, many family members are worried that if they complain services will be taken away from them or that there will be repercussions for their loved ones.

Evidencing quality from the perspective of the person living with dementia is complex both conceptually and practically. There is an inherent tension in providing standardized measures of quality of life and quality of care for such a heterogeneous group of people living out their lives in a multiplicity of ways. Yet unless there are standardized measures of these important outcomes and processes then practitioners, regulators, researchers, and policymakers will continue to rely on the easy-to-measure such as cognitive status or compliance with health and safety regulations.

As evidenced by this review, there are many questions unanswered about the efficacy of DCM to change practice and sustain change over time. Person-centered dementia care is not an easy or trivial process and, in some respects, this is reflected in DCM. Person-Centered Care continues to evolve as more evidence is learned about how services maintain personhood. Whether DCM remains a practical driving force within this will depend on its own ability to evolve so as to remain relevant to progressive definitions and frameworks describing contemporary person-centered care.

## Cross-References

- ▶ [Activity Theory, Disengagement Theory, and Successful Aging](#)
- ▶ [Aging and Psychological Well-Being](#)
- ▶ [Aging and Quality of Life](#)

- ▶ Behavioral and Psychological Symptoms of Dementia
- ▶ Challenging Behavior
- ▶ End of Life Care
- ▶ Environmental Influences on Aging and Behavior, Theories of
- ▶ Psychological Theories on Health and Aging

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## Physical Activity and Aging

Nicola W. Burton

School of Human Movement and Nutrition Sciences, The University of Queensland, St Lucia, Brisbane, QLD, Australia

## Synonyms

Exercise, wellbeing, health, successful ageing, healthy ageing, active ageing

## Definitions: Physical Activity, Exercise, Inactivity, and Sedentary

Physical activity is any bodily movement produced by the skeletal muscles that requires energy expenditure. Physical activity can occur in a range of contexts such as work (e.g., carrying and lifting), households (e.g., gardening, cleaning), travel (e.g., walking or bicycling to get to and from places), and leisure (e.g., sport, recreational walking). Exercise is a specific type of physical activity that is planned, structured, and repetitive, with the aim to improve or maintain one or more components of fitness, such as balance, strength, or endurance.

The words “inactive” and “sedentary” are sometimes used interchangeably to describe a lack of physical activity or exercise. Contemporary practice is, however, that “inactive” implies a lack of physical activity or exercise and “sedentary” describes behaviors of low energy expenditure that are done in a sitting or reclining posture, such as lying down to watch television and sitting to use a computer or travel in a motor vehicle. This distinction highlights that sedentary behavior and physical activity are not mutually exclusive lifestyle components. A person can have high levels of sedentariness (i.e., sitting 8–10 h/day) and also exercise daily, or have low levels of sedentary behavior and do no exercise.

## Health Benefits of Physical Activity

Inactivity is the fourth leading risk factor for global mortality and a leading cause of years lost due to poor health, disability, or premature death (World Health Organization 2010). Inactivity is estimated to be the main cause for approximately 25% of breast and colon cancers, 27% of diabetes, and 30% of ischemic heart disease burden in the general population including older adults (World Health Organization 2010).

Data from Sweden indicate that physical activity is the strongest factor associated with longevity among adults aged 75+ years, with regularly active people living on average 2 years longer than those inactive

(Rizzuto et al. 2012). Activity has a positive impact on many of the concomitants of aging. Sufficient and regular physical activity:

- Reduces the risk of high blood pressure, coronary heart disease, stroke, type 2 diabetes, breast and colon cancer, falls, depression, functional and role limitations, and premature death
- Improves bone health, cardiorespiratory and muscular fitness, physical functioning, performance of activities of daily living, balance, health-related quality of life, and life expectancy
- Is a key component of energy balance and weight management

*Benefits for well-being.* Physical activity can enhance well-being and health-related quality of life, and prevent and help manage poor mental health among older adults. Potential benefits include stress management, improved mood, mental alertness, competence, self-esteem, self-worth, and social connectedness (Franco et al. 2015). Physical activity may also provide specific psychological benefits that are associated with emotional well-being, such as enjoyment and fulfillment; time-out and distraction; a sense of accomplishment, mastery, and control; enhanced energy; and reduced fatigue and tension. A Taiwanese study with older adults demonstrated that leisure time physical activity was positively associated with psychological, social, learning, growth, and independence dimensions of well-being, both currently and over the following 3 years (Ku et al. 2014). Those who did frequent walking, gardening, or group exercise had higher levels of life satisfaction as they aged over 8 years, even after accounting for health, depression, and cognitive decline: this association was stronger for the oldest group aged 80+ than those aged 70–74 years (Ku et al. 2015). Regular exercise and physical activity can also reduce the severity of depression and improve well-being in older adults (Bridle et al. 2012; Windle et al. 2010).

Physical activity reduces the risk of cognitive decline by approximately 35% and the risk of dementia by approximately 18% (Blondell et al. 2014) and can help maintain or enhance

cognitive function in older adults with or without mild cognitive impairment (Carvalho et al. 2014). Among those with dementia, exercise may help improve some activities of daily living (Forbes et al. 2013).

*Benefits for healthcare service use.* Physically active older adults have fewer general practitioner visits, hospitalizations, emergency and outpatient visits, and extended hospital stays; and lower overall healthcare costs than those who are inactive (Sari 2011). Data from Jerusalem demonstrated that the proportion of older adults with emergency room visits was 37% for active people and 16% for those inactive at age 78 years, and 51% for active people and 31% for those inactive at age 85 years, after allowing for functional dependence, cognitive impairment, depression, body mass index, smoking, and conditions such as diabetes and heart disease (Jacobs et al. 2013). The proportion of older adults with hospitalization was 11% versus 17% at 78 years and 22% versus 38% at 85 years for those active versus inactive (Jacobs et al. 2013). *Initiating* physical activity in late adulthood resulted in a similar lower likelihood of emergency visits and hospitalization as being consistently active, and *ceasing* activity and *never* being active were associated with increased emergency visits and hospitalization (Jacobs et al. 2013).

Exercise, including walking, can be more cost-effective than medical interventions for some health conditions (Sari 2011). In the US general population including older adults, insufficient physical activity is estimated to account for 9–11% of healthcare expenditure, with a mean annual expenditure difference per capita of 30% between inactive and active adults and 15% between those doing some activity and those doing none (Carlson et al. 2015). Inactivity is the cause of more than 15% of annual costs of major noncommunicable diseases in China (Zhang and Chaaban 2013).

## How Much Physical Activity?

*General recommendations.* Recommendations on how much physical activity to do for good health have been produced by a range of organizations

across the world, e.g., national heart associations, public health institutes, sports medicine associations, and government departments of health. Countries with physical activity recommendations include Australia, Belgium, Canada, Chile, Denmark, England, Fiji, Finland, France, Ireland, Jamaica, Japan, the Netherlands, New Zealand, Norway, Singapore, Spain, Sweden, Switzerland, the United Kingdom, and the United States.

For people aged 65+ years, the World Health Organization (World Health Organization 2010) recommends:

- At least 150 min of moderate-intensity physical activity or at least 75 min of vigorous-intensity physical activity or an equivalent combination of moderate- and vigorous-intensity activity throughout the week
- For additional health benefits, people should increase to 300 min of moderate-intensity physical activity, or 150 min of vigorous-intensity activity, or an equivalent combination of moderate- and vigorous-intensity activity throughout the week
- For those with poor mobility, physical activity to enhance balance and prevent falls on at least 3 days per week
- Muscle-strengthening activities involving major muscle groups on at least 2 days a week
- When older adults cannot do the recommended amounts of physical activity due to health conditions, they should be as physically active as their abilities and conditions allow

*Focus of activity recommendations.* The lower recommendation (150 mins/week moderate, 75 mins/week vigorous) is for *general* health benefits, such as good physical functioning and a lower risk of cardiovascular disease. The higher recommendation (300 mins/week moderate, 150 mins/week vigorous) reflects that more activity is needed for other benefits such as reducing the risk of some cancers and preventing weight gain (Brown et al. 2014). *Specific* goals, such as managing an injury or health condition, or improving a select aspect of physical functioning, may require a different amount or specific types of physical activity.

Older adults with disability or health concerns may benefit from professional advice on adjustments to physical activity recommendations, based on individual capacity, risks, and limitations. Screening tools that assess health history (Australian Government Department of Health and Ageing 2005; Balady et al. 1998) can provide pre-participation guidance on potential risks and if a medical consultation is advisable. Because many of these tools screen for medication use or conditions often prevalent among older adults, they can yield a high rate of recommendations for medical consultation (Whitfield et al. 2014). Screening tools specific to older adults (Resnick et al. 2008; Cardinal et al. 1996) may, therefore, be advantageous.

*Physical activity intensity.* The intensity of physical activity reflects the effort and energy involved. With moderate-intensity activity (e.g., brisk walking, slow bicycling, general gardening), there is some difficulty talking, and heart rate is at 50–70% of the maximum. When doing vigorous-intensity activity (e.g., jogging, aerobics), it is difficult to say more than a few words without stopping to take a breath, and heart rate is at 70–85% of the maximum. High-intensity activity (e.g., running, jumping rope) is at more than 85% of the maximum heart rate. Maximum heart rate depends on age, can change with physical activity type, and may be lowered by some medications. While there are some simplistic informal means to estimate maximum heart rate based on mathematical formulae (e.g., a set number – your age), formal determination is based on exercise testing.

Activity recommendations are lower for vigorous- than moderate-intensity activity because vigorous-intensity activity expends more energy. However, *both* types of activities provide benefits. Vigorous-intensity activity may provide benefits at a slightly higher level more rapidly, but may be difficult or undesirable for some older adults to do. People can, therefore, mix types of physical activities depending on their ability, preference, and opportunities.

Most research on the health benefits of physical activity focuses on moderate- to vigorous-intensity physical activity. Notably, light-intensity activities – such as slow walking,

stretching, and light gardening/housework – can also provide some health benefits for older adults and may be more acceptable and tolerable for some people (Loprinzi et al. 2015). Emerging research is suggesting that light-intensity activity can have a positive impact on blood glucose, cholesterol, metabolic health, self-rated health, weight indicators, and mood.

*Physical activity types.* Activities that enhance balance typically involve balancing movements e.g., tai chi, yoga, dancing, and specific exercises (e.g., standing on one foot). Muscle-strengthening activities involve weight-bearing – this can include actual weights (e.g., carrying loads, lifting/pushing weights, weights on the wrists or ankles) or body weight (e.g., stepping, jumping, push-ups, sit-ups). Major muscle groups are the legs, back, abdomen, chest, shoulders, and arms.

*Physical activity thresholds.* These physical activity recommendations represent a threshold at which there is a *majority* of general health benefit. It is important to note, however, that physical and psychological benefits can be derived from smaller amounts of activity. Doing at least 30 min of activity 1–2 times a week can significantly reduce the risk of all-cause mortality (Wu et al. 2015). The reduced risk of mortality in older adults is 22% for activity less than recommendations compared to no activity, and 28% for activity recommendations compared to not meeting recommendations (Hupin et al. 2015). Low levels of activity – such as 40–75 min/week walking – have been associated with current emotional well-being and a reduced risk of depression and anxiety symptoms after 3 years among older women (Heesch et al. 2011). Often the greatest benefit to health is to change from doing no activity to do some.

## How Active Are Older Adults?

*How to measure physical activity.* There is a range of ways to assess physical activity. Questionnaires, logbooks, diaries, and interviews can be done face to face and by mail, telephone, or online. These methods rely on individual reports of how much physical activity was done in a set

time period, e.g., past day/week/month. People may be asked to report on frequency, duration, or specific types or intensities of physical activity in different settings. This assessment is, however, vulnerable to error, as it can be difficult to recall physical activity accurately, particularly if it was incidental (e.g., climbing stairs), during a time period with atypical behavioral patterns, or over a long period (e.g., during the past year). Errors can also arise if people want to present themselves in a positive manner.

Other types of assessment involve the use of instruments to measure the biomechanical or physiological consequences of physical activity. Pedometers and accelerometers are electric or electromechanical devices that detect motion. Pedometers count steps and accelerometers assess speed and intensity. These small devices are commonly worn at the waist or wrist, and some are worn on the ankle or thigh. Some personal devices, such as a watch or mobile phone, have an integrated pedometer or accelerometer and provide physical activity information on a visual display or relay data to a computer. This approach to assessment is less vulnerable to reporting errors and includes incidental physical activity that can be difficult to keep track of, such as short walks to do errands. However, some of these devices are not suitable to wear in water or to detect activities unrelated to walking and therefore cannot assess activities such as swimming, bicycling, yoga, and weights. Other types of instruments, e.g., monitors to assess heart rate, focus on energy expenditure as a reflection of the amount of activity done.

*How many are meeting activity guidelines?* The proportion of older adults meeting recommendations to do at least 150 mins/week of moderate- to vigorous-intensity activity varies markedly by country and method of measurement. The majority of reports range from 20% to 60%, with higher prevalences in Cyprus, Brazil, rural China, Columbia, Sweden, and Switzerland: when domestic activity is included: among men than women; and for younger than older age groups (Sun et al. 2013). There is mixed evidence on trends over time, although low- and middle-income countries may have decreasing levels of physical activity with the increasing

availability of mechanical and technological devices that reduce the need for physical exertion (Sun et al. 2013).

Pedometer-based health promotion messages for adults often recommend 10,000 steps each day. Benefits for older adults are, however, apparent from at least 4500 to 5500 steps/day for health-related quality of life, body weight, cholesterol, physical functioning, mobility and balance, blood glucose, and mood (Ewald et al. 2014; Tudor-Locke et al. 2011). Healthy older adults average 2000–9000 steps/day, which reflects the natural diversity of ability associated with age, illness, and mobility (Tudor-Locke et al. 2011). Those with illness or disability, but not limited to older adults, average 1200–8800 steps/day (Tudor-Locke et al. 2011). Data from the United States suggest an average of 4240 steps/day among older adults, generally with men accumulating slightly more steps than women, and a decreasing step count/day with increasing age (Tudor-Locke et al. 2013).

## Barriers and Enablers of Physical Activity

Among older adults, there is a range of potential barriers and enablers of physical activity; these relate to sociodemographic, personal, social, and environmental contexts.

*Demographic and personal factors.* Major demographic and personal factors that can help or hinder activity participation among older adults include affordability, activity habits, physical and psychological health, and activity-related attitudes (Franco et al. 2015). Affordability may be an issue in late adulthood because of a change in financial circumstances or priorities after leaving the paid workforce, or among those with socioeconomic disadvantage. Past habits regarding sedentary or physically active leisure pursuits may influence behavior in late adulthood, because of positive/negative experiences and established opportunities and networks. Physical limitations can reflect poor health; pain; discomfort; breathing difficulties; or concerns associated with falling, injury, musculoskeletal disorders, or urinary incontinence. Stress, psychological difficulties

(e.g., depression, anxiety), low mood, and negative reactions to life events (e.g., bereavement) may be a barrier. Personal attitudes relating to the perceived value of physical activity, activity competence and confidence, competing time priorities, independence, and apathy can also influence activity participation.

*Social factors.* Key social influences of physical activity among older adults relate to interactions, confidence, and support (Franco et al. 2015). Positive social interactions from seeing familiar people, from group-based activities, or with activity instructors can enhance motivation. Low social confidence or concerns with group diversity may be a barrier to group-based activity options. Some cultural or religious contexts may require specific social conditions, such as gender segregation. Social support for activity includes verbal encouragement and informational and practical assistance, e.g., advice, transportation, and equipment. Constraints may come from competing time demands from family or care responsibilities for, e.g., a partner or grandchildren. Some older adults may be discouraged from activity by overprotective or critical significant others worried about injury or exacerbation of a preexisting condition. Ageist stereotypes, from others or among older adults themselves, may constrain participation and reflect beliefs that exercise is unnecessary or potentially harmful, or that age-related decline is inevitable. Professional advice (e.g., from a trusted health practitioner) to do physical activity and supervised instruction may be particularly valued by older adults with vulnerabilities, and can enhance feelings of safety during participation.

*Environmental factors.* Salient environments for older adults' physical activity include pedestrian infrastructure (e.g., continuous unobstructed dedicated paths), crime-related safety (e.g., friendly people, lit areas), traffic-related safety (e.g., street crossings, safe drivers), accessible and appropriate opportunities (e.g., age-oriented options, walking destinations) and amenities (e.g., rest areas, public transport, toilets), aesthetics (i.e., well maintained, attractive, natural scenery), and environmental conditions (e.g., moderate weather, quiet, peaceful, minimal pollution) (Moran et al. 2014).

## Promoting Physical Activity for Older Adults

Interventions to improve or maintain physical activity in older adults can involve a variety of contexts and methods. Physical activity may be the single focus or integrated with other intervention components, e.g., healthy eating. Types of activity can include conventional exercise, walking, sports, or more novel applications such as dance or exergaming.

*Individual-level approaches.* These strategies focus on individualized delivery or small groups. Programs can be home-based or in other settings, e.g., exercise facility, church, health service, and aged care. The format may be individual- or group-based and supervised or unsupervised and, if supervised, led by peers, lay people, or professionals across a range of disciplines. Participant contacts can be face to face or remote using print materials, telephone, text messaging, or online resources. Programs may involve direct exposure, e.g., exercise training and instruction, or aim to enable independent engagement in physical activity, e.g., providing social support, advice, resources, or motivational counseling.

Individual-level physical activity interventions with older adults living in the general community can be effective, with an average improvement of 620 steps/day or 73 min/week and greater effects among more healthy people (Chase 2015). Position statements and best practice guidelines on physical activity in older adults identify multicomponent programs, low-risk and safety through graduated intensity, and behavioral change strategies (Toto et al. 2013).

*Behavioral change strategies.* Individual activity programs may be more successful if they combine cognitive and behavioral strategies, include motivational components that promote independent change, and incorporate problem-solving techniques and barriers management (Chase 2015). Cognitive strategies address activity-related attitudes and beliefs, e.g., perceived value, understanding of risks vs. benefits, and building confidence. Behavioral strategies include goal setting, action planning, self-monitoring, modeling (i.e., demonstrations and opportunities to rehearse),

and contingent rewards. Motivation for physical activity can be extrinsic (e.g., wanting to please significant others) or intrinsic (e.g., pleasure) and reflect interests in health and fitness, social and emotional benefits, weight management, enjoyment, improved appearance, and other gains. Importantly, the personal salience and meaning of these motivators will differ among older adults. Exploring and resolving ambivalence toward physical activity is a key component of counseling-based approaches to enhance motivation, and is based on the premise that there are different stages of readiness for change. Problem solving and barriers management can include self-regulation strategies on how to manage disruptive thoughts and feelings, strategies to enhance social support for physical activity, and coping planning on how to manage distractions, setbacks, and relapses.

*Community-level approaches.* These strategies target large groups or whole populations. Communication-based strategies use audiovisual materials and persuasive messages to promote e.g., awareness of the value of physical activity, recommended activity levels, and strategies for change. Signage can highlight opportunities for physical activity, e.g., the number of steps to a destination, using the stairs. Mass media campaigns are an appropriate part of community-wide activity campaigns but have uncertain effectiveness as a stand-alone strategy (Hawkins et al. 2007). Despite some initial low Internet confidence, older adults can successfully engage with online physical activity interventions (Ammann et al. 2013; Irvine et al. 2012).

Health and community-based services can enable staff to promote physical activity and can enable activity opportunities for older adults, e.g., staff training in physical activity counseling, organized activity groups, and supported access to community-based activity providers. Primary care may be a useful setting to reach older adults: activity interventions in this context need more evaluation but show promise (Stevens et al. 2013; Neidrick et al. 2012). Walking groups that target older adults are more effective in increasing physical activity than groups that target younger adults (Kassavou et al. 2013). Mass physical activity

participation events can attract and involve older adults (Stevinson and Hickson 2014).

Environmental approaches focus on enhancing the natural or built settings for physical activity. Large shopping malls may provide a safe, accessible, and affordable walking environment for older adults, redressing barriers of personal security and poor weather (Farren et al. 2015). Local government partnerships can develop more “walkable” neighborhoods characterized by pedestrian infrastructure, high residential density, mixed development (which provides destinations), high street connectivity, aesthetics, green space, and optimized safety (e.g., adequate street lighting) (Kerr et al. 2015). People living in high walkable communities accumulate an average of 766 steps/day more than those living in low walkable areas (Hajna et al. 2015). Exercise equipment and resources can be provided in local parks, aged care residences, and other settings accessible to older adults.

Economic incentives for physical activity include cash/gift vouchers or cost subsidies for older adults to access activity opportunities/resources, taxation strategies to promote active transport, and insurance returns or credits for ongoing activity participation. Government, worksite, and other groups can develop physical activity policy to identify behavioral targets; organizational goals, resources, and implementation plans; as well as organizational, political, and public opportunities, e.g., urban design and land use (Rutten et al. 2012).

## Future Directions

Directions for future enquiry on older adults’ physical activity include:

- Quantifying what intensity, frequency, mode, and duration of physical activity is most beneficial for enhancing different aspects of aging (physical, psychological, cognitive, social) and the benefits from low levels of activity
- Establishing and maintaining surveillance studies, in particular in low- to middle-income countries, to understand the patterns and trajectory of participation

- Assessing the relative importance of personal, social, and environmental determinants
- Identifying the most effective promotional strategies, at the individual and community level
- Exploring how physical activity can be enabled among older adults with specific needs, e.g., socioeconomic disadvantage, ethnic diversity, poor physical/psychological health, cognitive decline, frailty, physical limitations, in residential care, in regional, and remote areas
- Understanding how improvements in physical activity can be maintained over time

## Summary and Conclusion

Physical activity is about movement and includes behavior across a range of contexts. Inactivity is a leading cause of poor health, disability, and premature death. Regular and sufficient activity provides multiple benefits including cardiovascular, metabolic, respiratory, and musculoskeletal health; physical functioning; psychological and social well-being; cognitive functioning; and quality of life. For older adults, physical activity is the strongest factor associated with longevity. Current recommendations are for adults aged 65+ years to engage in at least 150 min/week of moderate-intensity activity and activities to promote balance and strengthen muscles. Importantly, benefits can be obtained from lower levels and intensity of physical activity, so people should be as physically active as abilities allow. There are a range of potential sociodemographic, personal, social, and environmental barriers and enablers to physical activity among older adults – these factors can inform individual- and community-level strategies to promote physical activity. Key components of successful individual-level programs to promote activity include a combination of strategies to address attitudes, self-directed behavior change, motivation, and problem-solving techniques and barriers management.

Physical activity requires minimal resources, provides physical and psychosocial benefits across a diverse range of aging experiences,

and reduces health service use and associated costs. It is never “too late,” with some benefits from initiating physical activity in late adulthood comparable with being consistently active. There is strong evidence and consensus that a physically active lifestyle, comprising non-exercise activities and moderate- to vigorous-intensity exercise, is an important component of optimal aging.

## Cross-References

- ▶ Active Aging
- ▶ Age-friendly Communities
- ▶ Aging and Psychological Well-Being
- ▶ Aging and Quality of Life
- ▶ Alzheimer’s Disease, Advances in Clinical Diagnosis and Treatment
- ▶ Anxiety Disorders in Later Life
- ▶ Attitudes and Self-Perceptions of Aging
- ▶ Burden of Disease and Aging
- ▶ Depression in Later Life
- ▶ Disability and Ageing
- ▶ Environmental Influences on Aging and Behavior, Theories of
- ▶ Healthy Aging
- ▶ Health Promotion
- ▶ Interventions for Late-Life Cognitive Health
- ▶ Leisure Activities in Later Life
- ▶ Lifestyle Factors on Depression, Effects of
- ▶ Mental Health and Aging
- ▶ Obesity and Weight Gain in Older People
- ▶ Quality of Life in Older People

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## Physical Therapy, Impact on Psychosocial Well-Being of Older People

Claudia Meyer

RDNS Institute, St Kilda, VIC, Australia  
Centre for Health Communication and Participation, School of Psychology and Public Health, LaTrobe University, VIC, Australia

### Synonyms

Physiotherapy

### Definition

Physical therapy is the health science of improving physical function and mobility through reducing pain, increasing strength and flexibility, and improving posture and balance. The American Physical Therapy Association defines their vision through recognizing that physical therapists diagnose, intervene, and prevent impairments and activity and participation limitations related to movement and function. Based on assessment and clinical judgment, physical therapists decide, in conjunction with the older person, whether a functional limitation can be rehabilitated or requires adaptation of the task or the environment. Rarely does physical therapy consider the psychosocial aspects of health for older people in isolation, yet many aspects of physical therapy impact a person's psychosocial well-being. This entry will explore the role of physical therapy in

psychosocial well-being, through the lens of building and/or maintaining functional capacity, and thus independence of older people.

## Introduction

Health is defined as “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity” (CSDH 2008). The World Health Organization (WHO) developed a framework, the International Classification of Functioning, Disability, and Health (ICF), which fits with the definition of physical therapy above, with its focus on activity and participation. Linking in with this too are the WHO Rights to Health: that all people are entitled to available, accessible, acceptable, and quality healthcare services (CSDH 2008). Older people across the world experience challenges to their physical health, with reduced capacity for improvement in function related to physiological, sensory, and cognitive changes as they age (WHO 2015). There is a decline in muscle mass and subsequent reduced strength, reduction in bone density, and changes to joint cartilage all impacting musculoskeletal function and movement (WHO 2015). Physical health challenges are often related to chronic disease, such as osteoarthritis and low back pain, complicated by multi-morbidity, with situations of conflict and natural disasters exacerbating existing chronic conditions such as hypertension and diabetes. Physical therapy is only one of a multitude of medical and allied health services that can support older people to regain their physical health but play a unique role in assisting older people to regain and/or maintain physical functional capacity.

Functional capacity can be defined as the ability to perform life skills under optimal conditions, essentially what a person is capable of doing (Bowie et al. 2006). Interestingly, functional skills can also be viewed through the lens of functional performance, what a person *actually* does, which is complicated by physical and cognitive abilities, motivation, and environmental factors such as social support (Bowie et al. 2006). Within Australia, recent aged care reform recognized the need

for capacity building of older people, to maximize preventive and restorative care, aiming to improve independence, quality of life, and social participation (Lewin et al. 2013). These reforms followed the vision for social care set out in the United Kingdom, premised on all people making a positive contribution to society and having the right to control their lives (Department of Health 2005). A reduction in functional capacity has the potential to impact in three key areas: at an individual older person level, for their caregiver and/or family, and at the level of health services more broadly. For an individual, independence is tied with quality of life and social connectedness. An example is an event such as a fall for an older person leading to curtailment of activity in up to 55% of people, subsequently leading to functional decline, reduced social participation, and decreased quality of life with institutionalization a looming threat (Kendrick et al. 2014). For the caregiver and/or family, there may be worry and concern for the older person with ongoing stress related to caring for someone with reduced functional capacity perhaps signaling the need for respite care services. For the health system more broadly, addressing the needs of an older person with reduced functional capacity requires healthcare services to be available and accessible but also, more importantly, suitable for individual needs and preferences and coordinated with other required services. Physical therapy plays an integral role in supporting the functional capacity of an older person.

To support the functional needs, and subsequently the psychosocial needs, of an older person and their caregiver/family, healthcare services should ideally be available, accessible, acceptable, and of high quality (CSDH 2008). Available physical therapy services include the type of physical therapy offered, such as exercise, manual therapy, postural control, and the provision of assistive devices. Available services for the older person ideally incorporate the need for neurological, orthopedic, and cardiothoracic rehabilitation as well as specialist services relevant, but not exclusive, to older people such as falls prevention, rheumatology, chronic pain, continence, and amputee management. Accessibility of physical

therapy services must account for metropolitan, regional, and remote locations; delivery of services through hospital, community, and residential care settings; and cost of services. Acceptability of services draws on the philosophy of person-centered care, with services provided free of prejudice and stereotype, acknowledging an individual's preferences and desires. High-quality healthcare services rely on the adequate undergraduate and ongoing training of physical therapists, of the ability of physical therapists to work as part of a multidisciplinary coordinated team.

### **Physical Therapy Services for the Older Person**

Physical therapy is concerned with movement disorders, with numerous services potentially available to ensure optimal physical functioning, such as neurological, orthopedic, and cardiothoracic rehabilitation and specialist services. Physical therapists are well positioned to assist with the increasing needs of older people related to health conditions such as cardiovascular disease, arthritis, and stroke to maintain optimal levels of functional capacity and reduce future demands on the health system (Australian Physiotherapy Association 2012).

Neurological rehabilitation focuses on regaining and/or maintaining physical function related to stroke, spinal cord injury, dizziness, or other diseases such as Parkinson's disease and multiple sclerosis. Most commonly, the link with psychosocial well-being is the impact of limited mobility on independence and social participation. For example, Parkinson's disease is a progressive disease leading to difficulties with gait and balance, ultimately leading to decreased independence as a result of inactivity and social isolation (Tomlinson et al. 2013). Current evidence suggests that physical therapy is of benefit for improving transfer ability through cognitive movement strategies, improving gait through cueing strategies, and improving strength, balance, and flexibility through exercise, yet there is limited evidence that explore how pain and fatigue

can impact an individual's well-being (Tomlinson et al. 2013). A further example is the link between stroke and depression, with an association found between depression and the physical disability, stroke severity and impairment in cognition resulting from the stroke (Hackett and Anderson 2005). Physical therapists are encouraged to identify and seek assistance for those with depression given that it affects rehabilitation participation and adoption of treatment strategies.

Orthopedic rehabilitation relates to the musculoskeletal system, the rehabilitation of muscles, bones, joints, and ligaments, resulting from trauma, degeneration, or congenital conditions. Most commonly for older people, injury and conditions are related to falls, osteoarthritis, and overuse. For example, vertebral fractures are a complication of falls and are related to increased morbidity, due to resulting pain and reduced quality of life (Giangregorio et al. 2013). Exercises are often prescribed for an older person with a history of vertebral fractures, with resulting benefits of reduced pain and improved function and quality of life, but this evidence must be treated with caution as high-quality studies are not yet available (Giangregorio et al. 2013). Distal radial fractures, resulting from a fall, are a common clinical problem in older people with osteoporosis. Rehabilitation is designed to improve hand function, yet little evidence exists for the effectiveness of a home exercise program (Handoll and Elliott 2015). Education prior to surgery, such as for hip and knee replacements (often due to osteoarthritic changes in the joints), is an important consideration in physical therapy practice. Major surgery is stressful for people, and, while the evidence is not strong, it is hypothesized that the provision of education to improve knowledge and health behaviors will reduce postoperative anxiety and pain and improve function and quality of life (Handoll and Elliott 2015).

Cardiothoracic rehabilitation incorporates rehabilitation following myocardial infarction and heart, lung, or vascular surgery or related to chronic pulmonary disease. Cardiac rehabilitation programs are designed to improve function, quality of life, and well-being of people with heart disease through exercise, education, and

psychological support (Anderson and Taylor 2014). Cochrane systematic reviews, although not specific to older people, but showing a mean age of 46–87 years across studies, showed high-quality evidence for supporting exercise-based cardiac rehabilitation in addition to education and psychological interventions following heart attack or cardiac surgery or for those who have chronic heart failure (Anderson and Taylor 2014). Pulmonary rehabilitation is considered a key recommendation for people with chronic obstructive pulmonary disease also comprising exercise, education, and psychosocial support (McCarthy et al. 2015). Improvements have been noted in quality of life and in domains of shortness of breath and fatigue, with enhanced sense of mastery over their condition and emotional function (McCarthy et al. 2015).

More specialist physical therapy services available for older people relate to management of falls, amputation, rheumatology, chronic pain, and continence. Each of these areas benefits from individual consideration, linking to psychosocial outcomes, as outlined below.

The prevention of falls is a major public health issue, with one in three older people falling each year, leading to escalating hospital-related costs (Gillespie et al. 2012). Physical therapy can assist through the provision of lower limb strengthening exercises and challenging balance activities, which have been shown to reduce falls rates (Gillespie et al. 2012). A recent Cochrane review suggests that both group and home exercise programs for community-dwelling older people reduce the rate and risk of falls, but that education alone is inconclusive (Gillespie et al. 2012). Exercise programs may have the specific goal of reducing fear of falling given the serious physical and psychosocial consequences for older people. Exercise interventions appear to have short-term beneficial effects on fear of falling, through improvements in strength, gait, balance, and mood (Kendrick et al. 2014).

For those living with limb loss, the main cause is vascular disease most commonly related to diabetes and trauma (Veteran Affairs Employee Education System 2008). Amputee rehabilitation considers several domains, with physical

therapists being one of a number of health professionals involved in the multidisciplinary team. The domains include: postoperative pain, including residual limb and phantom limb pain; physical health related to balance, strength, and endurance; function related to transfers, mobility, reduced activity limitation, and improved quality of life; and psychological and social support for associated comorbidities of depression and anxiety and return to home and community and recreational participation (Veteran Affairs Employee Education System 2008). The multidisciplinary team is critical for pain management, managing comorbidities, psychological assessment, and prosthetic training.

Rheumatological conditions cover a broad spectrum of joint-, muscle-, and bone-related conditions such as osteoarthritis, rheumatoid arthritis, fibromyalgia, and osteoporosis. Functional capacity is impacted through pain and swelling of the joints, stiffness, and limited mobility. Best practice recommendations are for multidisciplinary team management, incorporating medications, exercise, nutrition, assistive devices, and management of emotions and fatigue. Physical therapists are often involved in education for people with osteoarthritis, encouraging people to take an active role in the management of the disease, in addition to usual physical therapy techniques. A recent Cochrane review concluded that there is limited evidence to suggest that self-management programs are beneficial for reducing pain and improving quality of life and function, but it is acknowledged that active and positive engagement in life are unknown effects and program delivery should be closely assessed to ensure health equity for recipients (Kroon et al. 2014).

Chronic pain is a global term for pain that lasts beyond the usual time for expected healing, often correlated with psychological outcomes (Pain Australia 2015). Chronic pain can lead to depression, anxiety, physical deconditioning, and social isolation (Pain Australia 2015). In Australia, the National Pain Strategy is currently under way with recommendations including a coordinated multidisciplinary assessment and management, of which physical therapy plays a role in

addressing the physical domains of chronic pain management (Pain Australia 2015). Cognitive-behavioral therapy (CBT) is used as a means to address chronic pain, through an individualized program to healthy habits unhelpful thoughts and behaviors to be replaced with healthy habits (Monticone et al. 2015). CBT is designed to reduce the impact of pain, thus allowing physical therapy to be of greater benefit, and reduce physical and psychosocial disability. A Cochrane review assessing the effects of CBT on chronic neck pain found it to be effective for short-term pain reduction and improved quality of life, with a small effect on reducing the fear of movement (Monticone et al. 2015). Multidisciplinary biopsychosocial programs for chronic pain emerged from the United States and have growing support and evidence in many other areas across the world (IASP 2012). Program elements of medication management, exercise, and cognitive behavioral therapies are central, with service availability and length of waiting lists highly variable, potentially impacting quality of life and psychological well-being (IASP 2012).

Urinary incontinence is a common impairment in older age, particularly among women, and is a strong predictor for the need for community and/or residential care (WHO 2015). From a physical therapy perspective, exercise programs can be implemented to strengthen pelvic floor muscles, in turn contributing to enhanced quality of life for the older person. One of the profound consequences of incontinence is stigma, with many people not even seeking health professional advice (Garcia et al. 2005). It is suggested that stigma arises from the strong cultural expectation of managing bodily fluids, something people are taught to do from a very young age (Garcia et al. 2005). People who are stigmatized feel devalued and have their self-esteem threatened, but interestingly, health professionals can also avoid discussing incontinence for fear of being seen as biased (Garcia et al. 2005). Providing advice on healthy diet and lifestyle habits, management techniques including continence aids, and pelvic floor exercises can assist with reducing stigma, allowing people to lead a positive and active life (Garcia et al. 2005).

Through all of these examples, it can be seen that the assessment and treatment of physical dysfunction through the provision of exercise, use of manual therapy, and assistive devices can enhance the functional capacity and independence of an older person. The availability of services, however, is not sufficient to ensure that older people take up the options available to them. Issues related to accessibility also need to be taken into account and are addressed in the next section.

## Accessibility to Physical Therapy Services

Accessibility to services includes the physical, economic, and educational ability to access health services and information (CSDH 2008). Physical therapists are found in hospital, community, and residential care settings, variably within metropolitan, regional, rural, and remote areas. The World Confederation for Physical Therapy currently represents 350,000 physiotherapists globally, through 111 member organizations, supported by the World Health Organization to promote access and provide quality rehabilitation services (World Confederation for Physical Therapy 2015).

### Physical Accessibility

The need for acute physical therapy services is often related to trauma or sudden-onset medical conditions. Acute services are found in the hospital sector, with physical therapists a key player in treating people within hospital and then ensuring efficient discharge processes. Acute physical therapy services allow older people to regain mobility and strength and thus independence, albeit most likely in a supported manner with gait aids as required and potential assistance in the home. Discharge planning is critical in ensuring that an older person is supported in their transition from hospital to home (with community based services as required). Lack of coordination and person-centered planning can lead to poorer outcomes, including possible readmission to hospital, with collaboration a key ingredient to ensure understanding and mutual respect of the person and their caregiver (NHS Wales 2008).

Sufficient resources and skills are required to ensure successful discharge which, in practice, means that there is successful negotiation between hospital and community services to ensure adequate physical and social support (NHS Wales 2008).

Community-based physical therapy services cover the spectrum of community health centers and in-home aged care support, both of which are government subsidized, and private practice. In-home aged care support occurs through short-term services, specifically designed to provide support following an acute hospital stay. Longer term aged care support is provided on an increasingly more frequent consumer-directed basis, in line with providing choice and flexibility in the services that are provided to older people. Allied health services are a component of this support, with a focus on preventive and restorative care based on improving/maintaining functional capacity and independence (Lewin et al. 2013).

Physical therapy services within residential aged care facilities are generally provided by external organizations or, rarely, employed directly by the residential care facility. Physical therapists assess the physical needs of the residents; equip people with gait aids or other aids such as hip protectors, as required; and ensure staff are capable of assisting the mobility needs of the residents. Again, providing a sense of independence and autonomy to residents in an often disempowering environment is a goal of physiotherapy, but there is only limited evidence for the benefits of activity and exercise in this setting due to intervention and dependency differences (Cameron et al. 2012).

Ensuring physical accessibility to services extends to the uniquely challenging environment of rural and remote areas. In Australia, rural zones are classified as between 10,000 and 100,000 people, while remote areas are <10,000 people. Classification differs, for example, in Canada, with rural areas classified as <1,000 people, with a density of <400 people per square kilometer. The provision of physical therapy services in rural and remote areas is complicated by recruitment and retention rates of health professionals,

correlating with poorer health status of residents in these areas (Campbell et al. 2012). Lack of access to professional development opportunities, sufficient supervision, and inclusion are responsible for some of the barriers to retaining allied health in these communities, but autonomy and connection with the community are considered incentives (Campbell et al. 2012). From an individual older person's perspective, accessing services has been enhanced through the use of telemedicine, with promising results for chronic disease management and Internet-based physical activity/exercise interventions (Ekeland et al. 2010).

### **Financial Accessibility**

Acute and community physical therapy services vary considerably from a financial accessibility perspective. Financial commitment for a client is highly variable with fee schedules dependent upon prevailing market conditions of a particular country, with clients entitled to understand anticipated costs for service prior to undertaking treatment (World Confederation for Physical Therapy 2015). The financial circumstances of the older population vary substantially from being active participants in the workforce through to requiring support from family and/or the provision of pensions or other welfare (WHO 2015), impacting their ability to access healthcare services. Physical therapy services should reflect the economic variability of nations, as well as the complexity of conditions as outlined within this entry.

### **Information Accessibility**

Information accessibility is an important consideration to ensure that older people have access to information from which to make informed decisions about their healthcare. Shared decision making is the process of health professionals involving the person themselves in understanding options for treatment and how the person can choose care that meets their needs and reflects their values and preferences (Legare et al. 2014). There is currently low-quality evidence for shared decision making, but certainly interventions that target both the health

professional and the person themselves show more promise than individual interventions (Legare et al. 2014).

### **Acceptability of Physical Therapy Services**

Acceptable services should be respectful of the diversity of older people, acknowledging their unique needs and preferences in a manner free of bias and prejudice. A report commissioned by the United States Congress highlighted that inequity in healthcare for people from culturally diverse backgrounds actually resulted from structural health service issues related to bias and prejudice, impacting equity in healthcare *greater* than failing to address personal needs and preferences (Smedley et al. 2003). This report shines a light on the need to focus on a person-centered approach, through shared decision making and partnerships in healthcare, with adequate communication for inclusive healthcare required to address structural bias, moving beyond the bare minimum of provision of health information in different languages (Smedley et al. 2003).

### **Quality of Physical Therapy Services**

Quality of physiotherapy services is predicated on adequate training and ongoing professional development. The World Confederation of Physical Therapy recognizes differences in education and health system models internationally but recommends university-level studies of a minimum of 4-year duration, including competencies necessary for a professional career (World Confederation for Physical Therapy 2015). Only qualified persons may practice physical therapy and, if legislative requirements prevail, be licensed or registered, ensuring ethical conduct and the maintenance of professional development (World Confederation for Physical Therapy 2015). The style of learning within the Australian system is problem-based, the experience of learning using open-ended problems. This style allows for a holistic approach to the

management of movement disorders and has the potential to incorporate psychosocial considerations. The World Confederation of Physical Therapy recognizes the diversity of social, political, and economic environments in which physical therapists must work; hence, standards of practice should reflect prevailing conditions and the changing needs of the local community (World Confederation for Physical Therapy 2015).

A holistic approach allows for multidisciplinary team involvement. Quality physical therapy services often depend on the involvement of other health professionals such as general practitioners (GPs), medical specialists, practice/district nurses, pharmacists, allied health professionals, and community aged care workers. For example, strong evidence exists for the reduction of falls risk with physical therapists addressing lower limb strength and balance, pharmacists and/or GPs providing a medication review, and an optometrist conducting a regular visual assessment (Gillespie et al. 2012). Quality services should also ensure that they are coordinated, with smooth transitions through the various sectors, as mentioned above through effective discharge planning. Older people often have numerous health professionals involved in their care, in addition to physical therapists, and value their expectations and needs respected (NHS Wales 2008). The “passing the baton” metaphor from the National Health Service (UK) guidelines succinctly sums up the need for older people to receive the right care at the right time and in the right place and supported by the right people (NHS Wales 2008).

### **Conclusion**

As mentioned in the opening paragraph, physical therapy has not traditionally focused on psychosocial outcomes for older people. It is now clearer, however, that the physical domain of functional capacity cannot be separated from psychosocial outcomes. Physical therapists need to rise to the challenge of incorporating behavior change techniques and identifying meaningful goals in

collaboration with older people and facilitate active participation in the rehabilitation process. Through this, older people and their physical therapists can effect person-centered change toward building and/or maintaining functional capacity and independence.

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## Physiological Effects on Cognition

Yunhwan Lee

Department of Preventive Medicine and Public Health, Ajou University School of Medicine, Suwon, Republic of Korea  
Institute on Aging, Ajou University Medical Center, Suwon, Republic of Korea

### Synonyms

Chronic condition; Chronic disease; Cognition; Cognitive function; Cognitive impairment; Dementia; Medical disease; Health condition

### Definition

Medical diseases are closely associated with cognition. Medical conditions prevalent in older people include hypertension, diabetes mellitus, and obesity. Cognition encompasses cognitive function, such as memory and executive function, and pathologic states, such as cognitive impairment and dementia. In this entry, health conditions commonly observed in late life, including cardiovascular disease, type 2 diabetes, obesity, HIV, and frailty, and their relationship with cognition are presented.

### Introduction

The notion that physical conditions are related to cognitive health has gained prominence in recent years. The “brain–body connection” is intuitive, especially in late life, in that medical conditions are often accompanied by cognitive disorders, with health conditions often presenting as cognitive signs and symptoms. The prevalence of both multimorbid chronic conditions and dementia rises exponentially with age. It is estimated that about 10% of Alzheimer’s disease worldwide is attributable to midlife hypertension, type 2 diabetes, and midlife obesity (Norton et al. 2014). Deterioration or improvement in one affects the other,

with both sharing common risk factors and underlying pathophysiology.

Examining the relationship between health conditions and cognitive function is important in that it helps to identify modifiable risk factors and populations at risk of developing cognitive decline and to understand the underlying biologic mechanisms that, in turn, can lead to the development of preventive and therapeutic strategies for cognitive impairment and dementia. In this entry, several common diseases affecting older adults and their effects on cognitive function are presented. Potential mechanisms and critical pathways known to contribute to cognitive manifestations of physical conditions are described.

### Cardiovascular Disease

Cardiovascular diseases (CVD) are prevalent in older people and include hypertension, atrial fibrillation, coronary artery disease, and heart failure. Hypertension, defined as systolic/diastolic blood pressures of 140/90 mmHg or higher, raises the risk of cerebrovascular events, affecting both the macro- and microvascular structures in the brain (Launer 2013). Cerebral macrovascular disease includes clinical stroke, causing focal or diffuse impairments, and small vessel disease (SVD). SVD manifests as lacuna, focal lesions in the white matter, or deep white matter hyperintensities, resulting from ischemia. Cerebral microvascular disease includes cerebral microbleeds and microinfarcts. Coronary artery disease (CAD) is caused by atherosclerosis, formation of plaques within the vessel walls, leading to the narrowing of the arteries supplying blood to the heart. Acute myocardial infarction may result as atherosclerotic plaques clog the coronary arteries. Heart failure occurs when the heart is unable to pump sufficient amount of blood and oxygen to meet the body’s demand.

There is consistent evidence that midlife hypertension is associated with late-life cognitive impairment and dementia (Abete et al. 2014). Elevated levels of blood pressure primarily affect executive function, but hypertension is also reported to influence verbal and nonverbal

memory domains and can increase the risk of amnesic and multiple-domain mild cognitive impairment (Launer 2013). However, the relationship between late-life blood pressure and cognition is still controversial. Treatment of midlife hypertension has the potential to curb the projected increase in the number of people with dementia. However, there is insufficient evidence as to the benefits of treatment of hypertension in reducing the risk of cognitive impairment or dementia.

An elevated systolic blood pressure appears to be a prominent predictor of cognitive decline and impairment (Gąsecki et al. 2013). Alternatively, an increased diastolic blood pressure, because of its effect on small arteries, has been found to be related to cognitive impairment. Moreover, a U-shaped association has been observed between blood pressure and cognitive function (Abete et al. 2014). Not only hypertension but low blood pressure in late life may increase the risk of cognitive impairment and dementia. It has also been postulated that an age-related increase in systolic blood pressure and decrease in diastolic blood pressure, leading to a high pulse pressure, may predispose to large artery stiffness that contributes to decline in cognitive function.

Atrial fibrillation has been found to be associated with cognitive decline, cognitive impairment, and dementia (Jefferson and Thompson 2013). Global cognitive functioning and multiple cognitive domains have been reported to be affected, including visual and verbal memory, abstract reasoning, and executive function (Eggermont et al. 2012).

CAD has been reported to be associated with declines in global cognition, with reduced visual memory, visuoconstruction, verbal fluency, and psychomotor speed (Abete et al. 2014; Eggermont et al. 2012). CAD has also been found to increase the risk of non-amnesic mild cognitive impairment. Further, coronary artery bypass grafting (CABG), used to treat the condition, has been implicated in increasing the risk of dementia (Jefferson and Thompson 2013). Atherosclerosis and myocardial infarction have been found to increase the risk of cognitive impairment.

Heart failure, especially of compromised ejection fraction, has been linked to lower cognitive performance, including verbal memory and executive function (Eggermont et al. 2012). Adverse effects on attention, learning ability, delayed recall, working memory, and psychomotor speed have been reported (Abete et al. 2014). However, less is known about its effect on visuospatial and language domains. Reduced cardiac output and clinically manifested heart failure have been found to increase the risk of cognitive impairment and dementia (Jefferson and Thompson 2013).

Although the specific cause of cognitive changes due to CVD is still unknown, embolic stroke and chronic cerebral hypoperfusion appear to play a key role (Abete et al. 2014). CVD may induce reductions in cerebral blood flow, compromised cerebral autoregulation, blood–brain barrier dysfunction, and inflammation, contributing to Alzheimer’s disease pathology, microvascular abnormalities, and neurodegeneration (Jefferson and Thompson 2013).

Elevated blood pressure increases the risk of cerebrovascular disease and can also accelerate neurodegeneration, causing brain atrophy (Launer 2013). Vascular damage due to hypertension is considered to be brought on by multiple factors, such as hypoxia, thrombosis, inflammation, oxidative stress, and atherosclerosis. Elevated blood pressure is also believed to promote beta-amyloid deposition in the brain. These vascular and neurodegenerative changes are thought to interact to negatively influence neuropsychologic function.

In atrial fibrillation, reduced cardiac output and cerebral blood flow, increased risk of thromboembolism and clinical stroke, and enhanced amyloidogenesis due to chronic cerebral hypoperfusion are considered to lead to cognitive impairment (Launer 2013). Also, cerebrovascular disease appears to mediate the link between atrial fibrillation and cognitive decline.

Atherosclerosis can have adverse effects on the brain through chronic inflammation, promoting endothelial dysfunction and stroke, shared genetic factors, and oxidative stress (Jefferson and Thompson 2013). Myocardial infarction may induce arrhythmogenesis, microembolism, and

reduced cerebral blood flow. CAD patients who manifest cognitive impairment have an elevated platelet activity that could trigger perivascular inflammation and cerebral vasoconstriction, contributing to dementia progression (Abete et al. 2014). Moreover, CAD itself may lead to atrial fibrillation and heart failure.

The primary mechanism thought to account for cognitive decline among individuals with heart failure is cerebral hypoperfusion due to reduced cardiac output (Jefferson and Thompson 2013). Moreover, acute strokes caused by thromboembolism may ensue due to left ventricular dysfunction and cardiac dilation, endothelial dysfunction, and activation of coagulation cascades (Abete et al. 2014).

## Type 2 Diabetes

Diabetes mellitus, or type 2 diabetes, is a common metabolic condition, caused by insulin resistance and pancreatic beta cell dysfunction (Koekkoek et al. 2015). The prevalence of type 2 diabetes increases with age. Type 2 diabetes can lead to serious chronic complications, such as cardiovascular disease, nephropathy, peripheral neuropathy, and retinopathy.

Patients with type 2 diabetes exhibit lower cognitive abilities, compared with those without the condition (Koekkoek et al. 2015). Multiple cognitive domains, including memory, processing speed, and executive function, tend to be affected. Cognitive decline starts in prediabetic stages with slow decrements in cognitive performance with age, but the speed of cognitive decline may be accelerated than that of normal cognitive aging. The risk of amnesic and non-amnesic MCI is elevated among those with type 2 diabetes. Compared with those without diabetes, people with type 2 diabetes demonstrate higher conversion rates from MCI to dementia. Type 2 diabetes also increases the risk of both vascular and Alzheimer's dementia. About 6–7% of all dementia is attributable to type 2 diabetes. Midlife rather than late-life diabetes has been found to be particularly predictive of cognitive decline and impairment in late life (Feinkohl et al. 2015).

Several mechanisms have been proposed to explain the relationship between type 2 diabetes and cognitive deficits (Umegaki 2014). Chronic hyperglycemic state has been found to induce impaired neurogenesis and exert neurotoxic effects on the brain due to oxidative stress. Diabetes can also trigger disruption of the blood–brain barrier (BBB) integrity brought on by structural changes in the cerebral microvessels. Impaired neurovascular functioning due to diabetes-related structural and functional deficits in the cerebral vasculature may further contribute to impaired neural activity, BBB dysfunction, and reduced amyloid clearance from the brain. Moreover, chronic inflammation, amyloidogenesis, and insulin resistance appear to be common underlying mechanisms in the pathogenesis of both type 2 diabetes and dementia.

For those with type 2 diabetes, vascular, metabolic, and psychological factors may contribute to an increased risk of cerebrovascular damage (Feinkohl et al. 2015). Consistent findings point to poor glycemic control, hypoglycemia, microvascular disease, inflammation, and depression among diabetic patients to act as risk factors for cognitive decline. The role of dyslipidemia, hyperinsulinemia, and hypertension as risk factors for cognitive decline among type 2 diabetes, however, is less clear. Although blood glucose control has been reported to be of benefit in preserving cognitive function, recurrent episodes of treatment-associated hypoglycemia appear to increase the risk of dementia (Umegaki 2014).

## Obesity

The prevalence of obesity is increasing worldwide and poses a global threat to public health. Obesity increases the risk of cardiovascular disease, type 2 diabetes, and various forms of cancer (Prickett et al. 2015). Obesity is an accumulation of excess adipose tissue, often defined by a body mass index (BMI) of 30 kg/m<sup>2</sup> or greater, with overweight having a BMI in the range of 25.0–29.9 kg/m<sup>2</sup>. However, BMI tends to underestimate body fat with aging due to a progressive loss of muscle and bone mass (Whitmer and Gustafson 2013).

Waist circumference or waist–hip ratio has been used as a measure for central obesity, reflecting visceral and subcutaneous adipose tissue. Other techniques used to assess adiposity include anthropometry, bioelectrical impedance analysis, dual-energy X-ray absorptiometry (DEXA), computed tomography (CT), and magnetic resonance imaging (MRI).

The relationship between obesity and cognition has been studied across the life course, with consistent findings of cognitive deficits, especially of executive function, in children, adolescents, and adults who are obese (Smith et al. 2011). In obese children, global functioning, short-term memory, attention, and verbal ability have been reported to be affected. In adulthood, higher BMI is found to be associated with poorer performance in global cognitive function, memory, language, and motor skills. It is known that obesity predicts cognitive decline, but changes in weight do not reliably predict changes in cognitive ability.

Studies examining late-life obesity and its association with cognitive function are rather contradictory. In the Baltimore Longitudinal Study of Aging, higher BMI was associated with poorer performance in global function, memory, and language (Whitmer and Gustafson 2013). However, higher BMI was not associated with worse executive function but associated with better performance in attention, psychomotor speed, and visuospatial ability. In contrast, higher BMI was associated with a more rapid decline in global function, executive function, and memory. Obesity in late life as it relates to changes in cognition is also conflicting. Obesity predicted not only cognitive decline but also less decline and even better performance in some instance. Weight loss in late life, however, has been found to strongly predict poorer cognitive performance.

Epidemiologic studies have provided consistent evidence that obesity in midlife raises the risk of dementia and Alzheimer's disease (Whitmer and Gustafson 2013). Moreover, the relationship between BMI and cognition may be nonlinear, as underweight in midlife also poses a significant risk for dementia in late life (Bischof and Park 2015). Weight loss also appears to increase the

risk of dementia, reflecting either a prodromal phase or worsening severity of the disease. However, studies that have examined the association between late-life obesity and dementia risk have produced mixed results. Higher weight in late life appears to lower the risk of dementia in the short term but may increase its risk in the long term.

It has been hypothesized that the greater predictive value of midlife than late-life BMI on cognition may be due to higher BMI reflecting greater skeletal muscle mass which has been shown to be protective of cognitive function (Bischof and Park 2015). Other explanations center on BMI being a poor measure for evaluating adiposity, selective attrition of obese middle-aged adults due to early mortality, survival bias of the older respondents, and long prodromal phase of dementia (Whitmer and Gustafson 2013; Bischof and Park 2015).

Alternatively, central adiposity may be a more important indicator of cognitive deficits as it is tied to cardiometabolic risk (Bischof and Park 2015). Even among the normal weight by BMI, central obesity has been reported to be associated with higher dementia risk (Whitmer and Gustafson 2013). More recently, obesity as part of the metabolic syndrome, including hypertension, type 2 diabetes, and dyslipidemia, was recognized to act synergistically to raise the risk of cognitive impairment and dementia (Bischof and Park 2015). Although metabolic syndrome appears to affect cognition in global cognition, memory, and executive functioning, its association with cognitive decline may be age dependent, with the young–old ( $\leq 70$  years) but not the old–old ( $> 70$  years) demonstrating significance (Siervo et al. 2014).

There are multiple potential mechanisms that could explain the link between obesity and cognition. Obesity increases the risk of other cardiometabolic conditions mentioned above, and this could engender cognitive dysfunction. The adverse effects on cognition may be mediated by increased neural structural challenges, such as reduction in brain volume, amyloid accumulation, changes to macro- and microstructure of white matter, cortical thinning, and dopamine depletion, brought on by obesity (Bischof and Park 2015).

Adipose tissues secrete adipokines, causing pro-inflammatory state that induces chronic inflammation, contributing to the development of insulin resistance and endothelial dysfunction, resulting in impaired synaptic function (Whitmer and Gustafson 2013; Bischof and Park 2015). Also, genetic predispositions to total obesity and visceral obesity have been reported to be associated with cognition.

## HIV

Human immunodeficiency virus (HIV) is a lethal virus that compromises the immune system. HIV infection is now recognized as a chronic illness as people with HIV survive longer, with the development of combined antiretroviral therapies (Wendelken and Valcour 2013). The neuropsychologic manifestations by HIV have been termed HIV-associated neurocognitive disorder (HAND). HAND is defined as impairment in two or more cognitive domains and is further classified according to the presence and severity of limitations in activities of daily living, as mild neurocognitive disorder (MND) and HIV-associated dementia (HAD).

Early signs of HAND are mental slowing and impaired information retrieval, gait disturbances, and decreased manual dexterity, with general signs of apathy and depression (Wendelken and Valcour 2013). Working memory and executive function can also become impaired, but semantic and visuospatial abilities are usually spared. HAD, the most severe form of HAND, manifests as progressive subcortical dementia, with loss of attention and concentration, motor slowing, impaired verbal fluency, and behavioral problems, resulting in death within a year with no treatment (Clifford and Ances 2013). In the era of combined antiretroviral therapy, the manifestation of HAND has changed to a more cortical than subcortical dysfunction, with impairments in memory, learning, and executive function being predominant, more similar to that of Alzheimer's disease.

More recently, with the aging of the population, chronic HIV infection has attracted attention. Older adults with HIV are at an increased risk of

developing cognitive impairment (Wendelken and Valcour 2013). Older adults with HIV are cognitively vulnerable in that, compared to the young, they tend to manifest higher rates of cognitive impairment at the same detectable HIV levels in the cerebrospinal fluid. Moreover, genetic predispositions related to APOE  $\epsilon$ 4 allele for Alzheimer's disease have been reported in older adults but not the young (Clifford and Ances 2013).

HIV can infiltrate the brain by crossing the BBB via a number of different pathways, such as by trafficking on infected monocytes and T cells that in turn infect microglia and astrocytes (Hong and Banks 2015). This results in the release of inflammatory cytokines that further compromises BBB integrity and facilitates transmigration of HIV, eventually leading to neuronal death. Aging may accelerate HIV pathogenesis due to the chronic exposure to HIV and interaction with other age-dependent neurologic diseases. The effect of age on HAND may also be due to comorbid conditions, such as metabolic and cerebrovascular diseases. Coinfections, such as herpes virus, cytomegalovirus, and hepatitis C, may further contribute to severe complications and poorer cognitive performance.

## Frailty

Frailty is a distinct syndrome highly prevalent among the geriatric population with increasing age. Frailty is defined as a reduced ability to respond to stressors that increases vulnerability to adverse outcomes, such as disability and mortality (Robertson et al. 2013). Although no consensus exists on the operationalization of frailty, one way proposed is to define it as an accumulation of deficits. The other more commonly used concept is the phenotype model, defined as the presence of three or more of the five key components: poor grip strength, slow walking speed, low levels of physical activity, exhaustion, and unintentional weight loss.

Numerous epidemiologic studies have reported that physical frailty is closely associated with cognitive function. Frailty has been found to

predict cognitive decline and incident dementia (Robertson et al. 2013). The relationship appears bidirectional, as cognitive impairment has been reported to also predict frailty. Among the frailty components, gait speed and grip strength have been found to be most commonly associated with cognitive function. Other studies have also reported unintentional weight loss and low physical activity to be significantly associated with poor cognition. More recently, a new term, cognitive frailty, has been proposed to define cognitive impairment, excluding dementia, that accompanies physical frailty that is potentially reversible (Ruan et al. 2015).

Although multiple cognitive domains have been reported to be affected by frailty, executive function and attention have been found to be the most consistently associated (Robertson et al. 2013). Further, perceptual and processing speed, dual-attention processing, orientation, and reasoning have been reported to be affected in frail individuals. However, memory, though relatively worse in frail older adults, does not appear to be significantly deteriorated.

Physical frailty and cognitive impairment may share common underlying mechanisms (Halil et al. 2015). Reduced blood flow and impaired vascular dysfunction, hormonal dysregulation, altered immune mechanism and inflammation, and nutritional deficiency have been suggested to be linked to both frailty and cognitive impairment. Cardiovascular risk factors may play a role in the development of both frailty and cognitive impairment (Robertson et al. 2013). Increased levels of frailty have also been found to be associated with AD pathology. It has been suggested that reduced testosterone levels and insulin resistance are potential mediators in the development of frailty and cognitive impairment. Chronic inflammation can affect both brain and muscle function and has been linked to frailty and cognitive decline. Malnutrition and low protein intake can lead to sarcopenia, loss of muscle mass, and poor functional performance, which has been linked to both frailty and cognitive impairment. Depression has also been implicated in elevating the risk of both frailty and cognitive decline.

## Conclusion

Medical conditions prevalent in late life are associated with poor cognitive performance and increase the risk of cognitive impairment and dementia. Multiple mechanisms and pathways, such as vascular damage, neurodegeneration, inflammation, and insulin resistance, are responsible for changes in brain structure and function. Cardiometabolic diseases share common risk factors and may also act synergistically to adversely affect cognition in late life. An increased life expectancy is also predisposing older people to extended periods of morbidity and increased vulnerability. Identification of risk factors and proper management of medical conditions have the potential to lessen the cognitive burden in the older population.

## Cross-References

- ▶ [Alzheimer's Disease, Advances in Clinical Diagnosis and Treatment](#)
- ▶ [Comorbidity](#)
- ▶ [Frailty and Cognition](#)
- ▶ [Frailty in Later Life](#)
- ▶ [Obesity and Weight Gain in Older People](#)
- ▶ [Vascular and Mixed Dementia](#)

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## Plasticity of Aging

Markus Wettstein and Hans-Werner Wahl

<sup>1</sup>Department of Psychological Aging Research, Institute of Psychology, Heidelberg University, Heidelberg, Germany

<sup>2</sup>Network Aging Research (NAR), Heidelberg University, Heidelberg, Germany

## Synonyms

(Behavioral) malleability; Changeability; Making use of reserve capacity

## Definition

Generally defined, plasticity describes capacity for change, i.e., an individual's capability and reserve capacity to react to demands of the environment by means of cognitive, behavioral, or any other kind of reorganization. The core of plasticity is thus the potential for and amount of intraindividual change, driven by changing conditions in one's natural ecology or by means of training or experience. Given all the experiences and changing challenges an individual is facing across long-term developmental trajectories, plasticity is an important construct in life-span developmental psychology. Plasticity may appear at various levels (e.g., brain structure, behavior) and can be related to different domains (e.g., cognitive plasticity, behavioral plasticity, personality plasticity).

## Introduction

Aging has long been seen as the outflow of a strongly genetically driven program and age-related disease occurrences that may be hard to modify by means of external stimulation and enrichment. Encouraging research on plasticity, particularly cognitive plasticity which has appeared since the 1970s in geropsychology (e.g., Baltes 1973), has contributed much to correcting this rather rigid view of the aging process toward a more dynamic understanding of what remains developmentally possible even late in the human life-span. Life-span developmental psychology also has put strong emphasis on the plasticity of development and aging from its inception (e.g., Baltes et al. 1980). The major argument has been that development is not fixed at any phase of the human life-span and thus always malleable via changing conditions in one's environment or planned interventions. That is, plasticity points to unused or underused reserve capacities of individuals that may be released (or not) depending on respective environmental constellations. In this sense, the concept of plasticity also has important relations to ongoing discussions on successful aging (e.g., Rowe and Kahn 1997; Wahl et al. *in press*), because it points to still unknown potentials of aging that may only unfold under optimal enriching external conditions in the future.

In this work, we concentrate on the now classic area of cognitive plasticity and respective differentiations, such as distinguishing between normal versus pathological cognitive aging.

## Cognitive Plasticity

The kind of plasticity that has received most conceptual and empirical attention so far is cognitive plasticity. Cognitive plasticity describes the capacity for changes in the possible range of cognitive performance (Lövdén et al. 2010), i.e., the amount of increase in cognitive performance that is achievable under optimal circumstances by environmental support (e.g., via training). It thus

refers to cognitive “potential” or malleability as opposed to current cognitive performance.

The degree to which cognitive abilities are “plastic” across the life-span has been extensively investigated by previous research. We will first review empirical evidence on lifestyle effects on cognitive plasticity, before summarizing recent findings on training-induced malleability of cognitive performance in old and very old age as well in individuals with cognitive impairment. We will also briefly discuss the potential of physical and combined physical-cognitive interventions regarding late-life cognitive outcomes.

## The Role of Mental and Social Activity for Cognitive Plasticity

Cognitive plasticity is not only observable via intervention approaches but may also become manifest through lifestyle factors, (leisure) activities, and environmental “cognitive enrichment” (Hertzog et al. 1999, 2008; Kramer et al. 2004). Activity engagement may even, to some extent, reduce the prospective dementia risk (Hertzog et al. 2008; Karp et al. 2006). Despite some supporting empirical evidence for this “use it or lose it” perspective (e.g., social participation as a protective factor against perceptual speed decline in very old age; Lövdén et al. 2005), opposing findings have also been reported (Mitchell et al. 2012), and underlying mechanisms of the activity-cognition associations are still not well understood (Bielak 2010). Moreover, there is still a lack of studies convincingly demonstrating a lasting attenuating effect of activity engagement on mental aging (Salthouse 2006). Therefore, Hertzog et al. (1999) rather cautiously conclude that “Older adults, like anyone else, should do crossword puzzles and other activities if they find them entertaining and enjoyable. Whether they should consider such activities to be the analog of aerobic exercise for their cortex, and therefore solve puzzles in order to foster maintenance of their cognitive functioning, is still very much a matter of debate” (p. 533). Similarly, Salthouse (2006) recommends that “people should continue to engage in mentally stimulating activities because even if there is not yet evidence

that it has beneficial effects in slowing the rate of age-related decline in cognitive functioning, there is no evidence that it has any harmful effects” (p. 84).

Moreover, even if there is a relationship between activity engagement, cognitive ability, and late-life cognitive decline, activity is probably not a major determinant of cognitive ability, whose stability with age is mostly mediated by genetic factors (Briley et al. 2015), and the potential of activity engagement to prevent or alleviate age-associated cognitive changes may be limited: “To put it crudely, no one expects a cognitively active and engaged lifestyle to make an Einstein out of a used car salesman, nor would one expect one active and one inactive identical twin to show radically different profiles of cognitive ability” (Hertzog et al. 2008, pp. 169–270).

### **Cognitive Plasticity in Later Life: A Janus Face Situation**

As a means to operationalize cognitive plasticity, many cognitive interventions have employed a “Testing the Limits” approach (Baltes and Kliegl 1992; Kliegl et al. 1989), i.e., individuals received training until their maximal performance was achieved and no further training gains were observable. A major and replicated encouraging finding of such cognitive interventions with different age groups is that older adults benefit from these trainings and thus exhibit cognitive plasticity. However, compared to younger adults, training gains in older adults are usually smaller, indicating an age-associated decrease in cognitive plasticity (Baltes and Kliegl 1992; Kliegl et al. 1989; Baltes and Lindenberger 1988; Brehmer et al. 2007, 2008; Verhaeghen et al. 1992) and resulting in an increased posttraining performance difference between younger and older adults as compared to the pretraining, baseline difference. According to P. B. Baltes (1997), such findings indicate the “incomplete architecture of human ontogeny,” characterized by age-related loss in biological (brain) plasticity as well as by a reduced efficiency of cultural input and support (such as educational interventions or trainings) with advancing age. Baltes and Lindenberger (1988) used the term

“Janus-like character [of cognitive aging]” to describe the phenomenon of “continued plasticity accompanied by increasing limits to plasticity” (p. 283).

Given that – according to the conception of the incomplete architecture of human ontogeny (Baltes 1997) – the “need for culture” or for environmental support increases with age, whereas the efficiency of culture and also of intervention decreases, most intervention studies may lack this efficiency by not offering an extensive training exceeding days or weeks. The observation of age-associated decreases in training gains may thus be due to intervention formats that are too superficial in terms of training effort, intensity, and duration. A recent cognitive training program, the COGITO study, has addressed this criticism by investigating and comparing cognitive plasticity in younger and older adults via an impressively extensive intervention with an average of 100 daily practice sessions (Schmiedek et al. 2010a). Despite the finding of medium to strong training gains and reliable positive transfer effects to untrained tasks in both age groups over the 100-days training period, a decrease in cognitive plasticity with advancing age was still found (Schmiedek et al. 2010b; Noack et al. 2013). It thus seems unlikely that still longer or more intensive cognitive training programs will not lead to findings of significantly reduced cognitive plasticity as people age. On the other hand, it has to be acknowledged – and this is certainly good news – that cognitive plasticity is a life-long phenomenon that can be reactivated to a large extent by training and life-style factors (Hertzog et al. 2008).

Such a view is supported further by an ongoing large field trial, according to which cognitive training improvements can be enduring and also affect stability and change in functional ability: Results from the extensive ACTIVE study (Ball et al. 2002; Jobe et al. 2001) suggest that cognitive training has a positive long-term effect on cognitive abilities, with training gains continuing up to 10 years after onset of the intervention, and also attenuates to some extent late-life declines in cognitive and functional abilities (Willis et al. 2006; Rebok et al. 2014).

### Cognitive Plasticity in Very Old Age

At the conceptual level, advanced old age (or fourth age) has been described as possibly the most vulnerable phase of the human lifespan, a life period of “dilemmas” characterized by accumulating disease occurrences, functional losses, and nearness to death (Baltes and Smith 2003). According to Baltes (2006), the oldest-old are manifesting “a new level of biocultural incompleteness, vulnerability, and unpredictability in their everyday behavior” (p. 33). In addition, compensatory means at the brain (e.g., efficiency of neurocognitive scaffolding; Park and Reuter-Lorenz 2009) as well as the behavioral level (e.g., use of mnemonic strategies; Singer et al. 2003), although still available, are assumed to be underused and, in addition, low in magnitude and efficiency. Hence, limits in cognitive plasticity become particularly apparent in very old age. Singer et al. (2003) trained participants of the Berlin Aging Study (BASE) aged between 75 and 101 years in a mnemonic skill and found overall modest performance gains. Notably, the authors also observed substantial heterogeneity regarding the amount of training gains, and these interindividual differences in plasticity were significantly predicted by prior 6-year change (decline) in perceptual speed. Moreover, most individuals (85%) were not able to further enhance their memory performance during adaptive practice (i.e., practice sessions that were tailored to each study participant’s prior performance), which implies that there are substantial restrictions in very old adults’ cognitive plasticity.

However, the amount of available cognitive plasticity in very old age may also be a matter of the specific cognitive function that is considered and trained. Sutter et al. (2013), for example, offered a telephone-based verbal fluency training for adults aged between 64 and 92 years and observed an improvement in cognitive performance in the intervention group which exceeded the improvements in an active control group. Similarly, Yang et al. (2006) compared cognitive plasticity in young-old (mean age 74.4 years) and old-old individuals (mean age 84.0 years) by means of a self-guided retest paradigm and

observed that learning occurred across all tests and in all samples, although age-associated reductions in learning were observed as well.

### Cognitive Plasticity in Older Adults with Cognitive Impairment

Cognitive plasticity has also been investigated in older adults with cognitive impairment (mild cognitive impairment [MCI] and dementia). It seems that these “cognitively vulnerable” individuals primarily benefit from cognitive interventions regarding their subjective memory beliefs, whereas only minor intervention effects on their objective cognitive performance can be achieved (Rapp et al. 2002). However, there are also some more promising findings suggesting that cognitive plasticity still persists when cognitive impairment sets in (Calero and Navarro 2004), though to a lesser extent compared to cognitively healthy individuals (Schreiber and Schneider 2007), and that cognitive interventions in older adults with MCI can produce training gains (e.g., Brum et al. 2009). However, regarding the efficacy of memory trainings in both cognitively healthy and MCI older adults, Martin and colleagues (2011) conclude based on their review that “there is currently little evidence on the effectiveness and specificity of memory interventions for healthy older adults and individuals with mild cognitive impairment.”

In demented individuals, dual task trainings have been shown to be efficient for decreasing combined cognitive-sensorimotor “dual task costs” (Schwenk et al. 2010). Moreover, cognitive trainings seem to improve certain cognitive functions in patients with Alzheimer’s disease (Sitzer et al. 2006), but effects are rather specific and do not extend to neuropsychological functioning and general dementia severity (Davis et al. 2001).

Notably, cognitive plasticity may also have an important diagnostic function by revealing a prospective validity in terms of predicting later mental status (Baltes and Raykov 1996), thus potentially facilitating early detection and diagnosis of dementia (Baltes and Kühl 1992; Baltes et al. 1995) and of mild cognitive impairment (Sales-Galán et al. 2013). Higher cognitive plasticity (i.e., larger training gains) in individuals

with MCI has indeed been found to be associated with less marked cognitive decline (Calero and Navarro 2004). In addition, Boron et al. (2007) report that reasoning training gains prospectively predict later mental status/dementia status in a sample of older adults. Quantifying an individual's amount of cognitive plasticity may thus be an important avenue for early detection of dementia risk as well as early diagnosis of cognitive impairment in general.

The onset and manifestation of pathological cognitive aging itself, particularly dementia, seems to be a matter of "cognitive reserve," a concept closely related to cognitive plasticity: Findings suggest that the correlation between degree of brain damage (i.e., dementia neuropathology) and its clinical outcome (i.e., cognitive performance) is far from deterministic (e.g., Stern 2009). There are individuals who, despite progressing neuropathology, exhibit fairly "normal" cognitive performance until a certain point in time and who thus are able to "delay" the clinical manifestation of cognitive pathology. These individuals are assumed to be the ones with a higher cognitive reserve. Factors which are discussed as constituent determinants of the cognitive reserve are (early) education as well as lifestyle factors such as dietary habits or workplace complexity (e.g., Richards and Sacker 2003; Whalley et al. 2004).

### Physical Interventions and Cognitive Plasticity

Interestingly, increasing empirical evidence suggests that physical interventions, particularly aerobic exercise, are more promising and beneficial than cognitive trainings regarding enhancement of different cognitive functions and positive transfer effects (e.g., Colcombe and Kramer 2003). In their meta-analysis based on 18 intervention studies, Colcombe and Kramer (2003) found that largest cognitive training gains occurred for executive-control processes. Moreover, they observed that training effects were largest for interventions combining strength and aerobic training (rather than offering aerobic training alone), for long-term trainings (continued over 6 months and longer), and for mid-old (66–70 years), rather than for young-old or old-old

training participants. The efficacy of these physical interventions may be due to mechanisms which are more direct and more efficient than the respective mechanisms of cognitive interventions. These mechanisms are neurogenesis and improvement in brain plasticity (Colcombe et al. 2004), increase in brain volume (Colcombe et al. 2006), and reduction in brain tissue loss (Colcombe et al. 2003).

Moreover, the approach of combining both physical and cognitive interventions has been found to be promising regarding cognitive outcomes (Oswald et al. 2002). Physical-cognitive dual task trainings have been found to improve performance in dual task settings, in which limits of and age differences in plasticity usually become particularly evident (Beurskens and Bock 2012; Lindenberger et al. 2000). These dual task training formats indeed seem to be more promising and beneficial for improvement of dual task performance than offering only single task (i.e., physical or cognitive) training (Schwenk et al. 2010; Theill et al. 2013). As pointed out before, even "resource-poor," demented individuals benefit from such interventions (Schwenk et al. 2010).

However, not all studies, reviews, and meta-analyses reported strong effects of physical interventions (e.g., Snowden et al. 2011; Jedrzejewski et al. 2007). More research based on interventions with longer study intervals is needed to evaluate the efficacy of physical interventions as well as to identify the specific underlying mechanisms and the most beneficial activity type, duration, and intensity.

### Discussion and Outlook

In this chapter, we addressed the issue of plasticity of aging by focusing on cognitive plasticity. Cognitive abilities seem to be modifiable across the entire adult life span, although cognitive plasticity becomes increasingly limited with advancing age, consequently reaching its minimum in very old age.

Beyond the factors we described through which plasticity manifests itself, namely lifestyle

factors and interventions, the role of society and societal change may need additional consideration. For example, the so-called Flynn Effect, stating that over the twentieth century, each successive generation has exhibited higher IQ scores than the respective previous ones, has found empirical support across multiple cultures and nations (Flynn 1987), although cohort trends may vary according to the time interval and the specific cognitive domain considered (Schaie et al. 2005). It seems that the Flynn effect also applies for old and very old age, with later-born cohorts of old and very old adults showing better cognitive performances than earlier-born cohorts (Christensen et al. 2013; Gerstorf et al. 2011, 2015). In addition, later-born cohorts have been found to reveal less steep age-associated late-life cognitive declines (Gerstorf et al. 2011). However, this phenomenon, which may be termed “cross-cohort cognitive plasticity,” does not hold into the terminal life phase; rather, cognitive declines as a function of distance to death have become steeper across successive cohorts (Gerstorf et al. 2011), also when comparing earlier- and later-deceased cohorts rather than birth cohorts (Hülür et al. 2013). It thus seems that progress in education and in health care has caused improvements in cognitive abilities and attenuated age-associated cognitive declines across cohorts, but mortality-associated biological processes causing terminal cognitive decline may be too powerful to be counteracted by these societal changes.

We acknowledge that our focus on cognitive plasticity is somewhat narrow. For instance, recent empirical work has explicitly addressed the extent of *personality plasticity* across different phases of the life span (e.g., Terracciano et al. 2006; Mühlig-Versen et al. 2012; Allemand et al. [in press](#)). Generally, empirical findings do not support the original “plaster hypothesis” (Costa and McCrae 1994; James 1890) stating that personality remains stable after age 30. Rather, personality plasticity is observable across the whole life span, with ongoing differential personality changes in middle adulthood, old age, as well as very old age (Allemand et al. 2007; Möttus

et al. 2012; Wagner et al. 2015; Billstedt et al. 2014). Moreover, late-life personality has been found to be modifiable via (cognitive, therapeutic, and other) interventions (Mühlig-Versen et al. 2012; Jackson et al. 2012; Chapman et al. 2014) which clearly supports the notion of late-life personality plasticity.

In addition, motor performances seem to reveal some extent of plasticity. For instance, the fact that gait speed of very old adults has improved across successive cohorts (Christensen et al. 2013) and that older adults – even the “resource-poor” ones with dementia – benefit from motor trainings (Hauer et al. 2012) may be seen as evidence for late-life “*motor plasticity*.” Moreover, improvements in functional ability across very-old cohorts (Christensen et al. 2013) as well as declining disability rates across successive cohorts of older adults (Fries et al. 2011) may be regarded as positive evidence for “*health plasticity*.” Plasticity in other areas, such as social and emotional behavior or well-being, may also be considered. However, so far most research on plasticity of aging has indeed been dedicated exclusively to cognitive abilities. Future plasticity research thus needs to broaden its focus beyond aspects of cognition.

Finally, the construct of plasticity also requires critical consideration and additional refinement in the future. Specifically, plasticity has been criticized as a “vague and overused concept” (Lövdén et al. 2010, p. 659) whose specific underlying mechanisms and whose distinctiveness from other concepts are still not well understood. Indeed, cognitive plasticity and cognitive reserve have so far often been treated as synonyms. Similarly, a clear-cut differentiation, both based on conceptual consideration as well as on an empirical basis, between plasticity and related concepts such as learning, resilience, compensation, and adaptation is needed. Therefore, we agree with Lövdén et al. (2010) who point out that “it is necessary, now more than ever, given the different meanings of the plasticity concept in modern science, to operationally define the term and to sharpen its conceptual distinctiveness in relation to the more encompassing notion of change” (p. 660).

## Cross-References

- ▶ [Age-Related Changes in Abilities](#)
- ▶ [History of Cognitive Aging Research](#)
- ▶ [Life Span Developmental Psychology](#)
- ▶ [Memory Training Methods and Benefits](#)
- ▶ [Psychological Theories of Successful Aging](#)

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## Positive Emotion Processing, Theoretical Perspectives

Kimberly M. Livingstone and Derek M. Isaacowitz  
 Department of Psychology, Northeastern University, Boston, MA, USA

### Synonyms

Positive affective processing; Positive emotional processing

### Definition

Age differences in positive emotion processing refer to the differential processing of positive and negative emotional stimuli and experiences among younger and older adults, proposed as one mechanism for explaining emotional well-being in older adulthood.

### Introduction

Older adults report surprisingly positive affective experience, with most studies finding older adults reporting equally positive and less negative affect than their younger peers (Isaacowitz and Livingstone 2014). Such findings raise questions about how such a positive age-related trajectory in affective experience can be possible, especially in light of well-documented negative age-related changes

in physical and cognitive functioning. Given the recent focus throughout psychological science on cognitive processes in emotional experience and emotion regulation, much of the theory and research on age differences in affective experience has, not surprisingly, centered on possible cognitive pathways. A number of conceptual and empirical approaches to understanding this age difference in affective experience have considered how emotional material is differentially processed by younger and older adults. For example, prioritization of positive emotional goals (Carstensen et al. 1999), shifts in emotion regulation (Urry and Gross 2010), and cognitive (Labouvie-Vief et al. 2007) and brain (Cacioppo et al. 2011) changes leading to greater positivity have been identified as possible mechanisms underlying older adults' positive affective experience. In this entry, these cognitive pathways to potential affective outcomes are referred to as "positive emotion processing" (Isaacowitz and Blanchard-Fields 2012).

This entry reviews the primary cognitive approaches that have been proposed to explain potential age differences in affective experience. Whether emphasis is placed on shifting motivation, emotion regulation strategies, compensation for declining cognitive complexity, or changes in the aging brain, each places important causal weight on cognitive processes. In light of this, we consider each approach to potentially reflect "positive emotion processing," although some approaches may fit this terminology better than others. Notably, the term "positive" here encompasses stimuli and emotions that are explicitly positive, as well as those that are less negative in comparison to other alternatives (Reed and Carstensen 2012).

### **Positive Emotion Processing as Motivated Cognition**

The most well-established conceptual explanation for why older individuals report such positive affective experience probably comes from socioemotional selectivity theory (SST) (Carstensen et al. 1999), which suggests that in

older age, motivational shifts related to more limited time perspective influence prioritization of current emotional state over other possible goals. Therefore, one reason why older adults may experience maintained or enhanced emotional well-being is that they value this positive experience to a greater extent than younger adults.

Carstensen and colleagues further refined the theory to address possible cognitive mechanisms – "age-related positivity effects" in attention and memory – that may assist older adults in pursuing hedonic goals and achieving the goal of feeling good (Mather and Carstensen 2005). Though the descriptive work on age differences in positivity effects is important, findings on age differences in attention and memory are only one component of any attempt to use cognitive mechanisms to explain age differences in affective experience. Two central but distinct questions regarding age differences in positive emotion processing in emotion are: (1) To what extent do older adults show positivity effects – focusing more on positive and less on negative material? (2) To what extent are these positivity effects an explanation for age differences in affective experience (Isaacowitz and Blanchard-Fields 2012)?

One method that can be used to investigate age differences in positivity in attention is eye tracking. Eye tracking involves presenting stimuli on a computer screen and recording visual fixation to the material presented on the screen in nearly real time. Positivity effects can be assessed by measuring age differences in relative visual fixation toward positive, negative, and neutral stimuli. Several descriptive studies have used eye tracking to assess visual attention to emotional stimuli among younger and older adults. Overall, findings from these studies are consistent with age-related positivity effects in visual attention: Older adults attend relatively more to positive stimuli and relatively less to some types of negative ones (Isaacowitz et al. 2006). These patterns were originally observed with static images, but later studies observed similar patterns using video stimuli (Isaacowitz and Choi 2012). These patterns do not seem to be side effects of more general age-related changes in cognitive or perceptual functioning

(Isaacowitz et al. 2006). This work supports the idea of age-related positivity effects as well as the broader idea that there are age differences in positive emotion processing.

The descriptive pattern of older adults looking more at positive stimuli and less at negative ones is referred to as “positive looking.” After establishing this pattern, the next step was to determine whether age differences in looking relate to emotional experience, as would be expected given SST’s assertions about age-related shifts in prioritizing positive emotional experience. One study found that age differences were most likely to emerge among those in a negative mood state before eye tracking, compared to positive or neutral moods: After a negative mood induction, older adults displayed more positive looking, whereas younger adults looked relatively more at negative material (Isaacowitz et al. 2008). Studies that used positive looking to predict later mood change have found that positive looking appears to help older adults with good attentional abilities avoid negative moods (Isaacowitz et al. 2009; Noh et al. 2011). Positive looking has also been linked with improved mood regulation after upsetting videos among older adults (Isaacowitz and Choi 2012).

## Positive Emotion Processing as Emotion Regulation

Cognitive processes factor into other models of aging and emotion. The selection, optimization, and compensation with emotion regulation (SOC-ER) model proposes that older adults compensate for cognitive, physical, and social losses by selecting and optimizing certain emotion regulatory processes, in order to maintain and even enhance positive emotional functioning (Urry and Gross 2010). In the SOC-ER model, in order to successfully regulate their emotions, older adults must select strategies that are likely to work the best for them in light of age-related changes in the availability of key underlying emotion regulation-relevant resources. Although SOC-ER focuses on the stages in the emotional process that an emotion may be regulated, it is relevant here in that it

suggests that strategies vary in effectiveness across the life span. If successful emotion regulation is to be maintained, the use of specific emotion regulation strategies must shift with age.

Empirical research suggests that certain emotion regulation strategies are more advantageous for older adults and that successful implementation of such strategies is likely an important mechanism for maintaining well-being later in life. One intriguing possibility, following SST, is that positive emotion processing in situations that call for emotion regulation allows older adults to maintain high levels of emotional well-being. For example, the positive gaze preferences demonstrated by older adults, described above, can be considered a form of attentional deployment and, specifically, positive attentional deployment (i.e., toward positive and away from negative, as opposed to, e.g., toward negative). As another example, research has shown that older adults are quite successful in implementing positive reappraisal, a cognitive change strategy in which people think about the positive aspects of the situation, whereas younger adults were more successful in implementing detached reappraisal, in which they were asked to remain objective (Shiota and Levenson 2009). A separate study found that older adults were especially effective in using positive reappraisal to regulate sadness (Lohani and Isaacowitz 2014). These findings are particularly interesting, given that reappraisal is considered a cognitively demanding strategy in general and is theorized to be less effective for older adults (Urry and Gross 2010). One possibility is that their advantage in using positive reappraisal reflects greater experience with positive emotion processing, though this has not been tested.

Another way that older adults can successfully regulate their emotions is by using situation selection: proactively selecting the situations to which they are exposed, based on how they predict those situations will make them feel (Urry and Gross 2010; Charles 2010). This process first involves predicting the emotional consequences of a situation. Life experience may provide older adults with knowledge that aids their ability to predict how a situation will influence their emotions (Charles 2010), especially with regard to the

hedonic implications of the situation. Situation selection also involves the explicit decision to enter or avoid a situation. Greater emphasis in older adulthood on pro-hedonic goals proposed by SST may lead older adults to use situation selection to a greater extent than younger adults. To examine this process empirically, an “affective environment” paradigm was created that allows participants to choose negative, positive, or nonemotional stimuli to interact with (“situations” that they could enter into or avoid). One study found that older adults with strong emotion regulation self-efficacy chose to interact with more positive, compared to negative, material (Rovenpor et al. 2013). A subsequent study found that the strategy was equally effective in eliciting more positive affect across all age groups (Isaacowitz et al. 2015). Thus, positive situation selection is consistent with research on attentional processes, in that older adults prefer to process positive elements of their environment over negative ones.

### **Positive Emotion Processing as a Result of Cognitive Decline**

Though SST and emotion regulation theories have guided much research on potential positivity in older adults’ emotional processing, other theories also exist that predict or explain age-related shifts toward positive emotion processing. Dynamic integration theory (DIT) proposes that positive emotion processing reflects compensatory cognition, specifically a shift from more complex emotional processing to simpler, hedonically based emotional processing (Labouvie-Vief et al. 2007). This model describes two emotion regulatory processes: affect optimization, which maximizes positive affect and minimizes negative affect, and affect complexity, which involves emotion regulation for the development of personal and emotional growth, objectivity, and coordination with other emotional states, among other things. The latter mode of emotion regulation may involve delay of positive emotion and/or experience of negative emotions, for the sake of nonhedonic goals. According to DIT, these two

processes interact dynamically throughout the life span, though interaction varies by age. Adaptive emotion regulation consists of a dynamic integration of both processing systems, which, ideally, are flexibly coordinated over time, depending on the circumstances.

The ability to dynamically integrate these two processes changes over the life span, however. A longitudinal study over 6 years in a life span sample found that mean levels of affect optimization increased up to late middle age and leveled off; greatest increases occurred in early to middle adulthood and then showed minimal growth (Labouvie-Vief et al. 2007). In contrast, mean levels of affect complexity were highest in middle age, with declines as people aged. DIT proposes that these declines in affect complexity result from diminishing cognitive resources, resulting in an overreliance on affect optimization. Thus, in contrast to other models, for DIT, older adults’ emphasis on processing positive vs. negative aspects of the environment reflects simplified emotional processing, rather than a goal-driven process of active emotion regulation. One consequence of this is that it can also reflect a compensatory tool to protect against the effects of cognitive decline, used by older adults to maintain positive emotional states in the face of declining cognitive resources.

### **Positive Emotion Processing as a Result of an Aging Brain**

Others have focused on age-related changes in the brain to account for shifts in emotion processing. For example, the aging brain model (Cacioppo et al. 2011) has been offered as another explanation for positive emotional responding (and perhaps also positive emotional states) in older adults. According to this model, age-related reductions in amygdala responses to negative stimuli make older adults less reactive to them, thereby also sparing them negative mood responses to the elicitors. While there is little direct support for this model to date, some indirect support comes from recent evidence that adults with frontotemporal dementia show greater

positive emotion reactivity compared to age-matched peers (Sturm et al. 2015). This indicates a potential role for brain-related changes in promoting positive emotion processing, though evidence from older adults with dementia cannot directly explain age-related patterns in older adults without dementia. While this model awaits future testing, it provides a neural-based explanation for potential age differences in positive emotion processing.

The role of the changing brain in age-related changes in positive emotion processing seems to be a matter of debate. Whereas the aging brain model (Cacioppo et al. 2011) suggests that greater positive emotion processing is a result of changes in the amygdala, others have argued that reduced amygdala activity in older adults during emotion-related tasks reflects unprompted emotion regulation rather than decline in functioning. This cognitive control model argues that rather than simple declines in the aging brain, there are shifts in which emotion regulation strategies are used and how they are deployed (Mather 2012). Specifically, older adults use the cognitive resources they have available to successfully regulate their emotions. For instance, the areas of the brain associated with cognitive control of emotion – specifically the ventromedial prefrontal cortex and the anterior cingulate cortex – show less decline with age than other areas. In addition, older adults show greater recruitment of areas of the prefrontal cortex indicating either heightened processing of positive stimuli or reduced processing of negative stimuli (Mather 2012).

## Future Directions

As research on positive emotion processing continues, it will be important to establish the conditions under which these cognitive processes do or do not result in greater affective well-being. Social and financial circumstances and physical health likely provide boundary conditions on the influence of positive emotion processing on emotional well-being. Existing research suggests that individual differences in cognitive abilities seem to

play an important role in the effects of positive emotion processing in attention on experienced affect (Isaacowitz et al. 2009; Noh et al. 2011). Future research should incorporate important candidates for individual and situational factors that may influence the link between positive emotion processing and well-being. Some potential candidates include attentional functioning (Isaacowitz et al. 2009; Noh et al. 2011), executive control, and beliefs about emotion regulation (Rovenpor et al. 2013).

Many studies have investigated age differences in well-being and emotional experience, and the last few years have witnessed a large uptick in research on age differences in cognitive processing of emotional stimuli. There are still many open questions, however, about links between positive emotion processing on one hand and positive emotional experience on the other. Research on positive emotion processing suggests that it may be an important mechanism in helping older adults maintain high levels of well-being in the face of age-related declines in cognition and physical functioning. One important distinction that needs to be made is between use and effectiveness of positive emotion processing: Though older adults may demonstrate positive emotion processing, it is not always effective in eliciting positive emotions (Isaacowitz and Blanchard-Fields 2012). In particular, it seems most strongly linked to more positive affect in individuals with strong cognitive control (e.g., Isaacowitz et al. 2009; Noh et al. 2011) and in cases where individuals are allowed to engage with their environment naturally, rather than being restricted by experimental instructions or distracted by other tasks or information. Yet, many studies examine either use or effectiveness, rather than both. It will therefore be critical for all future studies of positive emotion processing (e.g., in attention and memory, in emotion regulation) to include measures of affective response to determine whether any observed age differences in cognition predict age differences in experience as well. In other words, studies of positive emotion processing preferences should also test effectiveness when possible.

## Conclusion

Several theories have proposed cognitive mechanisms by which older adults report maintained or enhanced emotional well-being despite declines in cognitive and physical functioning. Research has demonstrated that older adults demonstrate a greater emphasis on processing positive over negative information, compared to younger adults. Motivation, emotion regulation, cognitive decline, and changes in the brain have been proposed as explanations for these age differences in cognitive processing of emotional stimuli. Future research will further clarify how and when these age differences lead to greater well-being, which in turn will improve our understanding of emotions across the life span.

## Cross-References

- ▶ [Affect and Emotion Regulation in Aging Workers](#)
- ▶ [Age-Related Positivity Effect and Its Implications for Social and Health Gerontology](#)
- ▶ [Socioemotional Selectivity Theory](#)

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## Postretirement Career Planning

Ulrike Fasbender<sup>1</sup> and Jürgen Deller<sup>2</sup>

<sup>1</sup>Department of Business and Management,  
Oxford Brookes University, Oxford, UK

<sup>2</sup>Institute of Strategic HR Management Research  
and Development (SMARD), Leuphana  
University of Lüneburg, Lüneburg, Germany

### Synonyms

Bridge employment; Career development over the life span; Late career development; Late career management; Late career planning; Older workers; Post-retirement employment

### Definition

Post-retirement career planning refers to the planning process to actively engage in career-related activities after formal retirement entry.

### Introduction

From a historical perspective, the nature of retirement has changed in many industrialized countries during the last century. Before 1900, retirement did hardly exist because people worked as long as they were able to work or the formal retirement age was well beyond life expectancy. In the first half of the twentieth century, retirement became a statutory opportunity due to the introduction of social security. Until 1980, male workers were striving toward earlier retirement, while female workers were delaying their retirement. From 1980 to 2000, the decline of men's retirement age continued due to social and economic conditions. From 2000 onward, the situation of retirement is on the move driven by population aging and economic uncertainty (Shultz and Wang 2011). Nowadays, the term retirement refers to a pension-receiving state that in many cases involves the dissociation from the main employment but generally allows further

work engagement. Although retirement has long been seen as a phase of complete disengagement from work, it has been recently reconceptualized as late career development stage based on (more or less) voluntary engagement in career-related activities (Kim and Hall 2013; Wang and Shi 2014; Voelpel et al. 2012). In many industrialized countries, demographic changes and economic conditions have caused a political shift from an agenda of early retirement toward an agenda of extending working lives that lay the foundations for individual post-retirement career planning in the contemporary society.

The entry provides an overview of post-retirement career planning from an individual perspective. After covering career development across the life span, post-retirement careers will be discussed in terms of its social cognitive foundations and in terms of its planning process. In addition, relevant antecedents of post-retirement career planning will be introduced with regard to their proximity to career-related behavior. This will be followed by a discussion of empirical support for post-retirement career planning and an outlook for future directions.

### Career Development Across the Life Span

Career refers to the development of vocational interests, decisions, and behavior over the life span. The life-span, life-space theory of careers (in the literature also named as theory of vocational development, career development theory, and developmental self-concept theory; Super 1953, 1990; Super et al. 1996) combines the approach of having multiple roles in life (i.e., life space) with the approach of individual development of career paths (i.e., life span).

### Life-Space Approach

The approach of life space of career development refers to the room that people take for their career while living their life. The life space is based on the constellation of different social positions that drive people to occupy multiple

roles in life. For example, a person takes the role of being a spouse, father, grandfather, brother, friend, golfer, and volunteer next to his occupational role. Although the work role is a significant role in contemporary society, it is only one among many others. Further, the multiple roles people occupy interact with each other with regard to the resources (e.g., energy, time, and money) that people have. Referring to the previous example, the person's choice whether to continue working in retirement is based on circumstances related to the constellation of his different social positions. For example, with the birth of his grandchild, he may have fewer resources available for his work role than before. In addition, the allocation of resources between the different roles depends on the meaning that each role provides to people's lives.

### Life-Span Approach

Career development involves several transitions from one life stage into another. Figure 1 shows the ladder model of life career stages and development tasks referring to the approach of career development across the life span. Based on the sequence of life stages (i.e., growth, exploration, establishment, maintenance, and disengagement or reengagement), there are different task-related substages relevant in a prototypical pattern of career development.

#### Growth

The growth stage (approximately from ages 4 to 13) refers to the career development tasks involving curiosity, fantasies, interests, and capacities to answer the question "Who am I?" During this stage children learn to gain control over their own life, make decisions, and increase confidence in their own abilities. At the same time, children experience to get along with other children and adults guiding them to balance cooperative and competitive behavior in order to achieve their aims and keep up relationships to others. Further, time becomes a relevant factor that leads children to develop a future orientation. Overall, the growth stage helps a person to set the foundations for his or her vocational self-concept.

#### Exploration

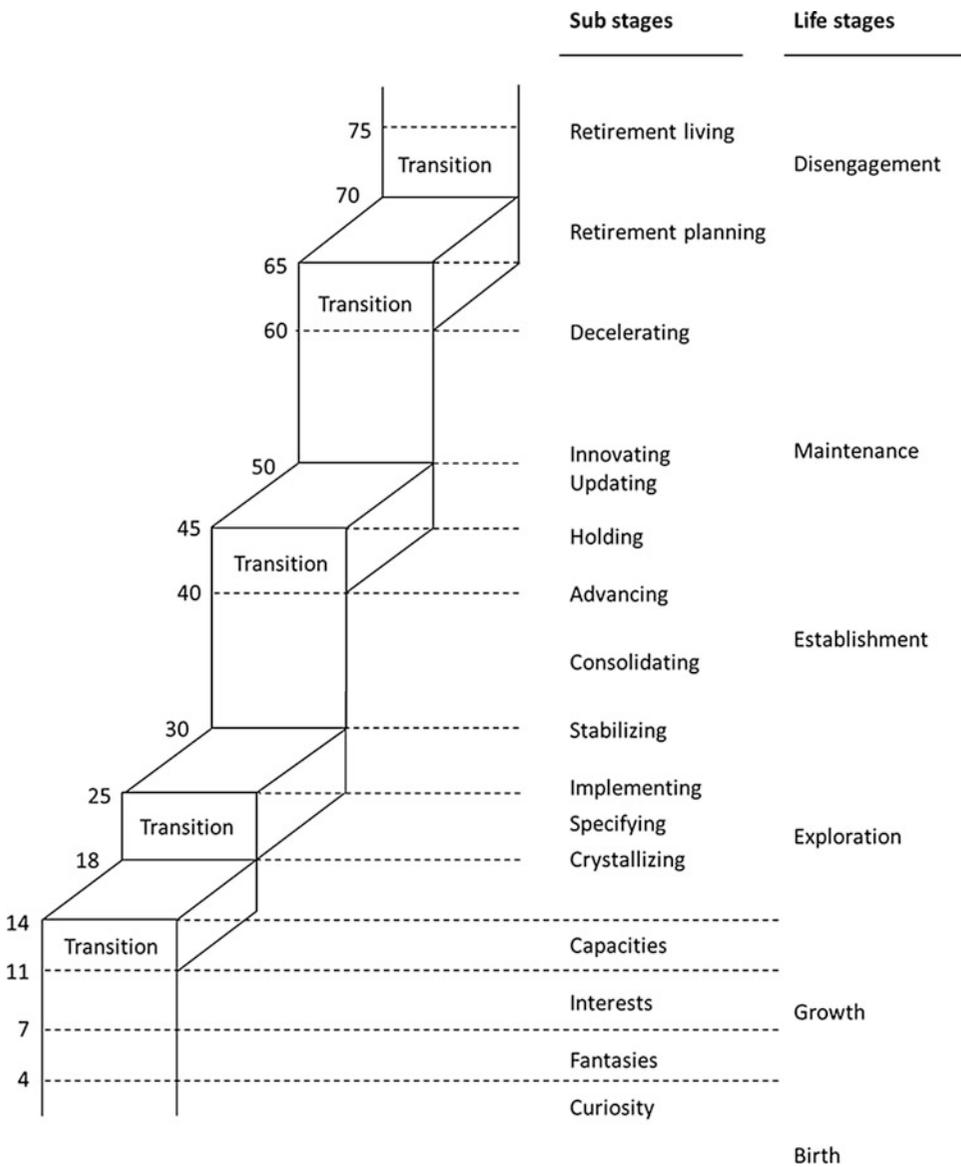
The exploration stage (approximately from ages 14 to 24) refers to the career development tasks crystallizing, specifying, and implementing a vocational choice and preparing work-role entry. In a first instance, exploration involves the imagination of possible selves in varying occupational contexts. This reflection of preferences is followed by the transfer of privately experienced vocational self-construct into educational and occupational choice. Finally, the exploration stage is completed by implementing choice through the means of selecting a training, preparing, and obtaining a specified occupational position.

#### Establishment

The establishment stage (approximately from ages 25 to 44) refers to the career development tasks stabilizing, consolidating, and advancing the vocational self-concept in order to build a secure work role. Stabilizing implies settling into the new position by assimilating to the work culture and fulfilling central job duties. This again facilitates consolidating the position by demonstrating sustained work, productive work attitudes, and positive coworker relations. At the final point of the establishment stage, people eventually pursue new levels of responsibility in order to move ahead to higher level positions inside or outside their work organization. Successful establishment yields to a consistent integration of the self-concept into the occupational role, which leads, besides earning a living, to higher levels of meaning in life.

#### Maintenance

The maintenance stage (approximately from ages 45 to 65) refers to the career development tasks holding, updating, and innovating the established position. For the majority of people, the transition from the establishment to the maintenance stage is characterized through the clarification of the satisfaction with the current work role and the critical examination of relevant work goals with regard to the future direction. At this point, people either decide to stay in the current position and therefore enter the maintenance stage or change their vocational orientation and therefore recycle earlier



**Postretirement Career Planning, Fig. 1** The ladder model of life career stages and development tasks (Super 1990) (Source: Life stages and substages based on the typical developmental tasks, with focus on the maxicycle. From D.

E. Super (1990). A life-space, life-span approach to career development. In D. Brown (Ed.), *Career choice and development* (2nd ed.; p. 214). San Francisco: Jossey-Bass. Copyright by John Wiley & Sons, Inc. Reprinted with permission)

stages of career development (i.e., the exploration and/or establishment stage). With entering the maintenance stage, people hold on to their secured position and maintain job proficiency and work achievements. Further, this stage involves updating professional skills and knowledge in order to enhance job performance. At the same time, discovering new challenges and innovating

the way of doing tasks help preventing job dissatisfaction and hence decrease the likelihood of mid-career changes or career plateaus.

**Disengagement or Reengagement**

The disengagement stage (in Super’s model approximately from ages over 65) refers to the career development tasks of deceleration,

preparation, and transition to retirement. During this stage, a majority of people experience lower levels of energy and interest for the work role, which leads to slowing down on the job, reducing work hours, and passing over tasks, skills, and knowledge to the younger work generation (Hartung 2013). Eventually, this leads to a complete separation of self-concept and work, requiring new life structures for people entering retirement. However, the prototypical pattern of career development becomes less meaningful with higher ages because the variety of possible development paths increases. As a consequence, disengagement can become reengagement. As it has been already mentioned in the introduction, retirement can also be a late career development stage, which does not necessarily yield toward a separation of self-concept and work but rather to retaining the work-role identity. As people have often worked for their whole life, their self-concept may be closely tied to their work role, driving them to continue working after formally entering retirement (Feldman 1994; Jex and Grosch 2013).

### Post-Retirement Career

Retirement is an enduring process that involves the planning to actively engage in career-related activities that often begins before entering retirement (Wang et al. 2013). There are a variety of factors that determine this planning process and influence retirees' decisions whether to engage in career-related activities or not. With formally entering retirement, people may continue working or volunteering as they have done before, or they create new opportunities for themselves and take up new responsibilities of societal participation and productive engagement. Career-related activities include post-retirement employment (also named bridge employment), which refers to paid work inside or outside the (pre-retirement) career field (Gobeski and Beehr 2009). There are different employment forms, including working for the same employer, for a new employer, or going into business for oneself (Shultz 2003). Also, post-retirement volunteering has been noted to be an important form of productive engagement after

retirement entry. Post-retirement volunteering includes formal activities that benefit civic organizations (e.g., managing a charity institution for cancer research) or informal activities that benefit family and friends (e.g., care of a disabled person). In real-life settings, often a combination of different career-related activity patterns including both post-retirement employment and volunteering can be found.

### Social Cognitive Foundations of Post-Retirement Career Behavior

#### Interaction Between Person, Environment, and Behavior

Over 20 years ago, Lent, Brown, and Hackett (1994) have formulated the social cognitive career theory to explain the process of interest development, decision-making, and performance attainment of career behavior across the life span. The career process model builds on Bandura's (1986) general social cognitive theory that states a triadic reciprocity between person, environment, and behavior. Triadic reciprocity implies the bidirectional influence of three elements, which are the (a) personal factors that consist of internal capabilities, such as cognitive, emotional, and physical resources; (b) the environmental factors, such as external resources and surrounding conditions; and (c) the behavioral factors that consist of actions and decisions (rather than attributes and capabilities) of the person. This three-way mechanism goes beyond previous theoretical approaches that often described behavior as a result of the interaction between personal and environmental factors,  $B = f(P \leftrightarrow E)$ . However, it is important to note that the actions and decisions people take alter environmental factors and draw back on their affect and thoughts and influence subsequent behavior (Bandura 1986).

Based on the dynamic interplay of person, environment, and behavior, the social cognitive career theory that is crucial for post-retirement career planning emphasizes on self-efficacy, outcome expectations, and personal goals as cognitive person variables that enable the person to act as an agency of self-directed career behavior. These cognitive person determinants involve

different self-reflective and self-regulatory processes that are central for career development after formal retirement entry.

### Self-Efficacy

Self-efficacy refers to a person's belief about one's own capabilities to deal with a situation and take action that are appropriate for the accomplishment of self-directed goals (Lent and Brown 2013). Beliefs about one's own self-efficacy determine a person as proactive agent within his or her own motivational orientation (Bandura 1986). The concept of self-efficacy is a dynamic set of beliefs linked to particular career and performance domains rather than being a global or unitary trait as self-esteem (i.e., the overall evaluation of self-worth), as can easily be confused. A person might, for instance, have strong self-efficacy beliefs about his or her ability to interact with different types of people (i.e., social task) but feel less competent at manual or technical tasks (Lent 2013). Further, there are different forms of self-efficacy, *task-specific efficacy* (i.e., the belief about one's capability to fulfill career-related requirements, such as having relevant work experience and knowledge),  *coping efficacy* (i.e., the belief about one's ability to cope with career-related obstacles, such as age discrimination at work), and  *process efficacy* (i.e., the belief about one's capability to guide the retirement transition, including post-retirement career preparation, retirement entry, role shift, and the adjustment to retirement), that are relevant to post-retirement career planning.

### Outcome Expectations

Outcome expectations refer to a person's anticipation of the likely consequences of one's behavior. With regard to post-retirement career planning, these outcome expectations possibly involve the anticipation of  *physical* (e.g., additional income),  *social* (e.g., intergenerational contact, approval from others), and  *self-evaluative* (e.g., self-satisfaction, work-role identity) outcomes that are likely to influence career-related decisions. Taken together, the two mechanisms of self-efficacy and outcome expectations can be transferred into the general questions "can I do this?" and "if I try, what will happen?"

### Personal Goals

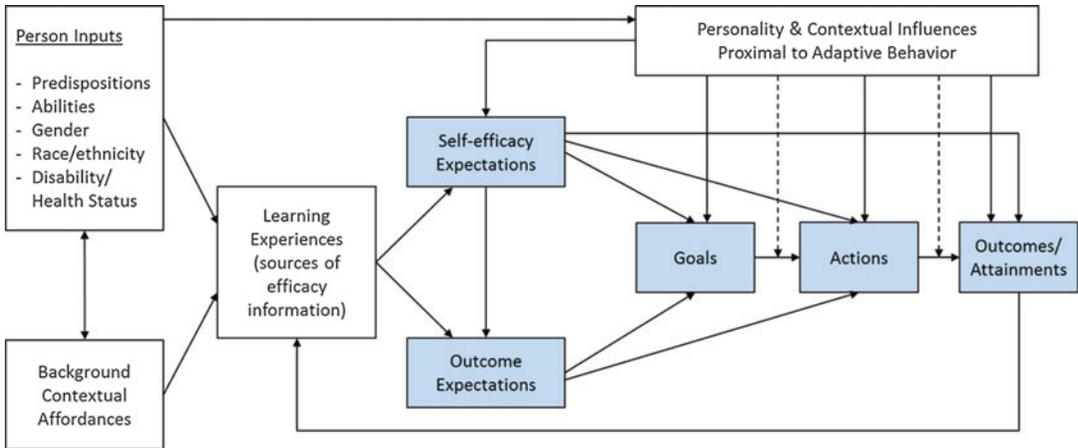
Another relevant instance of self-regulatory behavior that is central to post-retirement career planning is goal setting. People are more than mechanical performers following environmental forces but proactive agents that use personal goals as guiding principles to systematically take a course of action in order to achieve desired outcomes (Bandura 1986). Personal goals refer to one's intention to engage in particular behavior in order to produce a certain outcome (Lent 2013). Goals can be distinguished in  *choice goals* (i.e., the type of behavior that one plans to pursue) and  *performance goals* (i.e., the quality or level of performance that one wished to achieve related to the chosen type of behavior). Further, goals vary in specificity and proximity to the actual behavior (Lent and Brown 2013). In the context of post-retirement career planning, goals can be further divided into general career goals and specific intentions. While general career goals refer to occupational aspirations that exist independent of commitment or real considerations, specific intentions refer to the concrete willingness to take career-related actions.

### Post-Retirement Career Planning Process (or Career Self-Management Process)

The core process of post-retirement career planning describes how self-efficacy, outcome expectations, and goals are related to action and outcome attainment. Figure 2 provides an overview of the entire process of career self-management including the core career planning process in shaded boxes and its proximal and distal antecedents in white boxes.

*Note:* Direct effects are indicated with solid lines; moderator effects (where a given variable strengthens or weakens the relationship between two other variables) are indicated in dashed lines.

In the core process of career planning, self-efficacy and outcome expectations are the initial antecedents of career-related behavior. As can be seen in the process model, the two factors promote actions directly and indirectly through goals. The way self-efficacy and outcome expectations influence career behavior depends on the certainty of outcome attainment. Under certain conditions



**Postretirement Career Planning, Fig. 2** The process of career self-management (Lent and Brown 2013) (Source: Model of career self-management. From R. W. Lent & S. D. Brown (2013). Social cognitive model of career self-management: Toward a unifying view of adaptive career behavior across the life span. *Journal of*

*Counseling Psychology*, 60, p. 562. Adopted from: Toward a unifying social cognitive theory of career and academic interest, choice, and performance. From R.W. Lent, S. D. Brown, & G. Hackett, 1994, *Journal of Vocational Behavioral*, 45, p. 93. Copyright 1993 by R. W. Lent, S. D. Brown, & G. Hackett. Reprinted with permission)

(i.e., a high level of performance guarantees appointed career outcomes), self-efficacy is the predominant mechanism in determining career-related behavior, and outcome expectations are of lower importance. While under uncertain conditions (i.e., career outcomes are only loosely bound to the level of performance), outcome expectations are of crucial relevance for career behavior. For example, when an employee has worked for over 20 years for a company with a consistently high level of performance, he might be offered to continue working after retirement entry. However, due to company's skepticism regarding the work ability of the employee, the opportunity to continue working is uncertain. This means that the employee's self-efficacy and also his outcome expectations are highly relevant in order to set goals that help attaining outcomes. Therefore, when the employee believes that he or she can convince the company to hire him or her after retirement based on his or her capabilities and work experience (i.e., positive outcome expectations), the employee will (indirectly) be more likely to be hired. However, when the employee believes that the company will not be interested in him or her due to the company's negative views on older workers (i.e., negative

outcome expectations), the person will have lower chances to be actually hired independent from his or her believed capabilities to continue working in retirement.

That goals or intentions determine behavior has been proposed by various theories, such as the theory of planned behavior, social cognitive theory, or goal-setting theory. These theories also emphasize in particular qualities that are important for goals in order to be effective behavioral determinants. Referring to these qualities, goals should be explicit, specific, openly stated, in line with personal values, and proximal to actual behavior (Lent and Brown 2013). Taken together, self-efficacy, outcome expectations, and goals are relevant determinants of career-related actions. Further, goal-directed actions are more likely to promote desired career outcomes. For example, a person who is actively seeking for a job after formal retirement entry will be more likely to obtain a job compared to someone who is communicating his retirement situation neutrally without his career aspirations. In addition, self-efficacy is also directly linked to outcome attainment through its important role of facilitating, organizing, and persisting career-related behavior.

## Antecedents of Post-Retirement Career Planning

Antecedents of post-retirement career planning can be distinguished in proximal antecedents that directly influence the core elements of post-retirement career planning (i.e., goals, actions, and outcome attainments), while distal antecedents are seen to indirectly influence post-retirement career planning by the means of learning experience that convey in self-efficacy and outcome expectations (as initial antecedents of post-retirement career planning).

### Contextual Factors and Personality as Proximal Antecedents

Contextual factors can serve as proximal antecedents for career-related behavior as can be seen in Fig. 2. Among contextual factors, there are objective features and perceived features of the environment that are likely to facilitate, restrict, or override other factors (e.g., personality) involved in post-retirement career planning. In the eye of the beholder, support, opportunities, and barriers often vary in its importance to career-related behavior, which highlights the active and phenomenological function of people to interpret contextual factors around them (Lent et al. 1994). Environmental support (e.g., financial or social support), the absence of barriers (e.g., good working conditions such as low physical demand and low work stress), and other work-related factors (e.g., career attachment, intrinsic work motivation, or job satisfaction) support post-retirement career planning in a way that they directly influence outcome attainment and indirectly through self-efficacy, personal goals, and career-related actions that again convey in outcome attainment (Lent and Brown 2013).

Further, opportunity structures are seen to be highly relevant contextual factors shaping career-related behavior. Often sufficient socioeconomic and educational conditions allow people to convey their interests into personal career goals. However, interests and career choices are not necessarily linked to each other. As people working in a coal mine do not only work for simple pleasure but to fulfill their financial need, older people may decide for the same financial reason to continue

working in retirement. Some people are in the favorable position to choose their career option based on their special abilities, interests, and skills, while others are in the rather unfavorable position to have to take any job that is available for money. Opportunity structures (not only in terms of financial need) are, therefore, a major issue in determining post-retirement career planning (Lent et al. 1994).

In addition to contextual factors, certain personality dimensions are proximal antecedents for career-related behavior. Personality refers to a relatively stable set of dimensions (i.e., traits) that are seen to constitute people's endogenous basic tendencies of acting, feeling, and thinking (Brown and Hirschi 2013). In particular, conscientiousness (i.e., being responsible and self-disciplined) as one of the Big Five factors of personality may be relevant for career-related behavior, such as planning and persistence (e.g., while searching for a job after formal retirement entry). Also, other personality dimensions may facilitate career-related behavior with regard to networking or interviewing. Agreeableness (i.e., being cooperative and loyal) and extraversion (i.e., being action-oriented and enthusiastic) may facilitate engaging in social interactions, while emotional stability (i.e., being calm, stable, and relatively free from persistent negative feelings) may help coping with ambiguous situations. Further, openness to experience (i.e., being curious and imaginative) may facilitate career-related behavior that involves imagining or deliberating different (unconventional) career choice or problem-solving options (Lent and Brown 2013).

### Learning Experience as Mediator of Distal Antecedents

Self-efficacy beliefs and outcome expectations do not operate in a social vacuum but rather function in interaction with other person inputs and their particular environments, such as genetic predispositions, specific abilities or disabilities and physical health, gender, ethnicity (or race), and socioeconomic conditions. At this point, it is important to highlight that these person inputs influence career-related behavior mainly indirectly through learning experience of cultural

socialization that again transfers to self-efficacy and outcome expectations. In this regard, learning experience refers to four types of information, which are personal achievements, observational learning and modeling, social encouragement and influence, and physiological and affective states.

To clarify the role of learning experience, gender, as one aspect of the person, may help to illustrate the psychological and social effects that arise with regard to career-related behavior. Gender affects career development at multiple stages, especially through the social-cultural reactions it evokes from the environment during the growth and exploration stage but also during later stages. For instance, gender can influence the context children acquire the foundations for their self-efficacy and outcome expectations due to role socialization processes. Early gender role socialization is likely to bias the access to certain experiences that are necessary in order to gain strong self-efficacy beliefs and positive outcome expectations in areas seen as rather typical for male (e.g., science) or typical for female (e.g., care). However, after the initial career choice is made, people are able to change or revise their career paths as they operate as proactive agents in a dynamic environment (Lent 2013).

With regard to post-retirement career planning, learning experiences that are made in earlier stages but also during the current stage of career development are crucial for the decision whether one continues to work after formally entering retirement. As can be seen in Fig. 2, previous outcome attainments are relevant to stabilize (or revise) the self-efficacy and outcome expectations by forming a feedback loop through the means of learning experience. In addition, the role of person inputs is persistent within the current stage of career development (i.e., disengagement or reengagement) as older people face certain age-related role socialization processes. From the environment, for instance, physical deprivation and declining work ability are perceived as a general law of aging that leaves no room for individual escape. This overall rather negative image of aging might lower opportunities to gain access to certain experiences that are necessary in

order to gain strong self-efficacy beliefs and positive outcome expectations in order to continue working in retirement.

To a large extent, person inputs like abilities or disabilities and physical health, gender, and socio-economic conditions affect the different aspects of career development (i.e., interest development, goal establishment, and activity planning) through processing a socially constructed reality that apparently operates in the background but yet powerfully influences self-efficacy and outcome expectations by the means of learning experience. At times, this leads to skewed conclusions about certain interests, goals, and career choices to be “right” for different types of people (Lent 2013).

## Empirical Support

For over 60 years of research, the life-span, life-space theory has attracted much attention from researchers. As a result, there is a wealth of empirical support highlighting the two approaches of life span and life space for career development. However, although there is an impervious layer of research on career development among young adults and adolescents, it has been criticized that there is too little attention for mid- and late career development (Hartung 2013). Especially with regard to post-retirement career planning, a more thoughtful and fine-grained investigation of the disengagement or reengagement stage seems appropriate to further understand and compass the needs of a worldwide aging population.

Also, the social cognitive career theory has gained much attention in career literature related to various work domains (e.g., leadership, job search behavior) as well as to different career development stages from young professionals to mid- and late careers. A substantial body of research indicates the relevance of social cognitive variables (i.e., self-efficacy, outcome expectations, and personal goals) for career planning and development (Lent 2013). In particular, self-efficacy has been found to predict career-related interest, choice, and outcome attainment to a substantial extent (Lent 2013). Meta-analysis (i.e., a statistical technique that systematically

combines the research findings of published and unpublished primary studies) revealed that self-efficacy and outcome expectations are directly as well as indirectly (through interests, goals, and action) related to outcome attainment (Brown et al. 2011; Lent 2013; Sheu et al. 2010). Further, it has been found that contextual factors such as environmental support and barriers are relevant antecedents of career development. Although the direct effects of contextual factors on outcome attainment are relatively small, they persist to be central in strengthening or weakening the relationship between self-efficacy and outcome expectations with career outcomes (Lent 2013; Sheu et al. 2010). In addition, contemporary empirical approaches (e.g., Wöhrmann et al. 2014) have applied the social cognitive career theory firsthand to late career development, empathizing on the role of social cognitive variables for post-retirement career planning.

## Future Directions

This entry provided an insight to the key elements of post-retirement career planning from an individual perspective. The role of career development over the life span has been addressed with particular focus on the stage of disengagement or reengagement. Further, the process of post-retirement career planning was presented including its core elements and relevant proximal as well as distal antecedents. Special attention was provided to the social cognitive variables (i.e., self-efficacy and outcome expectations) that promote people as proactive agents of post-retirement career planning along their own motivational orientation.

With regard to future directions of post-retirement career planning, two major issues should be addressed here. First, it is relevant to emphasize on the necessity for more research on the later stages of career development. As mentioned before, there has been too little research attention to mid- and late career development. Considering population aging, it is of high relevance to consider the special challenges of late career development. Also, it could be stated that

the ladder model of life career stages and development tasks (as presented in Fig. 1) needs to be adjusted with regard to the changing nature of work, aging, and retirement. A contemporary model for career development should allow back and forth jumping between different stages and also enable returning from later to earlier stages of career development. Taken together, a more fine-grained investigation of the later career development stages seems to be crucial for further understanding of post-retirement career planning.

Second, another major issue to be addressed here is the consideration of the diverse nature of work regarding the significant role of choice. The favorable position to choose a career option based on special abilities, interests, and skills may lead people to perceive work as gain, while an absence of choice due to economic pressure may lead people to perceive work as pain. Promoting active aging that encourages older people to be productive for the sake of themselves, their families and communities, and the society as a whole relies on a concept of work that is based on voluntary decisions to engage in post-retirement career activities. However, economic pressure may lead older workers to engage in precarious work that may help to prevent poverty but not necessarily guarantee further individual benefits such as health and well-being. Future research should, therefore, investigate different types of work, in particular, the role of manual labor in post-retirement career planning.

## Cross-References

- ▶ [Age Diversity at Work](#)
- ▶ [Age-Related Changes in Abilities](#)
- ▶ [Aging and Psychological Well-Being](#)
- ▶ [Early and Unplanned Retirement](#)
- ▶ [Human Resource Management and Aging](#)
- ▶ [Life Span Developmental Psychology](#)
- ▶ [Motivational Theory of Lifespan Development](#)
- ▶ [Psychological Theories of Successful Aging](#)
- ▶ [Late Life Transitions](#)
- ▶ [Timing of Retirement](#)
- ▶ [Training at Work and Aging](#)
- ▶ [Work Motivation and Aging](#)

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## Primary Progressive Aphasia

Maria Teresa Carthery-Goulart

Center of Mathematics, Computing and Cognition (CMCC), Federal University of ABC (UFABC), São Bernardo do Campo, São Paulo, Brazil  
Cognitive and Behavioral Neurology Unit, Hospital das Clínicas, School of Medicine, University of São Paulo (HCFMUSP), São Paulo, São Paulo, Brazil

## Definition

PPA is a clinical syndrome characterized by an isolated and progressive language deficit due to gradual neurodegeneration of the left and frontal lobes in critical points of the language network, causing disruption of syntactic, semantic and phonological processing. PPA can have different clinical presentations and in 2011, an international group of PPA investigators recognized the need for

establishing a common framework for PPA identification. This research group agreed on terminology and on clinical, imaging-supported and definite pathology criteria for the diagnosis of three distinct variants: non-fluent/agrammatic (PPAANF), semantic (PPAS) and logopenic (PPAL).

## Introduction

Language disturbances may impact functionality, participation in leisure and social activities, and consequently, quality of life of elderly individuals. Some language changes are expected in the normal aging process but need to be distinguished from progressive aphasia syndromes that will require particular interventions.

Aphasia is a language disorder resultant from brain injury usually in the left hemisphere and that may have abrupt or insidious onset. The several aphasic syndromes are characterized by different degrees of impairment in comprehension or production of oral and written language due to disruption of one or more levels of language processing (i.e., phonological, syntactic, semantic). Aphasia in the elderly is often sequelae of cerebral vascular accidents. However, aphasic symptoms may also appear in isolation and insidiously as consequence of neurodegenerative diseases. The initial and very subtle language changes may go unnoticed or be confounded with those expected in normal aging.

In this entry, we are going to present the most common presentations of primary progressive aphasia (PPA), a clinical syndrome in which neurodegeneration of the frontal and temporal cortices gradually impairs language use and affects daily activities. First we are going to define PPA and present a brief historical background on the characterization and terminology used over the last decades. Then, we are going to introduce the most important clinical features of three common variants of PPA, according to current international consensus (Gorno-Tempini et al. 2011) along with their main neuroimaging and pathology correlates. Finally, we are going to address clinical management, focusing on behavioral interventions for those patients.

## Primary Progressive Aphasia: Historical Background and General Characteristics

PPA is a clinical syndrome characterized by an isolated and progressive language deficit due to gradual neurodegeneration of the left and frontal lobes in critical points of the language network, causing disruption of syntactic, semantic, and phonological processing. Clinical and research interest for PPA has been growing fast, and three of its variants have been well specified in terms of clinical manifestations and neuroanatomical correlates. Advances have also been made in predicting the underlying pathology in those three subtypes and establishing associations between clinical phenotypes and genetic mutations, although findings in this area are still not entirely consistent (Harciarek and Kertesz 2011; Rascovsky and Grossman 2013).

Two of its most common variants, progressive nonfluent aphasia (PNFA) and semantic dementia (SD), have been included in the complex of brain neurodegenerative diseases referred to as frontotemporal dementia (FTD) or frontotemporal lobar degeneration (FTLD) (Harciarek and Kertesz 2011; Neary et al. 1998), the second most common form of young-onset dementia after Alzheimer's disease. The most frequent FTLD syndrome is the behavioral variant of FTD (FTD<sub>bv</sub>), characterized by marked personality and behavioral disturbances. But PPA is not uncommon in FTLD, accounting for about 40% of the cases. The third most common PPA variant, logopenic progressive aphasia, has been reported more recently (Gorno-Tempini et al. 2004) and is linked to Alzheimer's disease pathology.

There is great heterogeneity in clinical presentations, medium survival, and age of onset (Harciarek and Kertesz 2011), even when considering a particular PPA variant. In addition, recent studies have suggested that distinct forms of PPA are associated with different susceptibility factors (Miller et al. 2013).

Although PPA is usually an early-onset dementia, with symptoms starting before the age of 65, in some individuals, manifestations start in more advanced ages, reaching the late 70s (Hodges et al. 2010). Early identification of PPA

may be more challenging among those individuals since tip-of-the-tongue experiences increase significantly with aging and may obscure the perception of a more marked lexical deficit, usually the first sign of PPA.

A landmark in the study of PPA was the publication of Mesulam et al. in 1982, with the description of six patients presenting with slowly progressive deterioration of language without generalized dementia associated to atrophy in perisylvian regions of the left hemispheric cortex. In 1992, Mesulam and Weintraub (1992) proposed that a diagnosis of PPA should be made when language impairment due to neurodegenerative disease is the only factor to affect everyday activities at least in the first 2 years after symptom onset. Language deficits remain as single cognitive manifestations for variable periods over the course of the disease (in some cases as long as 14 years) (Mesulam 2001). This cognitive profile is different from other dementia syndromes that begin with prominent amnesic, behavioral, or visuospatial symptoms (i.e., AD, FTDBv, and posterior cortical atrophy, respectively).

In the 1980s and 1990s, another related syndrome received a great deal of research: semantic dementia. Snowden et al. (1989) suggested this name to refer to patients presenting with a progressive loss of conceptual knowledge (semantic memory) contrasting with relatively preservation of memory for events (episodic memory). Diagnostic criteria for SD were proposed by Hodges and colleagues (1992) that in the following years detailed clinical, neuroimaging, and neuropathological characteristics of those patients (Hodges and Patterson 2007).

First symptoms of SD include difficulties to process word meanings, object and people knowledge (a deficit affecting both verbal and nonverbal semantic memory), and surface dyslexia (difficulty in reading words with irregular or exception spelling).

In the 1990s, numerous PPA cases were reported, and a large variation of language profiles was evidenced. Although word-finding and naming deficits are common among patients in the early stages of PPA, in the longitudinal course of the disease phonological, semantic and syntactic

deficits in oral and written language differ considerably among patients. These observations motivated the use of fluency (rate of speech and number of words per minute in spontaneous conversation) to characterize PPA subtypes into fluent or nonfluent (Mesulam 2003). Fluent PPA patients encompassed some features of SD, and there were a lot of discussions as to whether those two clinical pictures should be considered the same or not (Hodges and Patterson 2007; Mesulam 2003).

In summary, at that point, PPA patients were either classified as SD versus PNFA in accordance with Neary et al. consensus (Neary et al. 1998) or as fluent or nonfluent as stated by Mesulam (2003). The term temporal variant of FTD has also been employed in the literature as a synonym for SD.

That binary classification was not suitable for a proportion of PPA patients (Harciarek and Kertesz 2011), and in 2004, a third variant was described, logopenic progressive aphasia (Gorno-Tempini et al. 2004).

In 2011, an international group of PPA investigators recognized the need for establishing a common framework for PPA identification and agreed on terminology and on clinical, imaging-supported and definite pathology criteria for the diagnosis of three distinct variants: nonfluent/agrammatic (PPAANF), semantic (PPAS), and logopenic (PPAL) (Gorno-Tempini et al. 2011). This step was necessary to make multicenter studies more feasible and to potentiate advances in the understanding of cognitive, neuroanatomic, and molecular bases of PPA.

The PPA criteria in current use have proven very helpful to reach those scientific and clinical goals despite the fact that a considerable amount of patients present language profiles that differ from those proposed for the three most common variants. In addition, as mentioned before, there is great heterogeneity among patients of each variant, and the criteria may be difficult to apply in a purely quantitative basis (Wicklund et al. 2004), requiring a certain degree of expertise in qualitative analyses of speech production. Another important factor is that criteria are more appropriate to characterize the relatively early stages of the diseases. On their longitudinal courses, clinical

pictures tend to mix due to spread of neurodegenerative processes to other points of the language network. Furthermore, other cognitive, behavioral, and/or motor deficits may also appear.

Before being classified into a specific variant, patients shall meet PPA criteria (Gorno-Tempini et al. 2011; Mesulam 2001, 2003), and for that, three conditions must be fulfilled: most prominent clinical feature should be difficulty with language, language difficulties are the main cause of impairment in everyday activities, and aphasia should be the most prominent deficit at symptom onset and for the initial phases of the disease. In addition, the pattern of deficits should not be better accounted for by other neurodegenerative nervous system or psychiatric disorder, and patients should not present initially with prominent behavioral disturbance or other cognitive impairments in episodic memory, visual memory, and visuo-perceptual skills.

Deficits in other cognitive functions may be evidenced in neuropsychological assessment, especially in cognitive functions that share neuro-anatomical correlates with the language network (i.e., verbal immediate memory, calculation and numeracy skills, ideomotor praxis), but those must be milder in comparison with the language deficit. Regarding this aspect, it is important to emphasize that many cognitive tests are language mediated and affected by aphasia. For instance, it is expected that lexical retrieval difficulties will impact performance in episodic memory tasks that demand immediate and delayed word recall, and for that reason, visual episodic memory tasks should be preferred to investigate this cognitive domain in this population.

The presence of limb apraxia and of problems with coordination of fine hand movements does not exclude a PPA diagnosis. On the other hand, tremor and rigidity found in parkinsonian syndromes should not be present in the initial phases of the disease.

PPA staging criteria that account for language use have been developed (Sapolsky et al. 2014), but the degree of impact in everyday activities will vary, depending on the premorbid occupational and social activities of each patient. Many of them maintain an independent status and continue

working and driving for long periods after onset of language symptoms. This is possible due to relative preservation of time and space orientation, episodic memory, and executive functions.

In the following sections, we will introduce the main clinical, neuroimaging, and pathology symptoms of each of the three most common PPA variants: nonfluent/agrammatic (PPAANF), semantic (PPAS), and logopenic (PPAL). PPAS is marked by a profound semantic deterioration; PPAANF is characterized by a progressive breakdown of syntactic processing and/or planning of motor speech (speech apraxia), and PPAL affects phonological processing and verbal auditory short-term memory. Controversies and open questions for each variant will also be addressed.

## Characteristics of the Most Common PPA Variants

### Nonfluent/Agrammatic Variant of PPA (PPAANF)

In PPAANF, there is a gradual deterioration of the syntactic level of language, which is usually but not always accompanied by speech motor deficits. Those patients are nonfluent, that is, present reduced verbal output and effortful, slow, and hesitant speech.

In order to fulfill clinical diagnostic criteria, at least one of the two core characteristics must be present in language production: agrammatism (impairment in the production of grammatically correct sentences) and apraxia of speech (a disturbance in articulatory planning). Also, two out of three of the following features must be found: impaired comprehension of syntactically complex sentences, spared single-word comprehension, and spared object knowledge.

Agrammatism is a disorder involving syntactic and morphological levels of language, evidenced by three main features: omission or substitution of morphology, reduced variety of grammatical forms in sentence production, and slow rate of speech, even in patients without articulatory problems (Kolk 1998).

In PPAANF, morphology changes are characterized by gradual omission of verbs, function

words (i.e., prepositions, pronouns, conjunctions), and grammatical inflections. Frank grammatical errors may also be present (Gorno-Tempini et al. 2011; Ash et al. 2010). Sentence production is characterized by reduced frequency of grammatically complex structures (Ash et al. 2010), and oral and written discourse analyses evidence a higher number of declarative sentences with canonical word order.

Regarding rate of speech, PPAANF patients present less than one third the rate of elderly healthy individuals. The nature of this deficit has been debated, but a strong view is that effortful and nonfluent speech in this syndrome is more likely to be linked to grammatical processing deficits than to speech difficulties attributable to apraxia of speech (Rascovsky and Grossman 2013).

For the purpose of early clinical diagnosis, it is important to call attention to the insidious nature of PPA. Unlike vascular aphasia, the full clinical picture in all PPA syndromes may take some time to evolve. In very mild PPAANF patients, detecting agrammatism in spontaneous conversation may require careful qualitative analyses of recorded samples of oral output. The initial few grammatical errors may be more evident in tests of written production (Gorno-Tempini et al. 2011). As disease progresses, sentences tend to become simpler and shorter, and patients present with telegraphic speech.

Apraxia of speech is characterized by inconsistent speech sound errors (omissions, distortions, transpositions, insertions) due to a deficit in articulatory planning. Patients and close relatives may notice those speech difficulties and may refer to them as “stuttering.” Patients try to correct themselves, and hesitations and reformulations are common. There have been reports of patients who present progressive speech apraxia without aphasia symptoms and debates to whether those cases should be classified in the PPA spectrum (Josephs et al. 2014). However, although predominant apraxia of speech may occur in the initial phase, most cases present aphasia in the evolution. In addition, detailed analyses of speech revealed that PPAANF speech errors consist mostly of substitutions typical of phonological disorders

(language related) rather than sound distortions typical of apraxia of speech (Rascovsky and Grossman 2013; Ash et al. 2009).

Prosodic features of speech (intonation, stress, and duration of speech sounds and rhythm) are impaired in PPAANF (Ash et al. 2009, 2010), and this feature may be useful for distinguishing this PPA variant from PPAL (Henry and Gorno-Tempini 2010).

Comprehension of words, concepts, and simple sentences is spared in PPAANF. However, patients may encounter difficulties to process syntactically more complex sentences such as reversible passive constructions (“The dog was chased by the cat”). Sentence comprehension is more affected by grammatical complexity than by utterance length, what lends support to the syntactic nature of the deficits.

There is a considerable overlap between PPAANF and atypical parkinsonian syndromes. After some years of isolated language deficits, many PPAANF patients evolve with motor symptoms compatible with a diagnosis of corticobasal syndrome (CBS) and progressive supranuclear palsy (PSP) (Gorno-Tempini et al. 2011; Harciarek and Kertesz 2011).

Regarding neuroimaging findings, PPAANF clinical profile is associated to predominant left posterior fronto-insular atrophy on MRI or predominant left posterior fronto-insular hypoperfusion or hypometabolism on SPECT or PET (Gorno-Tempini et al. 2011). Tauopathies are the most common underlying cause of PPAANF but around a third of the cases present with AD pathology, and another small proportion of patients were reported to have ubiquitin-positive inclusions (Harciarek and Kertesz 2011; Rascovsky and Grossman 2013).

### **The Semantic Variant of PPA**

This variant has the most homogeneous clinical profile and is characterized by gradual deterioration of word and object meaning (semantic knowledge) with preservation of phonology and syntactic skills. This clinical picture contrasts with the early stages of probable Alzheimer’s disease characterized by a marked deficit in episodic memory and milder semantic deficits.

Impaired confrontation naming and single-word comprehension are the core features for clinical diagnosis along with three out of four of the following ones: impaired object knowledge, surface dyslexia or dysgraphia, spared repetition, and spared speech production (phonology, grammar, and motor speech) (Gorno-Tempini et al. 2011).

In spontaneous conversation, patients present fluent speech without phonological and morphosyntactic errors and anomia, evidenced by circumlocutory speech, semantic paraphasias, and use of generic or empty terms such as “everything” and “things.” Questioning the meaning of words (e.g., “what is giraffe?”) is a behavior not seen in the other PPA variants and that evidence the type of comprehension difficulty found in those patients (Kertesz et al. 2010). However, deficits may not always be clear in spontaneous conversation because patients benefit from contextual information to infer meanings.

PPAS patients are aware of symptoms in the early stages of the disease and mention difficulties in “remembering words” or sometimes “places” (actually in relating places’ names to their locations). In addition, some patients may have problems with face recognition (prosopagnosia) in early stages.

In naming tests, performance is dramatically impaired, and this contrasts with relatively good preservation of conversation skills. Different from other forms of PPA and from normal aging, PPAS patients refer they don’t know what is depicted on the pictures they are asked to name. Moreover, they rarely benefit from phonetic cues. When semantic knowledge is preserved (as in normal aging and in other PPA variants), giving the first syllable or phoneme of a word frequently helps individuals to retrieve a particular lexical item, whereas this is not significantly helpful to improve picture-naming performance of individuals with PPAS.

Retrieval of particular items in a given time (verbal fluency tests) is also markedly impaired. Some studies report patients find it harder to retrieve items from a semantic category (e.g., animals) compared to letters, but performance is

usually impaired in both tasks (Hodges and Patterson 2007; Carthery-Goulart et al. 2012).

In formal assessments of language comprehension, PPAS patients present worse performance for words than for sentences. This is an important feature to distinguish this variant from the other subtypes, but may not be evident in mild patients, unless sensitive neuropsychological tests are used. Verbal and nonverbal semantic association tests such as the Pyramids and Palm Trees test are frequently employed and show marked impairment. Auditory comprehension tests with several foils from the same semantic category are also recommended (e.g., asking patients to point “apple” in a set of eight fruits, as in the battery proposed by Hodges and colleagues) (Adlam et al. 2010).

On the other hand, PPAS performance is usually spared in sentence comprehension formal assessments. These tasks are designed to detect morphosyntactic problems and generally comprise simple and frequent lexical items. PPAS patients are able to use contextual cues and syntactic and problem-solving skills to choose the correct alternative.

PPAS patients generally present associative visual agnosia, that is, difficulties to recognize and assign meanings to objects, despite preservation of perceptual skills. In mild patients, difficulties are evidenced for low-frequency or low-familiarity items, becoming more severe as disease progresses.

Surface dyslexia and dysgraphia are common in PPAS. Oral reading and spelling are marked by regularization errors, that is, those patients tend to use rules for translating graphemes in phonemes and vice versa even in words with irregular or exception spelling.

Executive functioning and working memory are typically preserved, and these patients do not usually have problems to repeat verbatim long utterances and to solve nonverbal problems. Visuoperceptive skills and constructional praxis are also generally spared along with numerosity knowledge, calculations, and music knowledge (Rascovsky and Grossman 2013). The preservation of meaning in those categories, along with the reversal of the concreteness effect (abstract words

better understood than concrete ones) (Bonner et al. 2009), has been used to support the view that SD is not a universal semantic deficit but instead a problem of integrating visual features in the visual association cortex (Rascovsky and Grossman 2013).

However, the most accepted view is that the disease causes a breakdown in conceptual knowledge (Hodges and Patterson 2007), and the anterior temporal lobe is a “hub” for semantic processing. Supporting this view, patients have consistent errors across tasks using several input modalities. Thus, when a patient is not able to define “apple,” he will probably have difficulties with this same item in confrontation naming, in classification tasks, and in verbal and nonverbal semantic association tests.

The pattern of deficits in PPAS is not “all or nothing.” Semantic degradation is gradual and some semantic features may be initially retained. In the previous example, the patient may be able to define “apple” as “something we eat,” despite not being able to say it is a fruit and closest in meaning to “orange,” instead of “carrot.” In moderate to severe stages of the disease, conceptual information related to this item is gradually lost.

In the longitudinal course of the disease, PPAS patients develop behavioral and personality changes, predominantly eating disorders, aberrant motor behavior, and disinhibition (Rosen et al. 2006). Some of them evolve with motor neuron disease (Harciarek and Kertesz 2011; Hodges and Patterson 2007).

In MRI, PPAS patients present with bilateral anterior temporal lobe atrophy, usually greater in the left hemisphere. Prosopagnosia is usually associated to involvement of the right anterior temporal lobe (Snowden et al. 2004). SPECT or PET demonstrates predominant anterior temporal hypoperfusion or hypometabolism (Gorno-Tempini et al. 2011; Neary et al. 1998; Hodges et al. 1992). With regard to the underlying disease, 70% of the patients present tau-negative ubiquitin-positive pathology with TDP-43, 20% tau-positive Pick’s disease, and 10% AD pathology (Rascovsky and Grossman 2013; Hodges et al. 2010).

### PPA Logopenic Variant

This variant is characterized by a progressive deterioration of phonological lexical entries and of auditory verbal short-term memory, specifically the phonological loop component of the working memory model proposed by Baddeley and Hitch (1974).

The phonological loop is the cognitive mechanism that allows the temporary storage of verbal material for repetition and language comprehension and that also plays a crucial role in vocabulary acquisition during early language development. In cognitively healthy individuals, the phonological loop is susceptible to two types of interference: word length and phonological similarity, what means that in tasks of immediate recall of verbal materials (usually words and letter strings), a lower number of items is retained the longer and the more similar in sound those items are. The absence of one or both of those effects suggests a dysfunction of the phonological loop, and this is exactly what has been recently demonstrated for PPAL patients (Gorno-Tempini et al. 2008).

The core features of clinical PPAL are impaired single-word retrieval in spontaneous speech and naming and impaired repetition of sentences and phrases. Also, at least three out of the following four features must be present: phonological errors in spontaneous speech and naming, spared single-word comprehension and object knowledge, spared motor speech, and absence of frank agrammatism.

Although controversies persist regarding to whether PPAL should be considered a discrete variant (Sajjadi et al. 2012), PPAL clinical picture has been proven consistent in terms of unique language features and neuroimaging patterns. It is a rather common profile in some research groups, found in almost one third of PPA patients (Henry and Gorno-Tempini 2010). But classifying patients into this PPA subtype can be challenging since in some domains those individuals present with intermediate deficits compared to the other two PPA variants.

The term “logopenic” from Greek, meaning “lack of words” was used to define the verbal output features of those patients (Gorno-Tempini

et al. 2004, 2008). In spontaneous conversation, after an initial stage of mild anomia and word-finding difficulties, fluency becomes gradually reduced. But differently from PPAANF patients, PPAL verbal output comprises grammatically accurate utterances and no effort or dysprosodic features. Phonological paraphasias, when present, are well articulated and no phoneme distortions are observed. Those errors reflect failures in linguistic mechanisms (retrieval of incomplete phonological word forms from the lexicon) and/or working memory-related deficits (failure to maintain the phonological word form, while articulation motor programs are being planned and executed).

Slow rate speech and frequent long pauses due to word-finding problems are typical. Differently from PPAS, concept knowledge and word meaning are preserved. As disease progresses, however, deficits in semantic memory may be also present, but they are much milder from those seen in PPAS (Etcheverry et al. 2012).

In formal tests, PPAL patients evidence naming difficulties, but they are not as severe as in PPAS patients and consist of lexical retrieval problems (patients are generally able to provide definitions for the items and benefit from phonetic cues). Phonological paraphasias usually occur. Word comprehension and word repetition are generally spared.

Sentence comprehension and verbatim sentence repetition are impaired, and those failures are more related to the length of the utterances rather than to their grammatical complexity. In fact, for many patients, sentence comprehension is improved when items are written instead of spoken to them. In sentence repetition, patients demonstrate they have understood what was said, providing semantically appropriate versions of the original sentences but failing to repeat them verbatim (Henry and Gorno-Tempini 2010).

Phonological dyslexia has been reported in PPAL. This reading deficit is characterized by phonological errors and difficulties to read pseudowords due to disruption of grapho-phonemic conversion mechanisms, contrasting with the pattern presented by PPAS patients (Brambati et al. 2009).

Magnetic resonance imaging in PPAL predominantly show atrophy in the left posterior temporoparietal regions, and SPECT or PET shows predominant left posterior perisylvian or parietal hypoperfusion or hypometabolism. AD is the most common underlying pathology (Gorno-Tempini et al. 2011; Henry and Gorno-Tempini 2010).

Some risk factors have been associated to PPAL. Whereas learning disability is a common finding among PPA patients and their first-degree relatives, a recent study has demonstrated that a history of developmental dyslexia is more common among PPAL (Miller et al. 2013). In this group of patients, PPA symptoms may start earlier, and atrophy occurs in more defined regions in the posterior temporal regions.

## Treatment for PPA

The extensive progress in PPA diagnosis has led to a large number of patients in demand of treatment alternatives. In the absence of clearly effective pharmacological options, there has been an increasing interest in behavioral interventions, and literature on this topic has noticeably grown over the past 10 years (Croot et al. 2009; Carthery-Goulart et al. 2013).

Although highly controlled, randomized studies are still not available, a number of scientific reports of well-designed single-case investigations have revealed positive outcomes. Extensive generalization of the findings is not possible, but the consistent results of some types of interventions across studies increase their recommendation levels.

As PPA is a progressive disorder, not only therapies that achieve improvement of cognitive function but also those that demonstrate benefits at slowing the progression of deficits can be considered good treatment alternatives.

Interventions for speech and language deficits in PPA can be classified into two approaches: functional and impairment directed. Functional interventions focus on improvement of communicative skills and increasing/maintaining participation levels and are characterized by a more

ecological approach to deficits. Strategies include the implementation of environmental modifications and the use of several resources such as augmentative and alternative communication devices. The strong point of these proposals is that they focus on the patients' needs and try to establish a direct link between therapy practices and performance in daily routine tasks. Their weakness is the difficulty to achieve necessary experimental control to measure treatment effects.

Impairment-directed interventions, on the other hand, target specific speech and language deficits such as anomia, dysgraphia, or apraxia of speech and allow for a more controlled experimental setting. The need of detailed assessment to design personalized interventions directed to specific cognitive deficits is emphasized in many reports.

The majority of published interventions have been conducted with PPAS patients, were impairment directed, and targeted naming deficits. It has been shown consistently across a number of studies that PPAS patients are able to relearn target vocabulary during the active phase of treatment and to maintain gains above baseline levels for variable periods after ceasing intervention (Croot et al. 2009; Carthery-Goulart et al. 2013). However, generalization of learning to untrained stimuli and/or transference of therapy gains to different contexts have not often been achieved. This aspect should be a point of concern when selecting the set of stimuli to be trained and would also argue for the need of more context-based interventions. Recent studies have tried to fulfill this need by using personalized materials such as digital photos of individual household items (Savage et al. 2013) or training relevant activities for the patients, such as cooking (Bier et al. 2011).

It seems therapy benefits are maximized in PPAS if interventions start as early as possible in the presence of very mild semantic memory deficits and low levels of brain atrophy. Studies have shown that patients relearn significantly more items when they retain residual semantic knowledge about them (Jokel and Anderson 2012) and when they are able to link them to personal experience and context (Snowden and Neary 2002). A topic of debate is whether those learning

mechanisms rely on the relatively preserved episodic memory system involving the hippocampus and adjacent medial temporal lobe structures or if the anterior lobe neocortex also plays a role in those relearning mechanisms (Mayberry et al. 2011).

Other important issues have been investigated in PPAS patients. It has been shown that longer therapies are more effective in the maintenance of gains than shorter ones (Savage et al. 2013). Learning was achieved in PPAS patients after interventions of a single session, individual home practice, and computer-based therapies (a detailed description of the studies is available (Carthery-Goulart et al. 2013)). Individual home practice, especially aided by a computer (Bier et al. 2011), seems to be a very promising alternative both economically and also reducing caregivers' load. Nevertheless, all these issues need replication with a larger number of patients.

Fewer studies on behavioral treatments for PPAANF and PPAL have been published. In PPAANF, positive results in communication were shown with the use of augmentative and alternative communication devices, but some patients may show reluctance to use these tools (Croot et al. 2009; Carthery-Goulart et al. 2013). Impairment-directed interventions aimed at different aspects in PPAANF: agrammatism, phonological skills, apraxia of speech, and naming and lexical retrieval deficits. Differently from PPAS, most PPAANF patients are shown to present generalization of therapy gains to some extent, verified in untreated items (Schneider et al. 1996; Jokel et al. 2009), different tasks (Jokel et al. 2009), or functional communication.

PPAL is the variant with fewer intervention reports. Naming and lexical retrieval training resulted in significant improvement of these skills with generalization to untrained items (Newhart et al. 2009; Beeson et al. 2011) and also in conversation skills (Beeson et al. 2011). Active, errorful, and intensive treatment, involving problem-solving and generation of semantic information to facilitate lexical retrieval, has been suggested to help achieve those results, but more studies are necessary to confirm this hypothesis (Beeson et al. 2011).

Some case reports included functional MRI in order to understand the underlying brain plasticity mechanisms in PPA. These reports have suggested compensatory mechanisms through recruitment of cortical areas that are typically preserved for the specific PPA variant. Thus, behavioral treatment in PPAS has been shown to increase activation of the right superior and inferior temporal gyrus (Dressel et al. 2010). In PPAANF, Marcotte and Ansaldo (Marcotte and Ansaldo 2010) observed an expansion of networks involving semantic processing areas (i.e., left middle and superior temporal gyrus and inferior parietal lobe bilaterally). Finally, in PPAL, it has been suggested that behavioral improvements were supported by an increased reliance on the left prefrontal cortex during word retrieval, thus recruiting relatively unimpaired networks (Beeson et al. 2011).

In sum, cognitive rehabilitation is promising for PPA, but more research is needed to define the best types of interventions for each variant and stage of the disease, as well as their intensity, duration, and periodicity. Brain plasticity mechanisms also need further investigation in a larger number of patients. Controlled group studies comparing interventions to placebo treatments are a challenge in this field but may be achieved with research collaborations.

## Conclusions and Future Directions

PPA classification system has proven useful but a proportion of patients remain unclassified (Wicklund et al. 2004; Sajjadi et al. 2012). Moreover, patients classified in each of the three most common syndromes may have great variability. To solve these problems, more research is needed on the characterization of the stages of each variant along with sensitive and specific neuropsychological tools to detect mild deficits.

That being said, it is undeniable that the recent consensus has been helpful to establish international research collaborations and to improve communication among researchers in this field. It was an important step to advance in the search for treatment alternatives for those patients.

## Cross-References

- ▶ [Aging and Semantic Memory](#)
- ▶ [Behavioral and Psychological Symptoms of Dementia](#)
- ▶ [Language, Discourse Production and Communication](#)
- ▶ [Mental Health and Aging](#)

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## Prison Populations

Rebecca S. Allen, Keisha D. Carden and Karen L. Salekin

The University of Alabama, Tuscaloosa, AL, USA

### Synonyms

Incarcerated individuals; Prison inmates

### Definition

Though there has been lengthy debate, the majority of researchers, criminologists, and correctional experts agree that an “aging prisoner” is an individual of 50 years of age and older (Chettiar et al. 2012; Kerbs et al. 2015).

Over the past few decades in the USA, both federal and state prison populations have increased exponentially. The number of older adult prisoners has quadrupled in the past 25–30 years as a result of international demographic changes and increased sentence length in the USA, which incarcerates more individuals per capita than any other nation (Wilper et al. 2009). According to the Federal Bureau of Prisons, aging prisoners over the age of 50 account for 17.2% of the entire prison population in the USA. This number is expected to increase rapidly over the next 5 years and is projected to reach 33% (Chettiar et al. 2012).

This proliferation of aging prisoners carries serious financial implications as well as health and safety concerns during a period of diminishing federal and state resources. Prisons pay approximately \$5,000 in health care annually to support the average prisoner; however, this number nearly doubles for prisoners of age 50 and above and increases eightfold for prisoners approaching age 80. The American Civil Liberties Union (Chettiar et al. 2012) estimated that the overall cost of incarcerating the average individual was \$34,135, while it is \$68,270 for prisoners age 50 and above. Older prisoners require

significantly more health-care services, as well as frequent assistance with activities of daily living (i.e., eating, bathing, dressing, etc.). Further, aging prisoners suffer higher incidences of both mental disorders and physical diseases including major depression, post-traumatic stress disorder, cardiovascular disease, arthritis, respiratory disease, endocrine disorders, hypertension, HIV, AIDS, and hepatitis C (Kim and Peterson 2014; Loeb and AbuDagga 2006). Moreover, aging prisoners experience an “accelerated aging” phenomenon. Prisoners are more likely to be of low socioeconomic status and engage in unhealthy lifestyles prior to conviction, which is subsequently compounded by the trauma of incarceration and limited access to medical care. As a result, aging prisoners suffer from a higher rate of age-related declines and chronic pain than same-aged community peers (Kim and Peterson 2014). Wilper and colleagues (2009) found that many prisoners with serious chronic health conditions failed to receive adequate care. These authors defined “adequate care” as having access to five clinically meaningful treatments: (a) medical examinations, (b) pharmacotherapy, (c) prescription medications, (d) laboratory tests, and (e) acute care for serious injuries.

The majority of prisoners are convicted for petty crimes including nonviolent drug crimes, property crimes, petty theft, fraud, and public order and traffic violations. Current arrest rates for individuals at age 50 are 2% and 0% for those 65 and older (Kim and Peterson 2014). Aging prisoners are also far less likely to recidivate. Trends suggest that the percent likelihood of recidivating drops significantly at age 40 then falls to nearly zero approaching age 80. This is known as the “aging out” phenomenon.

In this entry, current issues pertinent to the international aging prisoner population are reviewed with a focus on the USA. Both physical and mental health needs and interventions (or lack of programs) to meet those needs within the US prison system are addressed. Specifically regarding physical health, prisoners’ desires regarding end-of-life care and medical treatment preferences as well as issues surrounding compassionate release and medical furlough

programs are examined. With regard to prisoners' mental health, the focus will be on the relation of spirituality and mental health needs as a variety of faith-based programs are typically available to prisoners within US prisons. Next, two current intervention programs, one to address physical health needs and one to address mental health needs within the prison system, are reviewed. The final substantive section of this entry will consider ethical issues such as international approaches to the death penalty and whether older prisoners with compromised cognitive capacity may be put to death without considerations of whether this may constitute cruel and unusual punishment. Finally, several directions for future research and treatment programs within the prison system are suggested.

### **Advance Care Planning and End of Life in Prisons**

With regard to the increasing population of aging prisoners, research has shown that the expectation of parole influences prisoners' end-of-life treatment preferences such that prisoners may prefer life-sustaining treatments if they believe they may live to be released from prison (Phillips et al. 2011). For example, Phillips and colleagues (2011) investigated life-sustaining treatment preferences and days of desired life within the context of varying chronic illnesses and physical disabilities among men in a medium security prison dedicated to the "aged and infirmed" in the Southeastern United States. In accordance with the demographics of the geographic area, most prisoners were non-Hispanic white (NHW) or African American (AA). These authors found that future days of desired life were related to prospective health condition, fear of death, negative affect, and trust in prison health care. Non-Hispanic white prisoners expressed a desire for more days of life out of prison, whereas minority prisoners did not differ in days of desired life either in or out of prison regardless of prospective health context. Minorities wanted more days of life than NHW prisoners regardless of prospective health context, but only if they believed that they would be paroled.

The findings of Phillips and colleagues can be used to understand the types of interventions that may be desired by older prisoners, with the ultimate goal of providing cost-effective quality care for older prisoners within the prison system. Specifically, negative affect and fear of dying may be ameliorated by greater accessibility within the prison system to prison-based hospice or palliative care programs that include prisoners serving as volunteers. The presence of prisoners acting as volunteers within chronic and palliative care clinics within the prison system may also partially ameliorate the lack of trust prisoners have in prison healthcare.

Given the aging demographic imperative and the enormity of the cost of caring for aging prisoners, creative solutions are warranted to provide quality of care that is in line with autonomous treatment preferences. In particular, alternatives to imprisonment for terminally ill prisoners, such as compassionate release and medical furlough programs, need to be further explored and more accessible (Loeb et al. 2007). Compassionate release, however, is rarely granted by state or federal courts within the USA. Medical furlough programs exist to provide terminally ill or disabled prisoners with an option for compassionate release. However, eligibility criteria for medical furlough are conservatively restrictive, excluding large groups of offenders (e.g., violent offenders). In Alabama, only three prisoners were released on medical furlough from 2001 to 2007 (Noonan 2010). Thus, it seems that very few ill prisoners may benefit from compassionate release and medical furlough programs within the USA, regardless of their age or health.

### **Mental Health**

A disconnect currently exists between adult developmental and aging research regarding increased reliance on religious/spiritual coping and the availability of such interventions within the correctional system. This is unfortunate given that a variety of faith-based programs are provided within the US prison system at low or no cost, and these programs could serve as feasible,

acceptable, and economical adjuncts to mental health treatment programs. Researchers have documented significant mental health problems among older prisoners in US prisons (Loeb and AbuDagga 2006; Wilper et al. 2009) and among those of other nations (Fazel and Grann 2002, 2004). Aday (2003) reviewed several US studies of older prisoners and noted that depression, guilt, worry, and psychological stress are common.

In their meta-analysis of religious coping practices and psychological adjustment to stress among community-dwelling adults, Ano and Vasconcelles (2005) reported that positive forms of religious coping are associated with positive psychological adjustment, whereas negative religious coping (e.g., spiritual discontent, passive religious deferral, reappraisal of God's powers, and punishing God reappraisal) results in negative emotional adjustment. Fernander and colleagues (2005) underscore the multivariate nature and varying patterns of association between religiosity/spirituality and offense history among adult male prisoners.

Allen and colleagues (2008) examined the relation of religiousness and spirituality to self-reported symptoms of depression, anxiety, and desire for hastened death among male prisoners in a medium security prison in the Southeastern United States. These authors found an association between more years of incarceration and lower self-reported forgiveness (i.e., forgives self, forgive others, and know that God forgives). Moreover, they reported that older male prisoners who reported feeling abandoned by God also reported more symptoms of depression and greater desire for hastened death, whereas those describing greater daily spiritual experiences reported fewer symptoms of depression and less desire for hastened death.

Allen and colleagues (2012) conducted a second study at the same prison to further explore the relations of religiousness/spirituality and physical and mental health. Specifically, it was thought that religiousness/spirituality would moderate the relations between physical and mental health, where the experience of high levels of positive religiousness and spirituality would reduce the negative impact of poor health on mental health. In this

second study, NHW and minority prisoners reported relatively high levels of organizational (e.g., attendance at religious services) and nonorganizational (e.g., praying or meditating) religious engagement within the prison system. Both positive and negative religious copings were related to report of depressive symptoms in the expected directions; however, contrary to expectations, neither type of religious coping strategy interacted with health. As expected, depression was also significant in the model for desire for hastened death, as was the interaction between negative religious coping and functional status. Prisoners' report of desire for hastened death was enhanced when they reported both physical limitation and greater use of negative religious coping. Descriptive information regarding functional limitations in this sample provides useful information for the design of religious coping and mindfulness-based interventions for use within an older male prisoner population (see section "[Current Interventions](#)" below).

As suggested in prior research (Randall and Bishop 2012), it could be that religiousness/spirituality exerts the most powerful influence not through individual experience but rather by enhancing social support among prisoners and improving positive psychological states. The particular impact of forgiveness and forgiveness therapy (Randall and Bishop 2012) as well as meditation programs such as vipassana or mindfulness (Perelman et al. 2012) as they relate to physical health-care costs, behavioral infractions, and positive emotional experiences should be investigated in future research (see section "[Current Interventions](#)" below). Practitioners in the area of corrections should investigate these ongoing therapeutic programs as models for potential implementation within their own facilities.

## Current Interventions

The rapidly increasing population of prisoners is heavily compounded by more frequent, longer, and more stringent sentences and institutions that are more restrictive on pardons, paroles, and compassionate release. Depleting federal and state

resources within the USA, growing proportion of aging individuals, and higher rates of poor mental and physical health outcomes highlight the need for comprehensive interventions that address these health, safety, and fiscal issues. Unfortunately, due to financial constraints, there are few comprehensive interventions being implemented currently in US prisons. There are, however, notable exceptions to this general trend.

Many aging prisoners are facing life sentences without the possibility for parole or have sentencing that will surpass their longevity. One case example of a comprehensive health intervention in the USA involves the Louisiana State Penitentiary (Angola). Angola is one of the largest maximum security prisons in the USA, housing over 5,000 prisoners with over 50% of them serving life sentences. Angola has implemented a program for its prisoners meeting the National Hospice and Palliative Care Organization criteria for community hospice programs. This hospice program is facilitated by trained prison staff and inmate volunteers. There is no independent or separate operating budget and no additional funded positions for this program. All training for staff and volunteers is provided by the local university hospice, and additional items (i.e., food/treats, toiletries, and religious items) are purchased through prisoner organizations and approved fundraisers or donated by community members. Prisoners' anxieties regarding imminent death are assuaged as they gain peace of mind knowing a hospice is available. Prisoners volunteering in prison hospice programs experience increases in self-esteem and knowledge. With the involvement of prisoners as volunteers in hospice programs, the overall trust in prison medical care is improved while the institution saves money. Programs such as Angola's address the multifaceted health issues within prison systems in the USA as the aging population in the correctional system increases.

With regard to low-cost programs that may have an impact on mental health, there is growing evidence that positive religious/spiritual coping practices or mindfulness-based religious practice helps prisoners cope with the prison experience (Chen et al. 2007; Perelman et al. 2012).

First, religious/spiritual coping and behaviors may reduce stress. Second, engagement in religious/spiritual behaviors may provide a social support network of like-minded persons, also contributing to the enhancement of psychological resources. The experience and expression of forgiveness may have particular salience in the prison setting (Randall and Bishop 2012).

In a maximum security prison in the Deep South, Perelman and colleagues (2012) examined the impact of 10-day vipassana silent meditation retreats in comparison with a mindfulness-based 10-week group intervention. They reported that, over the course of 1 year, prisoners in both groups reduced the number of behavioral infractions but only the vipassana group reported increased mindfulness and reduced mood disturbance. Neither group was found to have fewer health visits within the facility. Among male federal prisoners over the age of 50, 37% with a history of psychiatric treatment, approximately one-third claimed religion was their most important coping method and that lower levels of depression were associated with greater attendance at religious services and higher levels of intrinsic religiousness (Koenig 1995).

Prisoners are considered a vulnerable population internationally. Any intervention targeting physical or mental health must be approached with utmost care and attention to ethics in clinical health care and human subjects. Some ethical issues, however, have at their base policy issues or, potentially, political issues. Such is the case in consideration of death penalty cases, particularly within the context of diminished cognitive capacity or dementia.

### **Ethical Practice with Older Prisoners: Dementia and the Death Penalty**

The US Supreme Court has established that individuals who lack the capacity to understand the nature of their crimes cannot be put to death because such action would constitute cruel and unusual punishment. This applies to two specific categories of offenders, the intellectually disabled (formerly mentally retarded) and youthful

offenders under the age of 18 years. To date, however, the US Supreme Court has declined to hear any case that addresses the constitutionality of the death penalty for aged prisoners (Wood et al. 2014), though such a case was brought to the court in 2006 (i.e., *Allen v. Ornoski*). This case involved the potential execution of a 76-year-old, blind, diabetic, and disabled man; yet the high court cited the fact that this petitioner for a stay of execution was, at the time of the crime, culpable and therefore exempt from protections facing the death penalty. Wood and colleagues (2014) reported that although 14 countries have excluded older adults from a sentence of death, the US Supreme Court has declined to consider this issue. It is highly likely that the international aging demographic imperative coupled with the high cost of incarcerating older prisoners who are unlikely to offend again will bring the US Supreme Court's attention to this issue once again in the next decade. Psychologists may be asked to help the court through the preparation of amicus briefs reviewing issues of diminished capacity.

### Future Directions

This entry has presented information regarding current issues pertinent to the international aging prisoner population and addressed both physical and mental health needs and interventions (or lack of programs) to meet those needs. As per the authors' experience, the focus of the entry has been within the US prison system. It is noteworthy that, within such a cash-strapped system, interventions such as the Angola hospice program and the vipassana program have demonstrated positive results at low or no cost. Directions for future clinical and research efforts include translation of successful, low-cost interventions for greater implementation throughout the US-A. Volunteer efforts including hospice and palliative care or faith-based programs to meet mental health needs hold particular promise. Certainly, a focus on the aging prisoner population creates the need for certain modifications to accommodate changing physical, mental, and cognitive skills.

For example, the evidence-based religious/spiritual intervention, vipassana, reported by Perelman and colleagues (2012) assumes relative physical agility and stamina on the part of participants. Modifications would be necessary for older prisoners with arthritis or other functional limitations precluding the standard approach to meditation. Future research should focus on adaptations of evidence-based interventions such as vipassana for use by the burgeoning number of older prisoners. With regard to policy, the demographic imperative is likely to produce a resurgence of interest in compassionate release and medical furlough programs, particularly for prisoners of extreme age (80+) or with incapacitating chronic disease or functional limitations. Additionally, the US Supreme Court will likely consider the issue of death penalty sentences and cognitive incapacity in the coming decade. International attention to the issues faced by aging prisoners will facilitate a broad transformation that likely will create positive change for older inmates within prison systems.

### Cross-References

- ▶ [Distance-to-Death Research in Geropsychology](#)
- ▶ [End of Life Care](#)
- ▶ [Life Span Developmental Psychopathology](#)
- ▶ [Palliative Care](#)
- ▶ [Stress and Coping Theory in Geropsychology](#)

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## Proactivity and Aging at Work

Marilena Bertolino<sup>1</sup>, Hannes Zacher<sup>2</sup> and Dorien Kooij<sup>3</sup>

<sup>1</sup>Department of Psychology, University de Nice Sophia Antipolis, Nice, France

<sup>2</sup>Department of Psychology, University of Groningen, Groningen, The Netherlands

<sup>3</sup>Department of Human Resource Studies, Tilburg University, Tilburg, The Netherlands

## Synonyms

Action regulation; Personal initiative; Proactive behavior; Proactive personality

## Definition

Proactivity researchers distinguish between the concepts of proactive personality and proactive behavior (Crant 2000; Tornau and Frese 2013). Proactive personality was defined by Bateman and Crant (1993) as a relatively stable tendency to affect environmental changes. Individuals with high levels of proactive personality take action to influence their environments or “identify opportunities and act on them, show initiative, take action, and persevere until meaningful change occurs” (Crant 2000, p. 439). Behavioral expressions of proactivity constitute proactive behaviors, such as personal initiative, taking charge, expressing voice, and job crafting (Bindl and Parker 2011). Proactive personality has been linked to objective (salary and promotions) and

subjective (career satisfaction) indicators of career success (cf. Bertolino et al. 2011). Moreover, proactive personality has been shown to explain additional variance in career success even after accounting for other predictors such as demographics, motivation, type of organization, and type of industry (Bertolino et al. 2011). Proactive behavior has been shown to predict job performance above and beyond personality characteristics (Tornau and Frese 2013).

### Age and Proactive Personality

Age has been studied in relation to a variety of work outcomes, such as performance, organizational citizenship behavior, turnover, motivation, and job attitudes (Hertel and Zacher 2015). Although researchers have suggested that proactivity may change with age (Warr and Fay 2001) and that proactivity may contribute to successful aging at work (Zacher 2015a, b; Kooij 2015), only few studies have so far investigated links between age and proactivity at work (see Zacher and Kooij *in press*, for a review). Motivational characteristics of young and older employees may differ due to changes across the lifespan in certain individual differences (e.g., cognitive abilities), organizational rewards, and career situations (Kanfer and Ackerman 2004). Accordingly, while young individuals' goal orientations are more focused on growth, older individuals are more focused on maintenance (Ebner et al. 2006). Similarly, young adults are more likely to persist in optimizing performance, while older adults persist in minimizing losses (Freund 2006). This research on differences in the motivation of young and older workers suggests that proactivity may manifest differently in organizational settings and that the meaning of being "proactive" may be different for young and older workers. In other words, young and older employees may not necessarily differ in their overall levels of proactivity but might differ in the specific type of proactive behavior they engage in.

Zacher and Kooij (*in press*) conducted a systematic review and identified twelve studies (including two meta-analyses) investigating

associations between employee age and proactivity. In line with the literature on age stereotypes that associates lower motivation and flexibility with older employees (Posthuma and Campion 2009), a study showed that older employees are perceived to be lower in proactive personality than young employees, independent of rater age (Truxillo et al. 2012). These stereotypes are generally not confirmed by empirical data. Meta-analytic evidence showed that age was very weakly and not significantly correlated with proactive personality and taking charge, but it was positively (although weakly) correlated with personal initiative and voice (Thomas et al. 2010). Similar results were found in a subsequent meta-analysis (Tornau and Frese 2013). As noted by Zacher and Kooij (*in press*), the samples included in these meta-analyses were composed of relatively young and mid-career employees, which may have attenuated the relationship between age and proactivity. Zacher and Kooij (*in press*) further described the results of a number of studies examining the moderating effect of age on associations between proactivity and work outcomes. For example, in a sample composed of 252 government employees, Bertolino et al. (2011) showed that age acted as a moderator of the relationships between proactive personality and training motivation, perceived career development from training, and training behavioral intentions. Specifically, there was generally a more positive relationship between proactive personality and the outcomes for young employees than for older employees. These results suggest that young and older employees prioritize different outcomes: proactive young employees may be more interested in investing effort into career advancement, while proactive older employees may find more satisfaction in social activities such as mentoring or organizational citizenship behaviors (Bertolino et al. 2011).

In a sample of 182 job seekers aged between 43 and 77 years, age was negatively related to job search intensity, but no relationship was found with proactive personality (Zacher 2013). More specifically, the relationship between proactive personality and job search intensity was stronger

for relatively older job seekers compared to the relative younger job seekers, and job seekers' future time perspective mediated this relationship. In a replication study with mature job seekers (aged between 40 and 64 years), no relationship was found between proactive personality and age, but job search self-efficacy mediated the interactive effect of age and proactive personality on job search intensity (Zacher and Bock 2014).

In summary, on the one hand, results of meta-analyses do not support that older employees are less proactive than young employees, which is in contrast with research on age stereotypes (cf. Truxillo et al. 2012). On the other hand, studies indicate that proactive personality may play a more important role for young employees with regard to career-related outcomes and for older job seekers with regard to job search intensity.

### Age and Proactive Behavior

Studies on age-related differences in proactive behavior do not show differences between young and older employees in general, but there is some suggestion of differences between young and older women. Older women showed higher personal initiative (Warr and Fay 2001) and "on-the-job proactivity" (van Veldhoven and Dorenbosch 2008) in comparison with young women.

Proactive behavior has also been studied in the domain of organizational socialization and leadership. In samples of university faculty members and retail employees, a negative relationship was found between age and "indirect information seeking," a disadvantageous form of proactive newcomer behaviors (Finkelstein et al. 2003). In a study investigating proactive leadership behavior, older professors' behavior was perceived as less proactive compared to young professors' behavior but only when subordinates held negative age stereotypes (Zacher and Bal 2012). This result is consistent with research on negative older age stereotypes regarding proactive personality (Truxillo et al. 2012).

In summary, meta-analyses and single empirical studies agree on the fact that older employees do not show lower levels of proactive work and

"on-the-job behavior" than young employees. In contrast, there is some evidence that age stereotypes can have an influence on evaluations of proactive behavior of older employees.

### Lifespan Theories Linking Age and Proactivity

The lifespan developmental perspective focuses on "constancy and change in behavior throughout the life course" (Baltes 1987, p. 611) and is considered a useful base to understand aging at work (Hertel and Zacher 2015). According to this perspective, age-related changes can take different forms, such as growth, maintenance, and decline. Indeed, generally, physical abilities and fluid cognitive abilities tend to decrease with age, whereas crystallized cognitive abilities, some personality traits, and socioemotional abilities tend to improve with age (Kanfer and Ackerman 2004). Moreover, extrinsic motives (e.g., challenging work, advancement) decrease, and intrinsic motives (e.g., autonomy, accomplishment, helping colleagues) increase with age (Kooij et al. 2011). The occurrence of age-related losses requires adaptation; the use of proactive strategies may contribute to successful aging by facilitating such adaptation. Since losses outweigh gains with increasing age, strategies to deal with losses are considered particularly fruitful for older individuals (Baltes 1987).

According to the lifespan developmental perspective, intraindividual variability is an aspect which is influenced by the interplay between individual and contextual factors (Baltes 1987). Individual agency (including proactive behavior), which refers to having control over the environment and the self, is considered a relevant variable accounting for this plasticity in development. Indeed, research showed that older individuals that proactively chose an active lifestyle (intellectually, physically, and socially) can decelerate cognitive decline (Hertzog et al. 2009; Lindenberger 2014).

As noted by Zacher and Kooij (in press), the lifespan developmental perspective is composed of several sub-theories that are useful to

understand the role of proactive behavior during the aging process. All of these theories posit that individual agency is a key variable for human development and that proactivity plays a role for successful aging. Specifically, successful aging in the work context refers to the achievement or maintenance of favorable work outcomes (subjective and objective); it is assumed that proactive older employees and/or older employees engaging in proactive behaviors achieve or maintain more positive work outcomes compared to less proactive employees (Zacher and Kooij [in press](#)).

### **Selection, Optimization, and Compensation Model**

This model proposes that individuals engage in three types of proactive behavior that allow them to deal with age-related changes using their limited resources in beneficial way (Freund and Baltes 2000). The first strategy refers to selection and prioritization of goals that can be based on personal choices or due to the unavailability of goal-relevant resources. Optimization of goal-relevant resources is the second strategy and involves investing additional effort, participation in training and development, and seizing the right moment. The third strategy is compensation for losses and involves using other resources when previous resources are lost. These three strategies can be considered proactive behaviors because they are self-directed and future-oriented actions. Moreover, they have been found to be related to job performance and well-being, especially among older workers with high work demands (cf. Zacher and Kooij [in press](#)).

### **Socioemotional Selectivity Theory**

The theory of socioemotional selectivity (Carstensen et al. 1999) posits that the perceptions people have about time play a critical role in goal setting. Specifically, when time is perceived as unlimited, people are more inclined to choose career-focused objectives. Translated into an

organizational setting, young employees who perceive having more time remaining in their careers would be more interested in training and development activities, while older employees would have greater motivation for activities oriented toward helping others and maintaining relationships with colleagues. Research pointed out a negative correlation between age and future time perspective which, in turn, is associated with development goals (such as training and career) for young employees and with generativity goals (such as helping and mentoring) for older employees (cf. Zacher and Kooij [in press](#)). These goals, in turn, direct proactive behavior.

### **Strength and Vulnerability Integration Model**

This model developed by Charles (2010) is based on socioemotional selectivity theory and explains the role of age and perceptions of remaining time for emotion regulation. Emotion regulation strategies used for avoiding or limiting exposure to emotionally negative experiences, such as conflicts at work, are a form of proactive behavior. According to this model, the frequency and the use of attentional strategies, appraisals, and emotion regulation behaviors improve with age.

### **Motivational Theory of Lifespan Development**

This theory posits that people can use two types of proactive behavior in order to maintain high levels of control (Heckhausen et al. 2010). First, they can use primary control strategies to shape their environment consistent with their needs. Second, they can use secondary control strategies that imply changing goals in order to fit environmental demands. Similar to the selection, optimization, and compensation model, the motivational theory of lifespan development posits that individuals use primary and secondary control strategies including selection, pursuit, and disengagement to respond to age-related changes. With aging

the use of primary strategies decreases, while the secondary strategies are used more frequently.

### **Model of Preventive and Corrective Proactivity for Successful Aging**

According to this model, older adults develop resources and reduce stressors by engaging in preventive and corrective proactive behaviors (Kahana and Kahana 1996). Specifically, preventive behaviors refer to anticipating future stressors and minimizing them by engaging in health promotion activities or helping others or participating in social activities in order to enhance social resources. Corrective behaviors deal with extant stressors and may involve mobilizing social support and making environmental changes.

### **The Role of Job Crafting and I-Deals**

Lifespan theories and models underline the relevant role of individual agency for reaching developmental goals by maximizing gains and minimizing losses. Individual agency would activate proactive behaviors that, in turn, may lead to successful aging (cf. Zacher and Kooij *in press*). Selecting fewer goals, deciding on priorities, or regulating emotions is consistent with the notion of plasticity, which suggests that development is not predetermined but flexible and modifiable by proactive strategies (Zacher and Kooij *in press*).

In recent theoretical contributions, job crafting has been proposed to be a variable that may help older employees “to fit the characteristics of their job to age-related changes in their abilities and needs” (Zacher and Kooij *in press*). Indeed, job crafting is defined as a form of proactive behavior that changes the characteristics of the job (Wrzesniewski and Dutton 2001), and it is founded in the concept of person-job fit. Kooij et al. (2015) developed three types of job crafting that they consider potentially useful for older employees. *Accommodative crafting* indicates that older employees may delegate certain activities to other in order to compensate some limitations that come with aging. *Developmental*

*crafting* refers to engaging in behaviors with the objective to develop personal and professional growth. Finally, *utilization crafting* supposes the use of knowledge and skills by focusing on tasks that require readily available resources.

Like job crafting, the concept of negotiating idiosyncratic employment deals (I-deals) is seen as a form of proactive behavior. It refers to the possibility of making individualized work arrangements with one’s employer, thereby increasing older employees’ motivation and performance. According to Bal et al. (2012), flexibility and development I-deals are relevant for older employees because their needs and preferences tend to be more heterogeneous compared to young employees.

### **Toward an Expanded Theoretical Framework of Aging and Proactivity at Work**

Zacher and Kooij (*in press*) developed a theoretical framework of proactivity integrating age and age-related characteristics as predictors of cognitive-motivational and affective processes, and age-related characteristics as moderators of relationships between proactive behavior and work outcomes. The age-related person characteristics category is composed of a set of variables such as cognitive abilities, personality, emotional abilities, goal orientations, and health. Age-related changes in these characteristics influence cognitive-motivational processes in the sense that young employees strive for proactive development and career behaviors, and older employees prioritize on-the-job proactive behaviors such as personal initiative, voice, and generativity. Moreover, age may influence the contextual characteristics category composed of variables such as job characteristics, age stereotypes, organizational culture and climate, and work-family factors. Regarding job characteristics, the authors suppose that age-related increases in autonomy motivate older employees to show more proactive behaviors, including proactive compensatory and socioemotional behaviors, in comparison to young employees. Age-related

person and contextual characteristics are also proposed to moderate the positive associations between proactive behavior and worker outcomes, such as job performance and well-being. For example, age-related increases in negative age stereotypes may lower the positive influence of older employees' proactive behavior on other people's (e.g., supervisor, peers) evaluations of workers' outcomes. Moreover, due to age-related changes in emotional abilities, older employees are likely to react more negatively to proactive behaviors that elicit high-arousal emotions compared to young employees.

### Future Directions and Methodological Recommendations

As suggested by proactivity scholars, research should continue to investigate the role of age and lifespan development (Zacher and Kooij *in press*). In their review, Zacher and Kooij (*in press*) noted that, in organizational proactivity research, there is a lack of research regarding proactive socioemotional and compensatory behaviors that may help to better understand proactivity during the lifespan. Indeed, on the one hand, proactive socioemotional behaviors may lead to helping others and increase social resources. On the other hand, proactive compensatory behaviors could refer to role change and modification of goals in order to be closer to personal needs. Future research should consider tactics of proactive work behaviors that may occur over the lifespan. Indeed, Finkelstein et al. (2003) found that older employees engage less in indirect forms of proactive information seeking during the socialization process.

In their theoretical framework, Zacher and Kooij (*in press*) illustrate some age-related variables as mediators and moderators between age and proactive work behavior and work outcomes. For example, the authors suggest that future research should incorporate emotional, cognitive, and physical abilities, as well as stereotypes in studies on proactive personality. Moreover, the authors suggest including other outcomes besides occupational well-being and job performance, for

example, motivation to continue to work after the legal retirement age.

Regarding methodological recommendations on research linking aging and proactivity, Zacher and Kooij (*in press*) propose to include age-related mediators and moderators and to use longitudinal and cohort-sequential research designs. This would help to allow conclusions about age-related changes. The choice of the sample is also an important issue; for instance, it should be representative of all age groups (younger, mid-career, and older employees). Moreover, age has to be operationalized as a continuous variable, as creating age groups leads to a loss of statistical power. As young, mid-career, and older employees may differ in terms of proactivity, curvilinear relationships between age and proactivity should be examined as well. Finally, attention should be paid to time-related constructs such as organizational tenure and job tenure, as potentially control and moderating variables in the relationship between age, proactivity, and work outcomes.

### Practical Implications

Older employees are often victims of negative age stereotypes; indeed, they are perceived to be less proactive than young employees (e.g., Truxillo et al. 2012). Managers, decision-makers, and employees should be educated that older workers are not less proactive than young colleagues. They may be even more likely to engage in specific proactive behaviors, such as proactive socioemotional and strategic behaviors (Zacher and Kooij *in press*).

Special attention should be paid toward training design and career development activities in order to meet older employees' needs and preferences (Kooij and Zacher *in press*). Indeed, in most organizations, training and development activities are offered primarily to young people but very seldom to older employees. Managers should provide more opportunities for training and development to older employees, as this could be beneficial to them with regard to older employees' career-related proactive behaviors.

Studies have shown that older employees tend to engage more in proactive behaviors requiring socioemotional skills and social networks that help them compensate for potential age-related declines. In this line, organizations should support and encourage older workers to occupy roles having to do with mentoring, facilitating of knowledge transfer, and colleagues' supervision (cf. Zacher and Kooij *in press*). The adoption of these strategies would be beneficial for older employees and could improve their well-being and performance at work.

## Cross-References

- ▶ [Age Stereotypes in the Workplace](#)
- ▶ [Age-Related Changes in Abilities](#)
- ▶ [Motivational Theory of Lifespan Development](#)
- ▶ [Selection, Optimization, and Compensation at Work in Relation to Age](#)
- ▶ [Strength and Vulnerability Integration](#)
- ▶ [Training at Work and Aging](#)
- ▶ [Workplace Mentoring, Role of Age](#)

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## Problem Solving in Old Age

Christiane A. Hoppmann and Pavel Kozik  
 Department of Psychology, University of British  
 Columbia, Vancouver, BC, Canada

### Keywords

Coping; Decision-making; Everyday problem solving; Problem solving; Collaborative cognition

Problem solving involves the recognition that there is a discrepancy between one's current state and a desired end state as well as the strategies aimed at reducing this discrepancy (Marsiske and Margrett 2006).

At a very general level, problem solving represents the process by which an individual appraises and approaches problem (Marsiske and Margrett 2006). Problem solving thus involves various subcomponents including identifying specific characteristics of the problem at hand, making concrete plans, deciding on appropriate strategies, and engaging in behaviors that are aimed at reducing the discrepancy between current status and desired outcome (Marsiske and Margrett 2006). Hence, problem solving is a complex process that unfolds over time and that may have meaningful real-world implications.

There is a very large spectrum of problems that have been addressed in the adult developmental and aging literature. To illustrate, two hypothetical problem-solving scenarios are presented that are both relevant to older adults. *Scenario A:* Susan has been diagnosed with strep throat, a bacterial infection that is usually treated with antibiotics. What sounds like a straightforward problem actually involves many different steps: Susan is asked to report all medications she is currently taking plus any allergic reactions to antibiotics she might have had in the past; she then needs to locate a pharmacy to purchase her medication, review the medication leaflet, and finally take the medication as prescribed by her doctor for a period of one week. Problems such as this one are often referred to as instrumental problems and are unique in that they typically have a right or wrong answer. Older adults often struggle with well-structured instrumental problems to the extent that solving them is tied to basic cognitive abilities like memory, inductive reasoning, or perceptual speed, which are known to decline with aging (Diehl et al. 2005).

*Scenario B:* Helen has spent several weeks setting up a family brunch that is tentatively scheduled to take place in her home during the holidays. This task has required a great deal of effort, planning, and organization. Two days prior to the event her youngest son calls saying that the weather is projected to be warm, sunny, and beautiful and asks if instead of a brunch, she might prepare dinner, allowing the family to take a hike earlier in the day and enjoy the marvelous sunshine. Feeling upset but wanting to hide her feelings, Helen briskly says that she will call him back, takes a deep breath, and turns to her husband for comfort and advice. She is very irritated given the energy she has put into the family brunch, but she does not want to start a conflict because she knows that her son may very well be thinking about the overall family experience. Scenario B differs in many respects from Scenario A. It does not have an obvious right or wrong answer, is emotionally charged, and involves several other people. Hence there may be multiple problem-solving strategies Helen could choose from to

solve her problem. Helen's problem would be considered an ill-structured emotionally salient interpersonal problem, and past research has shown that older adults appraise and approach such problems in systematically different ways from young adults (Blanchard-Fields 2007). For example, older adults are more likely to tailor their problem-solving strategies to the problem context than young adults, and older adults also more readily combine different problem-solving strategies including instrumental and emotion regulation strategies, which ultimately render them more successful problem solvers than young adults. With such problem solving mobility, older adults might succeed where their younger counterparts may stumble (Berg et al. 1998; Blanchard-Fields 2007; Hoppmann and Blanchard-Fields 2010).

Taken together, these two problem scenarios illustrate that older adults may struggle solving one type of problem while potentially excelling on another. Older adults tend to do poorly on well-structured problems like the instrumental problem that Susan is confronted with in part because they are tied to fluid cognitive abilities. In contrast, older adults perform just as well or even better than young adults on ill-structured social problems like Helen's as long as the problem allows them to capitalize on their life experience and crystallized cognitive abilities.

Given the key role of socio-emotional factors in shaping how older adults appraise and approach complex everyday problems like the one described in Scenario B, an important recent extension of research has been to explicitly take into account the perspectives of multiple individuals that are involved in problem solving (Berg and Strough 2011; Berg and Upchurch 2007; Dixon 1999; Hoppmann and Gerstorf 2009). As described in Scenario B, Helen engages in a mixture of individual and collaborative problem-solving strategies. For example, she ends the call with her son to keep him from seeing how she is feeling (individual emotion-focused problem-solving strategy), and turns to her husband to help her come to grips with her negative emotions (collaborative emotion-focused problem-solving strategy) and/or assist her in coming up with a

joint action plan of how to proceed given the new circumstances (collaborative instrumental problem-solving strategy). For the purpose of this entry, the sample case of married couples will be used to illustrate how a dyadic perspective may extend an understanding of problem solving in old age. Even though the initial focus is on married couples, there are additional meaningful units that should be targeted in problem-solving research such as dyads of friends, siblings, or parents and their children (Berg and Strough 2011; Strough et al. 2008).

What makes problem solving among spouses so interesting to aging research? Many individuals identify their marriage as their most central relationship (Lang 2004). Furthermore, spouses typically are very close to each other, share many life experiences, have an in-depth knowledge of each other's strength and weaknesses, and live in the same environment (Hoppmann and Gerstorff 2009; Lang 2004; Meegan and Berg 2002). As such, spouses have a particularly high potential to notice when their spouse is confronted with a problem, to be impacted by one another's problems, and to directly involve each other in the problem-solving process. Typically, research on problem solving in older couples draws on findings coming out of two distinct research traditions. First, research examining problem solving in spouses conducted under a collaborative cognition perspective, which often uses experimental paradigms to compare collaborations among young versus older romantic partners or collaborations among spousal versus opposite-gender stranger dyads (Dixon and Gould 1998; Margrett and Marsiske 2002; Peter-Wight and Martin 2011; Rauers et al. 2011). Research emanating from this tradition provides encouraging news because it shows, for example, that older spouses are able to compensate for their own cognitive deficits by virtue of collaborating with their respective spouse and that this collaborative benefit is specific to collaborating with the spouse and not present when collaborating with a same age, opposite-gender stranger (Rauers et al. 2011).

Second, problem solving in older couples is informed by findings from the dyadic coping

literature, which uses a broad spectrum of different methods including experimental paradigms, repeated daily life assessments, and long-term longitudinal methods (Berg et al. 2011; DeLongis et al. 2004; Hoppmann and Gerstorff 2013; Michalowski et al. 2014). Of note, findings from daily life assessments demonstrate that collaborations between spouses can take many different forms and that they may come at a cost. For example, spousal collaborations can involve both strain and support, and they may be associated with increased negative effect for everyone involved (Berg et al. 2011; DeLongis et al. 2004; Hoppmann and Gerstorff 2013; Michalowski et al. 2014). Taken together, both streams of research point to the potential that older adults collaborating with their spouse may achieve together what may not be possible alone.

In trying to better understand how spouses may promote problem solving in old age, two different forms of collaborating are considered. First, spouses may *optimize* individual problem solving through the following potentially overlapping mechanisms: (a) Spouses may support each other's problem solving by establishing a positive emotional climate and by providing self-affirmation allowing their spouse to perform at their best (Fredrickson 2000; Murray et al. 2001). (b) Spouses may help reduce tension, anxiety, and nervousness, which are known to undermine optimal cognitive performance (Charles 2010). For example, older adults bringing a companion such as their spouse to a high-stake medical consultation may perform better on cognitively demanding tasks related to their medical condition than older adults without a companion (Ellingson 2002; Jansen et al. 2010; Wolff and Roter 2011). (c) Positive experiences with close others such as spouses may also counteract the vicious effect of aging stereotypes that undermine older adults' performance on a variety of difficult tasks (Abrams et al. 2006; Chasteen et al. 2012; Martens et al. 2006).

Second, spouses may get actively involved in each other's problem solving, which is particularly important when emotional and motivational support is no longer sufficient to *compensate* for

age-related resource losses (Baltes and Carstensen 1999). One key factor that has been shown to facilitate spousal collaborations concerns effective dyadic communication, in part because it allows older spouses to capitalize on their joint experience, knowledge, and expertise (Dixon and Gould 1998; Margrett and Marsiske 2002). Hence, effective communication may represent a pathway through which older couples may be able to collaboratively compensate for age-related resource losses. Another factor that has been shown to improve collaborative outcomes in older married couples relative to nominal pairs is a clear division of responsibility (Johansson et al. 2005). Furthermore, positive affective exchanges facilitate collaborative problem solving. For example, it has been shown that older spouses with high-affiliation exchanges achieve better performance outcomes on collaborative decision-making and errand-running tasks than spouses with low-affiliation exchanges (Story et al. 2007). Hence there are a number of potential mechanisms through which spouses may either create a context that optimizes individual problem solving or, if this no longer suffices, get directly involved thereby boosting joint problem-solving outcomes.

## Future Directions

Problem-solving research draws on a number of different approaches that make this literature rich, in hand with this go some challenges that ought to be addressed moving forward.

First, there is no established set of criteria to compare problem-solving effectiveness across studies, especially when it comes to ill-structured problems that have no right or wrong solution. This is concerning, because problem-solving effectiveness is central to almost all research on problem solving. So far, problem-solving effectiveness has been operationally defined using outcomes like the number of safe and effective solutions, self-reported problem-solving effectiveness, external judge ratings, or matches between goals and problem-solving strategies (Blanchard-Fields 2007; Thornton and Dumke 2005). It appears that

the field would greatly benefit if there were agreement on a coherent set of criteria that measure problem-solving effectiveness and that could be applied to different problem types and measures.

Second, experimental and daily life approaches to problem solving can be difficult to integrate because they target different pieces of the overall puzzle. On one hand, there is sophisticated *experimental* research focusing on different problem characteristics and how they are related to problem solving in young as compared to older adults (e.g., instrumental versus social; Blanchard-Fields 2007). On the other hand, there is *time-sampling* research showing that older adults tend to approach their problems in idiosyncratic ways based on their goals or certain personality characteristics (DeLongis and Holtzmann 2005; Hoppmann and Gerstorf 2013). Importantly, these person- and problem situation-focused perspectives are not mutually exclusive, but they are rarely investigated together (see Berg et al. 1998; Newth and DeLongis 2004 for an exception). To move the field forward, researchers might combine these different approaches. For example, one could ask older couples in the lab to work on well-structured instrumental and ill-structured social problems that could be solved individually or collaboratively. One might predict that collaborations are particularly beneficial for ill-structured social problems. A natural extension would then be to test if the respective lab findings have predictive validity for how the same couple approaches the problems they encounter as part of their everyday lives in their own environments.

Finally, problem solving does not take place in a social vacuum. As illustrated above, it may be fruitful to examine problem solving within the complexities of social relationships. Future research should advance knowledge by taking into account the perspectives of multiple individuals, by targeting the underlying mediating and moderating mechanisms as well as by examining the degree to which individuals of different ages benefit from collaborating with another person – be it one's romantic partner or someone else like a sibling or a friend.

## Conclusion

Problem solving is a diverse field that is informed by cognitive aging research as well as clinical psychological evidence. Importantly, age-related differences in problem solving depend on the type of problem that is considered. Further research needs to establish a sound way to measure problem-solving effectiveness across different problem types and age groups, more readily combine experimental methods and daily life approaches, and take into consideration the social resources that are provided by close others such as spouses.

## Cross-References

- ▶ [Cognition](#)
- ▶ [Cognitive Compensation](#)
- ▶ [Decision Making](#)
- ▶ [Everyday Cognition](#)
- ▶ [Social Cognition and Aging](#)

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## Problem-Solving Therapy

Sherry A. Beaudreau<sup>1,2,3</sup>, Christine E. Gould<sup>1,4</sup>, Erin Sakai<sup>5</sup> and J. W. Terri Huh<sup>5,6</sup>

<sup>1</sup>Department of Psychiatry and Behavioral Sciences, Stanford University School of Medicine, Stanford, CA, USA

<sup>2</sup>Sierra Pacific Mental Illness Research Education and Clinical Center, VA Palo Alto Health Care System, Palo Alto, CA, USA

<sup>3</sup>School of Psychology, The University of Queensland, Brisbane, QLD, Australia

<sup>4</sup>Geriatric Research, Education, and Clinical Center (GRECC), VA Palo Alto Health Care System, Palo Alto, CA, USA

<sup>5</sup>VA Palo Alto Health Care System, Palo Alto, CA, USA

<sup>6</sup>Stanford University School of Medicine, Stanford, CA, USA

## Synonyms

Behavioral intervention; Skills-based therapy; Treatment

## Definition

Problem-solving therapy (PST), developed by Nezu and colleagues, is a non-pharmacological, empirically supported cognitive-behavioral treatment (D'Zurilla and Nezu 2006; Nezu et al. 1989). The problem-solving framework draws from a stress-diathesis model, namely, that life stress interacts with an individual's predisposition toward developing a psychiatric disorder. The driving model behind PST posits that individuals who experience difficulty solving life's problems or coping with stressors of everyday living struggle with psychiatric symptoms more often than individuals considered as good problem solvers. This psychological treatment teaches a step-by-step approach to the process of identifying and implementing adaptive solutions for daily problems. By teaching individuals to solve their

problems more effectively and efficiently, this model assumes that their stress and related psychiatric symptoms will decrease. Older populations are suited to benefit from PST given support for its use for issues such as depression, stress associated with medical problems, or psychiatric issues in the context of cognitive impairment (Crabb and Areán 2015).

### Overview

PST has been used as a primary treatment modality for older adults, but can also be used as adjunct or “add-on” to an existing treatment. Similar to other cognitive-behavioral therapies, PST has been adapted into different versions of administration including manuals tailored to older adult populations with major depressive disorder, homebound elders with depression, and older primary care populations (Kiosses and Alexopoulos 2014). These various manual versions of PST strive to maintain the core features of the problem-solving model, which consist of teaching the steps toward solving a problem. This treatment has been applied to a multitude of young and old populations with medical, developmental, or psychiatric issues. PST appeals to providers working with older patients because of the versatility of the treatment and its flexibility in terms of the ability to deliver it in a limited number of sessions or shorter sessions (Lynch and Smoski 2009; Shah et al. 2012). Sessions range from as few as 4–12 or more, and session lengths generally last 30–60 min depending on the patient and his/her needs (Shah et al. 2012). PST has success in treating patients with cancer and has been delivered to older populations classified as having depressive disorders or those coping with other major life stressors, e.g., dementia family caregiver or hospice patients (Kiosses and Alexopoulos 2014; Nezu et al. 1998). Through teaching problem-solving skills, there is decreased reliance on specific cognitive abilities, such as executive function, compared with traditional cognitive-behavioral therapy (Simon et al. 2015). The decreased cognitive burden in PST has made this an attractive option for treating older individuals, particularly due to age-related reductions in cognitive performance and

increased risk of cognitive impairment with advanced age.

PST for depression often includes additional cognitive-behavioral techniques known to help depressed patients, such as behavioral activation, used to increase participation in pleasant activities. PST incorporates strategies to promote an individual’s ability to take a positive approach to solving problems, that is, an increase in optimism and viewing problems as challenges rather than insurmountable issues that cannot be overcome. Techniques to promote a positive orientation to problems include recognition and acknowledgment of one’s feelings when there is a problem; using negative emotion to alert oneself to the fact there is a problem to solve; and using techniques to enhance motivation, understand the problem, and even to rehearse how one will respond in a problematic situation (D’Zurilla and Nezu 2006; Nezu et al. 2007).

### Core Elements

The core elements of PST focus on identifying a problem and applying the steps of problem solving to a new problem during each session. This is typically delivered in an individual therapy context but can also be delivered in a group format. More recently, this treatment has been delivered by telephone and by live video chat technology (using the telephone or computer) with some preliminary success; however, in-person delivery constitutes the most common method of delivery with the most support (Kiosses and Alexopoulos 2014). PST teaches a methodical approach to solving everyday problems, which breaks the problem-solving process into distinct stages (D’Zurilla and Nezu 2006; Nezu et al. 2007). This allows the therapist to identify areas in which the patient might have difficulty problem solving and also ensures a measured, rather than a haphazard or avoidant, approach to the problem. Patients engage in the following steps during PST: (i) defining the problem and goals, (ii) brainstorming solutions, (iii) assessing the positives and negatives of each solution, (iv) deciding which solution to carry out and coming up with a plan to do it, (v) carrying out the solution, and (vi) assessing satisfaction with the outcome.

First, the patient defines the problem in specific terms. Therefore, a therapist would ask the patient to break down a broad problem into smaller problems. For example, the vague problem of “money trouble” distilled into several specific problems can include difficulty paying the rent, trouble affording holiday gifts for grandchildren, and challenges affording medication. Each of these issues would be treated as separate problems because each requires different solutions. After defining the problem, a specific goal would be stated. Obstacles to achieving this goal can also be documented and provide context to the problem. A goal that is specific and objective allows for an easy assessment of whether the goal was met. For instance, “pay the electricity bill” would be a specific and detailed goal and preferred over “increase income.” Older patients learn to simplify larger problems by asking themselves questions about the context and breaking the problem into smaller problems with manageable goals.

Next, the individual generates solutions to the problem. Given age-associated declines in executive functioning, this step can be challenging with some older adults, especially those who have issues with cognitive flexibility. Issues with executive functioning should not preclude use of this treatment approach given evidence that PST has been shown to work particularly well for older adults with executive dysfunction (refer to “[Cognitively Impaired Older Adults](#)”). Age-related or mild cognitive impairments including, but not limited to executive dysfunction, however, might require that the PST therapist spend more time reviewing some or all of the problem-solving steps. For improving a patient’s ability to generate solutions, experts recommend leading the patient through an exercise to demonstrate the brainstorming process with the most common exercise to generate as many uses as possible for a brick (D’Zurilla and Nezu 2006). Similarly, generating solutions requires that the older patient give as many goal-relevant solutions as possible and to hold off on weighing the positives and negatives until this step is completed. Therapists encourage the patient to give as many solutions as possible because the more solutions generated, the greater likelihood of finding an optimal solution or

solutions. Examples of possible solutions an older patient might give, relevant to the goal of paying the electricity bill, could include reducing electricity usage in order to lower the bill and make it feasible to pay, switching to energy saver bulbs, getting a part-time job to pay the bill, borrowing money from an adult child, and moving to a new place where the bill will be lower.

Next, in weighing the pros and cons of the solutions, the older adult might determine that while all solutions are possible, borrowing money is against their values and would put undue burden on someone else (i.e., their adult child). The anticipated effects of the solution on time, finances, friends, family, and other social contacts also factor into the consideration of these solutions. Keeping both the short-term and long-term goals in mind can be helpful in weighing these options. For example, getting a part-time job would help, but the older adult might have issues such as transportation or physical limitations that could make it hard to go back to work, making this a solution that will not work in the long term. The older adult might decide that a good short-term solution is to limit electrical use because they are only slightly short on their electricity payment each month.

After picking a solution based on the pros and cons, the patient next develops a plan of action to carry it out. For instance, the plan of action might include shutting off the lights when not in use, unplugging appliances not in use, and purchasing energy saver bulbs. Just as defining the problem is specific, so is the plan of action. In this example, the older patient’s plan of action might indicate how many and when new bulbs would be purchased as permitted by their budget, schedule checks of rooms to make sure all lights or unused appliances are off or unplugged, and leaving reminder notes in each room to shut off the lights.

The final step in this process involves evaluating how the plan went. If the patient expresses full satisfaction with the outcome, the patient takes stock in their success and rewards him or herself for a job well done. The therapist then guides the patient through a new problem. If the patient reports only partial satisfaction with the outcome,

he or she may wish to revisit the problem or a different aspect of the problem that week. Sometimes, patients discover new facts about the problem that will help to redefine the problem and goals, generate new solutions, and implement a plan that is now more likely to address the issue. In this example, the patient might discover that forgetting to shut off lights accounts for more energy usage than originally thought and remembering to shut off the lights, alone, would make up the difference in what they have been unable to pay in their monthly energy bill. An unanticipated obstacle could be the problem of forgetting to turn off the lights despite a desire to do so. This new information would guide the patient's process in working through the issue. The following case example describes how these steps might be applied in an older adult seeking treatment for depression.

#### Case Example

Mr. Z, an 82-year-old male, lives alone in an apartment at a senior living complex. He has no history of treatment for a psychological problem. His primary care physician, to whom the patient reported feeling sad and lonely and sometimes having difficulty with concentration and memory, referred him for outpatient treatment. During his visit with the geropsychologist, Mr. Z also describes having pain and sleep difficulties. Before his wife's death 2 years earlier, he often danced and attended social events at the local Senior Center. Since her death, however, he indicates he is no longer interested in these activities and spends most of his time in his apartment. He has three children with whom he has cordial, but not close, relationships.

At the onset of therapy, Mr. Z's therapist works with him to identify and define the problem for treatment. Mr. Z initially states that his problem is "loneliness." More specifically, he describes his problem as "my social network is too small." He states that his goals are to "meet more people in my apartment complex" and "improve my relationship with my children." He decides to focus on the former goal in order

to gain confidence before moving to the goal with higher stakes. Mr. Z initially has difficulty developing solutions to reach his goal, but lists the following: (1) say "hi" to people when passing them in the halls, (2) knock on neighbors' doors and introduce himself, (3) sit in the lobby of his complex (instead of in his room), (4) make dinner for his neighbors and invite them over, (5) attend programs offered at the complex, and (6) join a conversation with the ladies who sit near the complex's pool.

After developing solutions, Mr. Z and his therapist evaluate the extent to which the solution meets long- and short-term goals, impact, and feasibility for each of the solutions. For example, when Mr. Z examines the solution to make dinner for his neighbors, he notes that it is consistent with his short- and long-term goals and could be a positive way for Mr. Z and his neighbors to get to know each other. Nevertheless, he also recognizes that this requires buying food (expense), preparing the meal (time), and cleaning his apartment (energy and motivation). When comparing the alternative solutions, he considers all the pros and cons and decides that this solution is less feasible than some of the others. In discussing with his therapist, Mr. Z modifies this solution to make it more feasible. He decides to bake brownies and share them with people in his complex. He states that this is cheaper, requires less time and energy, and is enjoyable for him.

Mr. Z lists steps to implement this solution including (1) going to the grocery to buy ingredients, (2) baking the brownies, and (3) taking the brownies to his neighbors. He and his therapist then identify potential obstacles. He describes (1) lacking motivation to go to the store, (2) forgetting to go to the store, and (3) forgetting what ingredients he needs. He plans to make a list of the ingredients and go to the grocery store immediately after his session.

At the next session, the therapist reviews Mr. Z's satisfaction with the outcome and he reports that his neighbors enjoyed the brownies he baked. He observes that they greeted and started conversations with him

more frequently. He reflects that identifying obstacles increased the likelihood of him completing the task and confirmed improved mood. He continues to work on different problems, many of which focus on increasing his social engagement. After completing ten sessions with his therapist, Mr. Z reports minimal depressive symptoms, optimism for the future, and greater confidence in his ability to overcome future problems.

As illustrated in this example with Mr. Z, PST does not necessarily target depressive symptoms per se in an older adult with depression, but rather the patient works on an everyday problem that could maintain or could cause depression (i.e., isolation). This same principle would apply to other psychiatric symptoms or issues, such as anxiety, in which the patient's identified problems but not psychiatric symptoms per se constitute the primary target of treatment. An exception to this rule is when a problem-focused approach will not remediate an issue. In this case, switching to an emotion-focused approach (e.g., one in which the patient generates solutions to address the goal of coping with an unchangeable situation) is appropriate. Though these problem-solving steps are applicable to persons of all ages, the context of the older adults' problems typically differs from the context of these problems in younger individuals (Knight 2009). Specifically, older adults are more likely to have medical and psychiatric comorbidity, different life experiences, and different current life stressors than a younger person.

### **The Evolution of PST as a Clinical Approach**

PST has a long history of support for use in both clinical and nonclinical populations and individuals of all ages (D'Zurilla and Nezu 2006). Creativity research findings first informed the development of a problem-solving model. A 1950 presidential address to the American Psychological Association called for more research in the area of creativity, proposing that that problem solving utilizes novel steps and creativity to identify solutions. Around that same time, an advertising executive developed one of the earliest PST programs called "Creative Problem-Solving

Program," which used brainstorming techniques to stimulate creative performance. Later, its focus expanded to social competence as a way to enhance patients' problem-solving abilities and their confidence in their ability to manage problems.

Amidst the backdrop of growing interest in creative problem-solving and social competence, the 1970s witnessed a paradigm shift among clinicians who questioned the prevailing medical model of psychiatric illness as a disease. These clinicians favored a positive approach targeting the underlying reasons for maladaptive behaviors. This new approach focused on the association between psychiatric disorders and low social competence. The hypothesis that low social competence reflects an inability to cope with problems effectively or appropriately, resulting in psychological problems, garnered empirical support. This new outlook in PST and other treatments that emerged at the time gave a positive outlook on an individual's ability to learn to function better in spite of preexisting psychiatric issues. Early interventions within the positive approach framework utilized behavioral methods (e.g., modeling, behavioral rehearsal) for specific problematic situations. Subsequent recognition of cognition as a mediator for self-control and utilization of cognitive approaches (e.g., cognitive appraisals) allowed for generalization beyond specific problematic situations to beliefs and attitudes within the context of PST. These cognitive approaches were particularly influenced by Lazarus's relational theory of stress (Lazarus and Folkman 1984).

### **Relational Problem-Solving Model**

The primary model for PST is a relational problem-solving model of stress (D'Zurilla and Nezu 2006). This model is grounded in the relational model of stress (Lazarus and Folkman 1984) and social problem-solving model (D'Zurilla and Nezu 2006). In the relational model of stress, theorists posit that stress is a relationship between the individual and their environment. Stress arises when demands surpass an individual's coping resources and results in harm to the individual's well-being. In the relational

model of stress, problem-solving goals only apply when a person can change the environment; thus, problem solving will be ineffective when the environment or situation is unchangeable (D’Zurilla and Nezu 2006). For instance, in the previous case example, the older patient had control over the amount of time he spent socializing. If the problem in that example had been to walk better, but the older person had a medical issue causing a slow but inevitable decline in the function, focusing on ways to improve walking would be ineffective according to the relational problem-solving model. In contrast with this view that problem solving is ineffective for unchangeable problems, social problem-solving theorists believe that problem solving can in fact be used if the situation cannot be changed. In these cases, emotion-focused goals or a combination of emotion-focused and problem-focused goals is the target of problem solving. That is, if the situation cannot be changed, then the problem solving could focus on reducing distress (emotion-focused goal). Thus, a social problem-solving therapist might work with the older patient on problem-solving ways to address negative feelings and improve coping with losing physical functioning.

Three components of the relational problem-solving model, namely, stressful life events, problem-solving coping, and well-being, interact dynamically with one another. Stressful life events may be major negative events, such as notable occurrences like the death of loved one or daily problems that are time limited or ongoing situations. A major negative event may exacerbate the effects of daily problems on well-being, and compounding daily problems may precipitate a major negative event (e.g., illness, divorce). Research findings suggest that frequent daily problems lead to diminished psychological and physical well-being (D’Zurilla and Nezu 2006). The relational problem-solving model focuses on coping with daily problems, which in turn can be a problem-focused and emotion-focused goal.

Ineffective problem-solving coping also amplifies negative outcomes on well-being. Ineffective problem solving could be a function of difficulty with problem-solving skills or a

negative orientation to the problem, as discussed below. Additionally, extreme levels of stress may impede problem solving, thus adversely affecting well-being. The reciprocal relationships between the components of relational problem solving provide a strong foundation for PST with multiple targets in treatment (i.e., both emotion-focused and problem-focused goals).

### **Orientations/Styles, Use of Social Problem-Solving Scale in older Adults**

The PST model presupposes two possible orientations to a problem and several problem-solving approaches that either increase or decrease the likelihood of successful outcomes. These orientations and approaches are relevant to adults of all ages. Orientations to a problem are simply positive or negative (D’Zurilla and Nezu 2006). Those with a positive orientation express optimism about their problems and feel their problems can be overcome. In contrast, individuals with a negative orientation expect the worst, feel hopeless, and feel that nothing they can do will fix their current predicament. Teaching patients with a negative orientation to problems to adopt a more positive orientation is essential for effective use of the problem-solving skills. In other words, patients who do not believe they can overcome a problem are not expected to succeed if they feel they are on the path to failure. For this reason, some versions of PST incorporate motivational exercises to increase receptivity and positive feelings toward the ability to address one’s problems. These exercises sometimes occur during discussion of the PST model, which can explicitly describe optimism toward the current predicament as a key ingredient for improvement in treatment. Some versions of PST built in exercises in order to motivate patients, such as visualizing the outcome if the problem were solved.

In addition to the two orientations, several problem-solving styles are also the focus, namely: impulsive, avoidant, and rational styles. The impulsive problem solver reacts rashly without careful planning of how to approach a problem. This style is often associated with a poor outcome in solving the problem. The avoidant style fits with classic procrastination, where an individual finds that

solving the problem is so overwhelming that they avoid trying to solve the problem at all. The outcome is also poor in that the problem often becomes worse. The ideal style would be the rational problem solver who systematically finds out the information needed to plan an effective solution to address their problem. The combined positive orientation, coupled with rational problem solving, is what patients aspire to achieve, with acknowledgment that these different styles and orientations can vary in the same individual in different situations. Situations that are stressful are more likely to be associated with more maladaptive orientations and styles than less stressful ones.

Therapists in clinical research settings, but sometimes those in clinical settings, assess a patient's problem-solving ability at the start of treatment in order to determine which specific abilities will need the most work. The most popular measure of problem-solving orientation and style is the Social Problem Solving Inventory-Revised (SPSI-R) (D'Zurilla et al. 2002). This scale has both a long form and a short form. The long form provides subscales that correspond with the different steps of problem solving taught in treatment and the positive and negative orientations. The short form has fewer subscales but still provides useful information about an individual's self-rating of their rational problem-solving skills. The SPSI has norms for individuals young (17–39 years old), middle aged (40–55 years old), and elderly (60–80 years old); thus, a benefit of this measure is that older adult norms exist. Comparing individuals' scores with SPSI norms indicate if problem-solving ability corresponds to below, at, or above the average responses for that age group.

### **Evidence in Older Adults**

PST has gained additional popularity beyond its application to psychiatric populations to include medical patients, particularly patients with cancer who experience substantial psychosocial changes (Shah et al. 2012). Patients with cancer, who also tend to be older adults, face multiple challenges including adaptation to physical and biological changes during cancer treatment. Cancer can also affect outlook on life, strain social relationships, and lead to instrumental challenges to

functioning (e.g., difficulty with driving or bathing). A problem-solving approach with patients of this ilk bolsters coping efforts and can be offered in an individual or group format. The issues encountered by cancer patients share similarities with those issues encountered by other older medical populations. As such, it makes sense that PST has also been used to treat depression in frail older adults (Kiosses and Alexopoulos 2014), to prevent Generalized Anxiety Disorder in stroke patients (Mikami et al. 2014), general primary care populations (Kiosses and Alexopoulos 2014), older adults with diabetes (Crabb and Areán 2015), and family caregivers of loved ones with dementia (Zarit 1996). Successful outcomes of PST in these various older adult populations include reduced depressive symptoms and increased physical function (Kiosses and Alexopoulos 2014), decreased risk of developing GAD (Mikami et al. 2014), and reduced behavioral and psychological symptoms in persons with dementia or decreased negative feelings of dementia family caregivers (Zarit 1996). Other reported successful outcomes in populations of depressed older adults include improved quality of life and reduced disability-mediating reductions in depressive symptoms, but no supported improvements in various physical outcomes (e.g., weakness, weight loss, fatigue, and exhaustion) for frail elders (Kiosses and Alexopoulos 2014). The efficacy of PST has support when compared with active comparator interventions, including supportive or reminiscence therapies (Kiosses and Alexopoulos 2014). A large randomized control trial, problem-solving therapy versus cognitive restructuring of medically ill seniors with depression (PROMIS-D), will examine whether PST demonstrates an advantage beyond those obtained with cognitive-behavioral therapy in Australian older adults with multimorbidity (Sharpe et al. 2012). Data collection for PROMIS-D is underway (no data available at this time). Another randomized control trial, the Program to Encourage Active, Rewarding Lives for Seniors (PEARLS), targeted depression and health-associated quality of life using PST for older individuals receiving home-based primary care services (Ciechanowski et al. 2004).

PEARLS findings suggested superior effectiveness for PST compared with usual care for depressive symptoms and functional well-being.

In addition to the benefits of PST when delivered as the primary intervention for older patients or their caregivers, it has support for use as a step or adjunct to treatment. The large-scale study, Improving Mood—Promoting Access to Collaborative Treatment (IMPACT), demonstrated that brief PST delivered to older primary care patients with depression within 4 to 8 sessions in an integrative or collaborative care setting exceeded benefits of usual care in community settings in terms of depression-free days (Areán et al. 2008; Alexopoulos et al. 2005). An additional benefit of PST in the IMPACT study along with its effectiveness for treating depression was improved access to care (Simon et al. 2015). While most of the benefits of PST are focused on older individuals with depression or medical morbidity, the benefits also extend to persons with cognitive impairment.

### **Cognitively Impaired Older Adults**

In the past decade, more attention has been placed on adapting PST and other psychotherapies to treat the contextually different circumstances which older adults may inhabit. For example, the likelihood of having comorbid cognitive impairment and psychiatric conditions such as depression and anxiety may increase with age. Although cognitive impairments are also seen in younger cohorts with depression or anxiety, there are additional factors that may have a larger impact on older adults with comorbid psychiatric conditions and cognitive impairment, which need to be considered and understood with respect to treatment. Older adults may experience greater disability due to these comorbid conditions than younger populations, which may further aggravate depression and anxiety symptoms. Cognitive impairments can also impact treatment receptivity and engagement in and response to treatments (both pharmacological and non-pharmacological) in all age groups.

PST can be particularly helpful in treating older adults with psychiatric conditions and cognitive impairment and more specifically executive dysfunction (Alexopoulos et al. 2005). As older adults age, there are concomitant

pathophysiological changes in the brain that can impact executive functions such as shifting attention, initiating and inhibiting responses, and processing abstract concepts (Areán and Huh 2006), which may contribute to reduced problem-solving ability. These cognitive functions may become further affected with depression and anxiety in the picture. There are many aspects of PST content that allow for less reliance on executive function abilities, which can make this therapy particularly helpful for older adults with executive dysfunction. PST has been shown to lead to better treatment response than supportive therapy due to the acquisition of problem-solving skills related to the executive function impairments of planning and initiation (Alexopoulos et al. 2005). If modifications are needed for cognitively impaired individuals, these modifications are not made on the content but instead on the process and manner in which PST steps are presented, in order to accommodate different cognitive patterns of impairment (e.g., greater repetition of PST concepts or skills in older adults with memory difficulties to facilitate learning). As previously discussed, there are different versions of PST that have been developed for administration in different settings, some of which may be appropriate versions to use to address varying cognitive abilities in older adults with depression or anxiety.

Several process modifications in the delivery of PST can accommodate specific cognitive impairments (Areán and Huh 2006). If an older individual has a noted problem in cognitive tasks that involve sequencing and this ability seems to be impacting his or her ability to benefit from PST, it may be more helpful to apply a version of PST in a step-wise and progressive manner, in which the older adult must master one problem-solving step before moving on to the next step. In addition, there are modifications to help older adults with executive dysfunction, particularly difficulty processing abstract concepts. Although D’Zurilla and Nezu (2006) underscored the importance of mastering problem orientation in younger cohorts in order for PST to be successful, a focus on problem orientation may impede implementation of PST in older adults who have difficulty processing abstract concepts. For example, the ability to understand

one's problem orientation entails understanding of abstract concepts such as self-worth, perceptions about oneself or others' views, and how these views may impact mood and the individual's skills for solving problems. For older adults who have difficulty with abstractions, it may be more helpful to provide education about problem orientations in the moment as the patient brings up negative thoughts about a problem rather than discussing problem orientation in the abstract. Finally, some aspects of PST patient forms have been simplified for older adults with difficulty organizing sections with more information and text than their cognitive capacity can allow.

### Conclusions

The versatility of PST in terms of delivery and number of sessions makes it a useful treatment in the context of diverse challenges, psychiatric issues, and comorbidities that arise in many older patients. This approach has empirical support for its effectiveness and efficacy for use in older adults in the community, primary care settings, and home-based settings for use in-person or with technological delivery. It can be used as a primary treatment, adjunctive approach, or as a preventative intervention in group or individual settings. While most evidence has focused on depression, continued development of this approach to address anxiety or to treat mental health symptoms in patients with frank cognitive impairment, such as mild neurocognitive disorders or dementias, is a promising direction for expanding PST's application.

### Cross-References

- ▶ [Anxiety Disorders in Later Life](#)
- ▶ [Cognitive Behavioural Therapy](#)
- ▶ [Comorbidity](#)

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## Process and Systems Views of Aging and Memory

Daniel Zimprich<sup>1</sup> and Tanja Kurtz<sup>2</sup>

<sup>1</sup>Department of Psychology, Ulm University, Ulm, Baden-Württemberg, Germany

<sup>2</sup>University of Mainz, Mainz, Germany

### Synonyms

Forgetting; Learning

### Definition

Memory is the explicit or implicit recall of information encoded in the recent or distant past. Depending on the type of information recalled, memory involves different memory systems. Memory can be divided into primary (short-term) and secondary (long-term) memory. Long-term memory in turn may refer to declarative or nondeclarative memory. Nondeclarative memory describes unconscious remembering, whereas declarative memory describes conscious remembering. Memory systems incorporate different

memory processes. These processes comprise, for instance, encoding, retention, and retrieval. With a grain of salt, memory systems can be described as the “hardware” of memory, whereas memory processes can be seen as the “software” of memory.

The expectation of an age-related decline in memory belongs to the most common beliefs about aging (Ryan 1992). Indeed, there are studies showing that, on average, memory declines in older age (see Kausler 1994 for a review). As will be discussed in this entry, such decline may refer to different memory systems differentially. Following this, in order to understand aging and memory from a process and systems view, it is necessary to describe memory and aging on a fine-grained level: What kind of memory system is the target memory system of the investigation? Moreover, due to different processes of different memory systems, it is necessary to be precise regarding age-related effects in a memory system and the corresponding memory process. Taking into account different memory processes is in particular relevant for discussing the issue on possible influences of age-related differences in memory systems.

Note that we will address these issues regarding normal aging and with a focus on episodic memory due to its relevance for research on memory and aging. Moreover, most of the research presented in the following has utilized, an average-based approach, meaning that “average” younger adults are compared “average” older adults regarding different memory systems. Limitations and possible extensions of this approach with respect to implications for cognitive aging research will be addressed in the concluding remarks of this chapter.

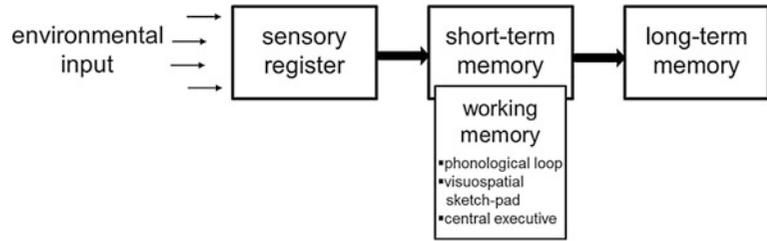
### Memory Systems

Memory may refer to different memory systems. Broadly, primary memory (PM) is distinguished from secondary memory (SM). Whereas primary memory describes short-term remembering, secondary or long-term memory covers all aspects of long-term remembering. This systems view of memory is also known as the “modal view”

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The order of authors is random; both have contributed equally.

**Process and Systems Views of Aging and Memory,**  
**Fig. 1** Memory systems



(Shiffrin and Atkinson 1969). In line with the modal view (Shiffrin and Atkinson 1969), information (regardless of what type of information) is first registered in the sensory register and subsequently, information enters short-term memory (PM). After successful registration and transformation of information, information is transferred to long-term memory (see Fig. 1). With respect to aging, each memory system shows differential age-related effects.

### Short-Term Memory (PM)

Short-term memory is employed, for example, in tasks asking participants to recall the serial position of eight numbers that were presented in advance. Baddeley (1992) suggested that short-term memory may be more than a simple buffer, but rather consist of a complex memory system covering the holding and manipulation of information over a short-term interval. The model of working memory incorporates three distinct processes: phonological loop, visual sketchpad, and central executive. Briefly, the phonological loop describes the maintenance of phonetic information, whereas the visual sketchpad describes the maintenance of visual information. The central executive coordinates the phonological loop and the visual sketchpad and thus the active holding and maintenance of both types of inputs. Depending on whether information is maintained successfully in working memory, the information enters long-term memory.

Whereas age-related differences are small in short-term memory (cf. Grady and Craik 2000), there are findings suggesting that there are more pronounced age-related differences in working memory (see Hasher and Zacks 1988 for a review). While the term short-term memory refers to the capacity for holding a small amount of

information ( $7 \pm 2$  elements according to Miller's famous "magical number seven") active across a few seconds, working memory refers to the structures used for the processing of information in short-term memory, thus extending the idea of a relatively passive short-term memory store by the active processes of manipulating information in different but interacting subsystems of short-term memory. Overall, research shows that, on average, older persons show lower working memory abilities. Possible explanations for this age-related effect may be, for example, a deficit in cognitive inhibition in older adults (Hasher and Zacks 1988). Cognitive inhibition is relevant for working memory performance, because irrelevant in contrast to relevant information has to be suppressed—otherwise it would occupy valuable working memory space and processing resources.

### Long-Term Memory (SM)

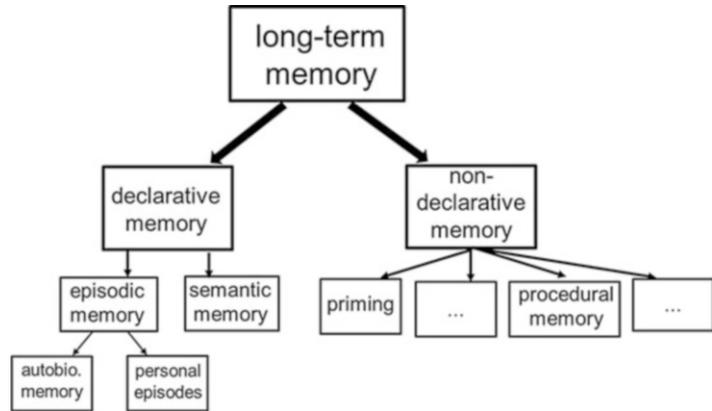
Long-term memory can be divided into declarative and nondeclarative memory (see Fig. 2). Typically, declarative memory is meant when the term "memory" is used; it refers to the capacity for conscious recollection about facts and events. Declarative memory is representational, and these representations can be either correct or incorrect. In contrast, nondeclarative memory is neither correct nor incorrect. It is dispositional and is expressed through performance rather than conscious recollection. Nondeclarative forms of memory comprise of specialized performance systems, e.g., priming and procedural memory.

### Nondeclarative Memory

Procedural memory and priming are two examples of nondeclarative memory systems, which have been examined (at least to some part) with respect to aging. Procedural memory describes

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**Fig. 2** Memory systems of long-term memory



any acquisition and the successful performance of a specific skill over the long term. Examples of procedural memory are riding the bicycle, playing piano, or typing. Once a skill is learned, the skill is performed successfully consecutively without effort. Studies on aging and procedural memory suggest that there is, on average, an age-related decline in speed of performance but no or only little age-related decline in preserving the skill. For instance, in a study by Smith et al. (2005), persons in old age (65–95 years of age) were able to learn a novel visuomotor task, but they were, on average, slower than younger adults. During a follow-up after 2 years, it was shown that older adults preserved memory performance of that task as indicated by improved times of performing the original task across five trials.

There are mixed results regarding the issue of age-related differences in priming. Some studies show that there is an age-related decline in priming, while other studies suggest that there are no or only little age-related differences in priming (cf. Brickman and Stern 2009). Note that these mixed results may be due to comparatively low measurement reliability and/or the insufficient power to detect age differences. In turn, studies that show age-related differences in priming may have included older individuals with incipient dementia (cf. Brickman and Stern 2009).

### Declarative Memory

As stated above, declarative memory reflects the capacity for conscious recollection. Depending on whether factual knowledge or personal events are

the target unit of remembering, declarative memory refers to semantic (knowledge) or episodic memory (personal events; Tulving 1972).

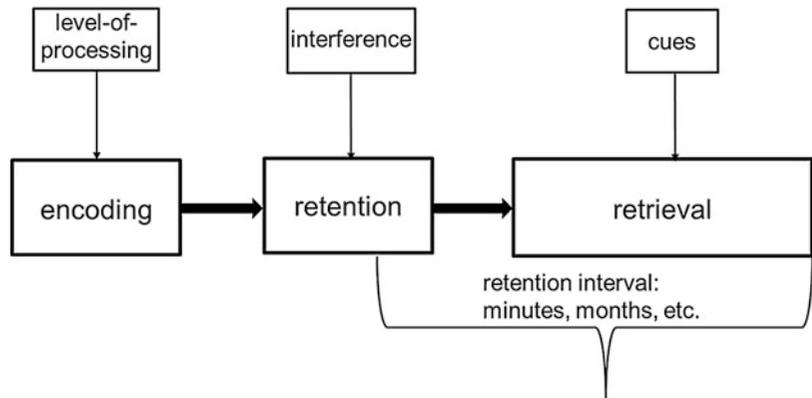
### Semantic Memory

What is the capital of Poland? What is a synonym of “approval”? Asking such questions is one way of testing semantic memory. Semantic memory describes the successful retention of general and verbal knowledge. Due to a longer history of education, a longer history of using verbal material, etc., it is expected that semantic memory increases from being a child to a young adult until being a middle-aged person. Afterwards, semantic memory may still increase or remain relatively stable in old age. Thus, it is expected that there are no pronounced age-related effects in semantic memory toward older age – at least on average.

Note that these studies, which suggest that there are no deficits in semantic memory in older age, contradict subjective ratings of verbal abilities of older adults. For instance, many persons in older age report word finding difficulties and tip-of-the-tongue phenomena (cf. Brickman and Stern 2009). Light (Light 1991) argued that this discrepancy may be due to domain-specific retrieval processes of semantic memory. Accordingly, there might be domain-specific retrieval deficits. Apart from possible domain-specific retrieval deficits, language and underlying cognitive processes (e.g., understanding spoken language) may represent an influence of semantic memory of persons in older age (see Burke and Shafto 2004 for a review).

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**Fig. 3** Influences of long-term memory systems



Verbal fluency tasks represent another way to test semantic memory. Typical verbal fluency tasks require participants to retrieve as many candidates of a presented theme such as “animals with K as first letter” as possible. Verbal fluency tasks are often used in order to differentiate between healthy persons and persons with MCI or dementia. Regarding healthy or normal aging, there is empirical evidence that, on average, older persons show a deficit in verbal fluency as compared to younger adults (e.g., Kempler et al. 1998).

### Episodic Memory

This chapter focuses on episodic memory because of its prominent role in cognitive aging research. This prominent role of episodic memory is expressed by the finding that here age differences are typically most pronounced (as compared to other forms of memory, e.g., semantic memory), which is why it has dominated the research on memory and aging. Episodic memory is defined as the conscious recollection about personal events. According to Tulving (1972), such personal events have to be related to each other in a spatial-temporal way. Autobiographical memory, thus, is one aspect of episodic memory. Besides autobiographical memory, any memory that refers to a personal event is episodic in nature.

### Different Processes of Episodic Memory

Any long-term memory system – be it declarative or nondeclarative – incorporates different memory

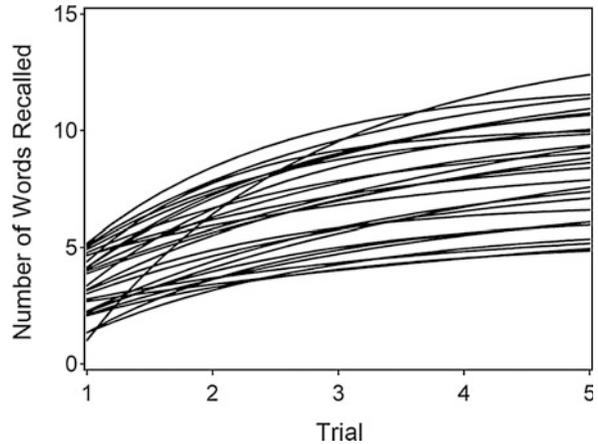
processes, which are required to achieve the ultimate goal of any memory system: remembering. With respect to declarative memory, there are three processes, which are particularly relevant from an aging perspective: encoding (acquisition), retention (storage), and retrieval process (see Fig. 3). Encoding refers to the process of memory where incoming information is processed for the first time (see paragraph on “[Short-Term Memory](#)”). Information is transformed into a mental representation, which may consist of, for instance, a picture, or an association between objects (see the paragraph on “[Encoding](#)” below). This representation is stored. The retention phase “uses” the representation stored and keeps it without major transformations. Finally, the retrieval phase describes the process of retrieving the information after a defined retention interval (e.g., minutes, hours, days, months, etc.). Due to their relevance for possible age-related effects in episodic memory, we will describe these process and corresponding influences (general ones and specific age-related ones) regarding episodic memory. Note that these processes are also processes of semantic memory.

### Influences of Age-Related Differences in Episodic Memory

As stated above, a large body of research focused on age-related differences in episodic and overall indicates that, on average, older adults have more difficulties to recall information in terms of episodic memory tasks than younger adults

### Process and Systems Views of Aging and Memory,

**Fig. 4** Example of individual differences of 80-year-old adults in verbal learning curves



(Kausler 1994). Because of their high controllability, verbal learning tasks are common in order to test episodic memory in the laboratory.

Verbal learning may refer to learn words, numbers, letters, etc. In a typical verbal learning experiment, a list of, for instance, known words is presented, and subsequently, participants are asked to recall as many words as possible in any order (i.e., free recall). In order to measure the trajectory of learning, thus, the dynamic part of episodic memory, usually multi-trial tasks are used. These tasks require participants to learn the given verbal material across several trials. Consequently, recall performance of these several trials can be plotted, and a typical learning curve emerges (see Fig. 4). Following this, parameters of a verbal learning curve can be investigated regarding aging and with respect to individual differences (see Zimprich et al. 2008).

According to Tulving (1972), verbal learning tasks can be seen as measures of episodic memory, because learning of verbal material in a new spatial-temporal context represents a personal event. A large body of research suggests that age-related differences are highly pronounced in these verbal learning tasks of episodic memory (Kausler 1994). In contrast to the majority of studies on verbal learning and age-related differences, which were realized in the laboratory, there is also a line of research that implements verbal learning tasks in a naturalistic environment. This line of research has been mainly influenced by Neisser (Neisser and Hyman 2000) and his

approach of “remembering in naturalistic contexts.”

There are several influences on episodic memory, which were suggested to explain age-related differences in different memory processes of episodic memory (see Roediger 2008 for a review). In general (and regardless of age-related effects), quantitative influences of episodic memory processes can be distinguished from more qualitative influences. An example of quantitative influences is time (respectively, practice). Ebbinghaus (1885/1964 as cited in Roediger 2008) showed that an increasing number of trials enhances recall performance. Miller (1956) argued that, on average,  $7 \pm 2$  items (or “chunks”) can be remembered. Of course, the use of effective mnemonics may lead to an increase of this number. Besides such quantitative variables, more qualitative influences were also suggested. For example, depending on the quality of the to-be-learned material, e.g., whether this is more or less meaningful, memory performance may differ ( Craik and Lockhart 1972). Overall, age-related differences are more evident if, for example, material is less meaningful – highlighting the qualitative, content-dependent aspects of different episodic memory processes. In the following, possible influences on age-related differences in episodic memory will be discussed separately for the three different processes of episodic memory: encoding, retention, and retrieval (although some influences tap different processes simultaneously).

### Encoding (Acquisition)

A large body of research examined influences on encoding. Beginning with Bower (1970), the idea of an effect of imagery during encoding was formulated. Basically, the assumption is that due to imagery of the to-be-learned material, such material is “richer” (higher associations) and in turn more easily transformed into a broader mental representation, which is transferred into long-term memory. For instance, in a study by Bower (1970), it was shown that the instruction to create imagery during encoding of the to-be-learned material leads to higher recall performance than without such instruction.

Apart from the imagery approach, (more or less in same decade) the generation effect has been the focus of many researchers (e.g., Slamecka and Graf 1978). Briefly, these researchers argued that due to the conscious action of actively generating to-be-remembered material, recall performance is enhanced in contrast to simply reading the material. Examples of generating material are finding synonyms or the completion of words or sentences.

A further approach addressing influences on encoding is the level-of-processing approach by Craik and Lockhart (1972). Craik and Lockhart (1972) state that in dependence on the level of elaboration, which refers to a deep or more shallow elaboration, encoding, and, thus, acquisition, is facilitated. In line with this hypothesis, Craik and Tulving (1975) showed that persons who were instructed to process material in a semantical way leads to higher recall performance compared to the recall performance of persons who were instructed to process the material based on phonemic or orthographic characteristics.

Craik and Byrd (1982) suggested that an age-related decline in conscious processes such as episodic memory may be due to age-related differences in attentional resources and its effect on encoding *and* retrieval. Attentional resources, or as Craik and Byrd (1982) have termed them metaphorically, mental energy, are essential for successful encoding and retrieval. In line with the level-of-processing approach (Craik and Byrd 1982), Craik and Byrd (1982) also assumed that deeper (more elaborative) encoding is related

to higher recall performance. Moreover, due to the (functional) relation between higher attentional resources and deeper encoding, Craik and Byrd (1982) argued that due to a deficit in attentional resources, encoding and retrieval may be hampered. Based on studies which tested these hypotheses by using divided attention tasks (in order to measure age-related differences in attentional resources), Craik and Byrd (1982) concluded that encoding is diminished due to decreased specificity and less spontaneously initiated processing; additionally, retrieval is diminished due to less resources available that are for successful retrieval.

Salthouse (1996) suggested that processing speed is a major explanatory variable of age-related differences in episodic memory. The main premise is that processing speed, that is, the ability to process information rapidly and correctly, decreases on average with older age and that due to this age-related decrease in processing speed, episodic memory performance decreases. Processing speed represents a basic cognitive ability, which may act as a (limiting) resource for the successful performance of effortful tasks (e.g., episodic memory tasks). According to Salthouse (1996), the relation between age, processing speed, and episodic memory is based on two mechanisms: the simultaneity and the limited time mechanism. Briefly, the simultaneity mechanism asserts that processing speed enables people to keep information activated, which then, can be used for further processing. The limited time mechanism posits that processing speed is also needed to execute elementary cognitive operations more rapidly. In conclusion, lower processing speed is associated with an internal lack of time, which leads to canceling ongoing elementary operations (limited time mechanism) and with insufficient information required simultaneously (simultaneity mechanism). These consequences of (relatively) low processing speed come into play during encoding and retrieval when both time and information of prior processes are required.

The associative binding approach by Naveh-Benjamin (2000) argues that older adults have more difficulties than younger adults in

associating to-be-learned material. Building cues during encoding, that is, creating associations between objects, may be helpful to make material more meaningful. One reason that old age is accompanied by a deficit in building such associations may be that older adults do not have good or even the necessary strategies (which may be trained, e.g., during memory trainings) of how to build such associations.

Similarly, it was shown that older adults may have a deficit in organizing to-be-learned material to each other in a meaningful way as compared to younger adults (Witte et al. 1990).

### Retention (Storage)

Of course, the number of potential influences of age-related difference in episodic memory “via” encoding must be bigger than the one via retention, because encoding describes the process of memory in which material is transformed. During retention, such action is not present – at least it would be difficult to measure. Instead, as stated above, in this process the transformation is kept into memory without major transformations or actions. Nevertheless, one major potential influence on episodic memory via retention is interference (Underwood 1957). Interference describes recall difficulties due to interfering material, that is, material which, for instance, is similar. An example would be that a person who learned both the Spanish word “sueño” and the Italian word “sogno” (both mean “dream” and are pronounced similarly) may have problems differentiating between them. Interfering material may collide with the to-be-learned material during retention (and retrieval; see below), which may result in less stable memory traces and, as a consequence, more forgetting. Interfering material is material that was acquired before the encoding of the target material (retroactive interference) or afterward (proactive interference). Due to such overlap of material encoded, retention of the “target” material (in the sense of having a stable representation in memory) might be hampered, and following this, retrieval may be wrong or unsuccessful.

An approach on age-related differences in episodic memory is the inhibition account by Hasher

and Zacks (1988). The inhibition account by Hasher and Zacks (1988) states that inhibition is an influence variable of age-related differences in episodic memory. Inhibition, that is, impeding incorrect responses, is relevant during retrieval if there are interferences during retention. In other words, because “sueño” and “sogno” are so similar, their representation in memory may be less stable and, at the same time, share more overlap than if only one of both words would have been learned. If the task is to recall one of both, the other has to be successfully inhibited during retrieval – which becomes more difficult the larger the overlap or the less stable retention is. Hasher and Zacks (1988) argued that old age is characterized by a deficit in inhibition, which may explain age-related differences in episodic memory.

### Retrieval

In contrast to retention and similar to encoding, during retrieval, there are several influences, which had been the focus of a large body of research. Note that general influences that are relevant for encoding are also relevant for retrieval. If to-be-learned material was encoded successfully by creating associations, organization, etc., the resulting cues may be used during retrieval. For instance, Tulving and Osler (1968) stated that retrieval is successful if there are adequate retrieval cues. In general, retrieval cues facilitate any retrieval because they are associated with the to-be-learned material. Thus, if there is an adequate cue, the corresponding association is activated, and in turn the material associated is available and accessible. Cues may refer to internal or external cues. Example candidates for external cues are music, seeing a friend, etc. Example candidates for internal cues are thoughts, emotions, and so-called internal subjective cues. Tulving (1962) assumed that during a multi-trial learning task, with free recall as the output modality, any person creates his or her own internal cues across the to-be-learned material even if this is semantically unrelated. For example, a person may have been asked to learn a word list containing the words “pencil” and “water.” Due to individual prior association with “pencil” and “water,” that person may have the

association of “holidays” in order to use “pencil” as cue for “water,” respectively, and vice versa. As stated above, it was shown that older adults may have a deficit in this type of organization (Witte et al. 1990). Such a deficit in organization during encoding may thus affect the quantity and quality of internal cues, which are required for successful retrieval.

More recently, retrieval itself has been suggested to represent an influence variable of episodic memory (see Roediger and Karpicke 2006 for a review). In terms of this approach, retrieval may function as a “memory booster.” Put differently, due to successive retrievals (retrieval practice), the to-be-learned material is strengthened with regard to its availability. This retrieval practice effect is also named the testing effect. Bjork (1975) argued that retrieval can be considered as a memory modifier, meaning that more retrieval leads to higher recall performance even if there is no new encoding occasion. The benefit of retrieval practice is in particular evident after longer retention intervals such as a week.

With respect to aging, there are studies showing that retrieval practice is a potential influence of age-related differences in episodic memory (Meyer and Logan 2013; Tse et al. 2010). For instance, Meyer and Logan (2013) showed that older adults benefitted from additional testing to a similar degree as younger persons. However, there are other studies demonstrating that older adults cannot take advantage of retrieval if there is no feedback for their performance (Tse et al. 2010). Note that the testing effect requires relatively high recall performance during the initial test. Due to relatively low recall performance in initial trials of older adults, feedback may influence retrieval practice of older adults.

Further possible variables influencing retrieval processes of episodic memory in old age are, as stated above, attentional resources ( Craik and Byrd 1982) and processing speed (Salthouse 1996) due to their suggested mechanisms on both encoding and retrieval. With regard to retrieval and in line with the approach by Tulving and Osler (1968), lower benefit of retrieval practice, lower attentional resources, and processing

speed may be related with more inadequate retrieval cues leading to hampered retrieval, that is, worse remembering of episodic events.

## Concluding Remarks

Knowing possible influences of age-related differences in different memory systems and corresponding memory processes, one approach might consist of providing older adults the relevant support during the corresponding memory process. For example, there are studies showing that older persons increased their recall performance if there was support during encoding as realized by instructions to organize the to-be-learned material (compared to a standard instruction) (Bäckman and Larsson 1992). This result suggests that the relation between a suggested predictor limiting a memory process (such as the encoding quality) and memory performance is stronger for an older person than for a younger person. Put differently, there is a reliable interaction between retrieval support and age. Future research could follow this line of research and thus extend existing research on influences of age-related differences in memory systems. If it were known that relations between possible influences of memory processes, such as encoding or retrieval, and memory performance are stronger for persons in older age than for persons in younger age, hints regarding optimizing memory systems could be formulated. This issue is particularly interesting from a cognitive aging perspective, because some researchers suggested that in older age the so-called dedifferentiation is a possible pattern of relations between different cognitive domains (Baltes and Lindenberger 1997). Dedifferentiation means that cognitive domains become more associated in older age in contrast to childhood or adulthood, when cognitive abilities are more differentiated from each other.

Similarly, approaches that focus on individual differences in aging than on mean differences in memory systems (as realized by the large body of research discussed above) may extend research on

aging in a similar vein. These approaches derive from a lifespan development approach (Baltes et al. 1999), respectively, from approaches of individual aging (Hofer and Sliwinski 2001). Hence, we would expect that there are individual differences in a variety of abilities between persons (1) of different ages but also (2) between persons of similar age. Due to individual initial abilities, their interaction with the environment, and an individual history of these influences, we would expect that there are individual differences in memory systems in persons of older age, too. Future approaches which investigate individual differences in different memory systems in age-homogenous groups could provide ideas of processes underlying aging. More precisely, analyzing predictors of individual differences in memory systems among persons of similar old age may help to gain insights into mechanisms of aging: *why* do persons in similar old age show different performances in different memory systems?

Longitudinal studies, for instance, allow for investigating individual differences in aging and memory by analyzing changes of a variable of interest and individual differences therein (e.g., Zimprich 2002). Furthermore, longitudinal studies on correlated changes may provide hints on the coupled development of memory systems and influences of corresponding memory processes on the individual level. If it were known how individuals change their episodic memory and, in particular, regarding how a particular episodic memory process changes, changes therein could be related to individual changes in the suggested influences (e.g., processing speed, attentional resources) (e.g., Zimprich and Martin 2002). Moreover, examining age-related and individual differences in the converse of remembering, that is, forgetting, may also further our understanding of memory aging (e.g., Zimprich and Kurtz 2013).

Summing up research on processes and systems views of aging and memory, the issue of aging and memory is complex and requires a fine-graded analysis insofar as it incorporates (1) different memory systems, (2) different

memory processes of different memory systems, and (3) age-related differences, which depend regarding their relevance on the corresponding memory system and process. With regard to aging, the episodic memory and corresponding processes have been the focus in research due to the most prominent age-related differences therein. Other memory systems seem to be relatively unaffected by aging. Thus, in society the common belief about aging as reflected in an age-related decline in memory (Ryan 1992) needs to be adjusted: Aging is, on average, associated with declines in episodic memory. With respect to research, study aims could involve focusing on different memory processes explicitly, precise analyses of interactions between possible influences of memory processes and age, and individual aging – at least if the aim is to understand aging and memory from a process and systems view.

## Cross-References

- ▶ [History of Cognitive Aging Research](#)
- ▶ [Individual Differences in Adult Cognition and Cognitive Development](#)
- ▶ [Memory, Autobiographical](#)
- ▶ [Memory, Episodic](#)
- ▶ [Memory, Procedural](#)

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## Prospective Memory, New Perspectives for Geropsychological Research

Matthias Kliegel<sup>1,2</sup>, Katharina M. Schnitzspahn<sup>3</sup>, Céline Souchay<sup>4</sup> and Christopher Moulin<sup>4</sup>

<sup>1</sup>Department of Psychology, University of Geneva, Geneva 4, Switzerland

<sup>2</sup>Center for Interdisciplinary Study of Gerontology and Vulnerability (CIGEV), University of Geneva, Carouge, Switzerland

<sup>3</sup>School of Psychology, University of Aberdeen, Aberdeen, UK

<sup>4</sup>Laboratoire de Psychologie and Neurocognition (LPNC), CNRS-UMR 5105, University Grenoble Alpes, Grenoble, France

### Synonyms

Delayed intentions; Goal-directed behavior; Memory for the future; Volition

### Definition

Prospective memory (PM) designates the ensemble of processes recruited to remember to perform an intentionally planned action after a certain delay (e.g., Ellis and Kvavilashvili 2000). Typical everyday-life examples are to remember to call a friend after the weekend, to take medication according to schedule, or to take a meal out of the oven after 30 min. Notably, several studies have revealed that 50–80% of everyday forgetting is attributable to PM failures, which underlines its core role for everyday-life functioning (Crovitz and Daniel 1984). Given its importance for the maintenance of an individual's independence and autonomy and considering its implication in social functioning and health behavior, PM has more and more often been considered to be a key topic for studying real-life outcomes of cognitive aging (e.g., Aberle et al. 2010; Ihle et al. 2012; Schnitzspahn et al. 2011a; Woods et al. 2012). Thus, the two key questions for a geropsychology of PM that will be discussed in the present

chapter are: (1) What are the developmental trajectories of PM across old age and (2) what are the mechanisms that underlie stability and change in PM?

### What Do We Know About Adult Age Effects in PM?

To address the first issue, 30 years ago, systematic research on PM and aging started with the question of whether PM shows similar declines as other types of memory. In his seminal chapter on memory and aging, Craik (1986) suggested that typical PM tasks are characterized by high demands on self-initiated processes and low environmental support. Since the ability to recruit self-initiated processes declines with advancing age, Craik argued that PM performance should be particularly sensitive to the effects of aging (see also Maylor 1995; McDaniel and Einstein 2000). Consistent with this prediction, some 20 years later, in the first meta-analytic review on age effects in PM, Henry et al. (2004) concluded that, on average, older adults perform substantially worse than young adults in laboratory-based PM tasks. However, closer inspection of the literature reveals that age-related differences across individual studies vary substantially. While some studies found pronounced age-related declines in PM performance (e.g., Maylor 1996; Park et al. 1997), other reports revealed that older adults perform as well as their young counterparts in some event-based PM tasks (e.g., Einstein and McDaniel 1990). Consequently, solving the “puzzle of inconsistent age-related declines in prospective memory” (McDaniel et al. 2008, p. 141) constitutes a pressing issue in research on PM and aging.

### Current Theoretical Accounts for Age Effects in PM in the Laboratory

Why is there sometimes a PM impairment and sometimes not? Before answering this question, one needs to consider a little more how PM is measured. Crudely speaking, research can be divided into laboratory tasks, or more

naturalistic tasks. In laboratory tasks, which are discussed first, participants take part in “ongoing tasks” which simulate the ongoing mental operations and current concerns of daily life. Participants are given a prospective task to carry out on top of or as part of this ongoing task, either in response to a given cue, such as “press this button when the word is written in red”; or at a given time point. As will be highlighted below, the relationship between the ongoing task and the type of cues given greatly influence PM performance and yield insights into the aging profile of PM.

Several conceptual models have been used to describe and explain varying age effects in PM. The multiprocess theory (McDaniel and Einstein 2000) suggests that – in contrast to Craik’s (1986) proposal that all PM tasks are highly demanding – specific characteristics of a PM cue and/or the accompanying ongoing task, in which the PM cue is embedded, determine the amount of resource-demanding attentional processes involved in the successful performance of a PM task. As controlled resources decline with age, the general prediction of this model is that age deficits will emerge when a task requires high amounts of controlled attention while age stability may be found when the task may rely on more spontaneous processing. Conceptually, the multiprocess theory has suggested several specific factors that are key in determining the amount of controlled attention involved in PM performance. The most prominent of these factors is cue focality. This refers to the overlap between the processing required for the ongoing task (OT) and the PM cue (Einstein and McDaniel 2005): The greater the overlap (i.e., the more focal the cue, e.g., when being engaged in an ongoing lexical decision task and having to detect a specific word such as “tornado” as PM cue), the more the information that is required for the PM task is already treated in the course of the OT, enabling spontaneous retrieval of the intention. By contrast, in the case of nonfocal cues, there is no or only a small overlap (e.g., having to detect a specific syllable such as “tor” in a lexical decision task). Here, controlled attention is required for the extra cue monitoring which is assumed to be especially difficult for older adults. In line with

the general prediction of the multiprocess theory, Kliegel et al.’s (2008) meta-analysis confirmed larger age differences for nonfocal versus focal cues; yet, they also revealed reliable age deficits for focal tasks, suggesting that other variables besides cue focality need to be identified as additional moderators.

One of those additional moderators was recently revealed by a third meta-analysis conducted by Ihle et al. (2013) who extended the focus from the cognitive processes involved in cue-detection such as cue monitoring to the analysis of post-cue-retrieval processes. Specifically, to answer the question of whether age effects in PM are further moderated by post-retrieval response management processes, we compared PM and aging studies as to whether they used PM paradigms that required a fixed order of responses after detecting a PM cue (e.g., immediately interrupting the OT and switching to the PM task) or whether participants had to freely coordinate the two parallel task goals in their responses. Again, in all analyses, estimated population PM age effects were reliably greater than zero suggesting clear age deficits in the PM tasks analyzed. When comparing task types, however, a main effect of task order specificity with larger PM age effects in specified than in unspecified PM tasks and, confirming prior results, a main effect of cue focality with larger PM age effects in nonfocal compared with focal PM tasks. Of conceptual importance, there was no interaction between task order specificity and cue focality suggesting that both cue monitoring and response coordination exert independent effects on age-related PM performance.

These abovementioned findings are in general in line with the multiprocess theory, but they also call for an extension as well as a specification of these models with respect to possible interactions and interdependences of the single factors proposed. One of the possibilities for extending the model will be discussed later in the chapter. For the sake of completeness, it is underlined that these findings are generally in line with another important theoretical account on event-based PM, the preparatory attention and memory processes theory (PAM; Smith 2003, 2008; Smith and

Bayen 2004) which suggests that PM performance relies on the amount of cognitive capacity devoted to preparatory attentional processes in order to monitor for the target cue. The amount of these resources can be influenced by certain task characteristics. Thus, both theoretical frameworks suggest that less strategic resources are needed in PM tasks requiring low amounts of monitoring which should enhance PM performance and reduce age effects. On the contrary, those PM tasks which require resource-demanding processes should result in (larger) age-related performance differences, as the ability to recruit strategic attention-demanding processes declines with advancing age. Note that the two models differ with respect to the question of whether controlled resources are always involved in PM (PAM) or whether some PM tasks may fully rely on spontaneous processes – multiprocess theory – yet, for the prediction of age differences, this conceptual difference is of minor importance, as in both cases, age stability may be predicted if the task is low/non-dependent on controlled attention.

While these models derived from laboratory PM research have been powerful in explaining heterogeneous results of lab-based studies, they cannot account for a (in cognitive aging research relatively unique) pattern that has been revealed with respect to age effects in PM when performance in the laboratory is compared with performance in participants' everyday lives and that goes even beyond the dissociation of finding decline versus stability.

### **The Age PM Paradox: A Unique Challenge for Cognitive Aging**

Considering the broader literature that has studied PM in the lab but also used more naturalistic tasks in older adults' everyday life (e.g., asking them to send a text message twice a day), results have revealed a unique pattern introduced as the age-PM paradox (Rendell and Craik 2000). This phenomenon is reflected in an age advantage (i.e., older adults outperform younger adults) across tasks carried out in everyday environments (e.g.,

remembering to call the experimenter once a day) and the reverse pattern (age deficit, as reviewed above) in tasks carried out in the laboratory (e.g., remembering to press a prospective response button upon encountering a specific word in a test session). In fact, Henry et al.'s (2004) meta-analysis demonstrated that both effects were almost of identical effect size, with the age-related deficits in laboratory PM tasks showing an effect size  $r = -.34$  and age benefits in naturalistic tasks showing an effect size  $r = +.35$ . Importantly, more recently, the pattern obtained mostly in comparing age effects across studies has been cross-validated in single samples using matched lab-based and naturalistic tasks and revealing a clear and strong cross over interaction between age and task setting on PM performance (see, e.g., Schnitzspahn et al. 2011a). Thus, while most laboratory studies would suggest the answer to the question of whether PM declines with age to be yes, several other studies might suggest this to be not the case. In their meta-analysis, Henry et al. conclude that this may indicate that PM performance in real-life tasks (i.e., PM "tasks" that naturally occur in everyday life such as the examples given above) may actually be spared, even if aging was associated with a decline in the basic cognitive processes involved in PM (such as working memory, see Zeintl et al. 2007; or inhibition or switching; see Schnitzspahn et al. 2013). In consequence, the descriptive pattern of age effects on PM shows in fact three possible outcomes that need to be explained: decline, stability, and possible improvements.

In consequence, considering the age-PM paradox, this pattern strongly calls for research on both (a) the precise pattern of PM performance that young and older adults show in their everyday life and (b) the mechanisms and processes involved in both age-related lab and real-life PM performance underlying all three possible trajectories. In consequence, the second part of this chapter aims to advocate for two extensions to the current state of the art in research on PM and aging. The first considers an extension of the search focus on the descriptive level from lab to life and the second concerns a conceptual extension of factors discussed as possible

mechanisms for explaining different age trajectories in PM in and outside the lab.

### **Need for Extensions in a Geropsychology of PM – Part 1 (Descriptive Focus): From Lab to Life**

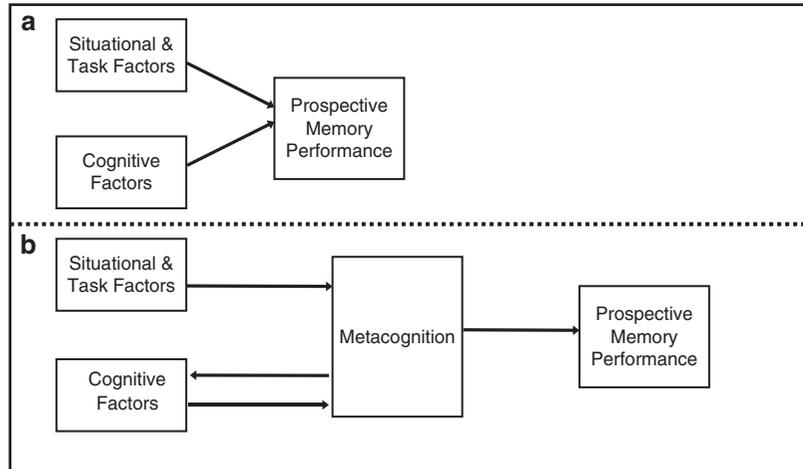
Although, considering the findings on the age-PM paradox, one may actually predict that PM performance in real life may be spared or even improved in older adults, surprisingly, virtually nothing is known about everyday-life PM performance. So far, naturalistic studies have always provided participants with to-be-remembered tasks by the experimenter (e.g., Kvavilashvili and Fisher 2007) but not yet directly investigated naturally occurring intentions.

As one of the rare examples, following up on earlier diary studies on young adults (see, e.g., Ellis 1988; Ellis and Nimmo-Smith 1993), Ihle and colleagues (2012) measured PM performance in everyday situations on five consecutive days in young and older adults. Specifically, participants were called every evening to ask them about their intentions for the following day and to verify if they successfully remembered and performed the planned intentions for that very day. In addition, all intentions were rated regarding their importance. Results showed an age benefit in everyday PM performance. However, this only held true for intentions with low to medium importance, whereas performance in both age groups was comparable for intentions rated as highly important. While both age groups seemed to profit equally from the use of reminders and were impaired by everyday stress, older adults' superiority was associated with the strategy to consciously reprioritize initially planned intentions. In sum, this study suggests that the age-related benefit observed in naturalistic, experimenter-given tasks transfers to everyday PM. More recently, Schnitzspahn et al. (2016) followed up on this finding asking 20 younger and 21 older adults to keep a diary of their naturally occurring intentions over the course of 30 days. Results confirmed a general age benefit for real-life PM tasks. Importantly, this finding was qualified by

revealing that the benefit only held true for specific types of intentions such as health and social intentions. Further, moderation analyses showed that the relationships between cognitive functioning and everyday PM were different for young and older adults. While better inhibition and short-term and long-term memory were related with successful PM performance in the young, this was not the case in the older adults. These findings again corroborate the notion that the age benefit found in naturalistic experimenter-given tasks may in fact extend to real-life PM performance, but they also underline that it may differ depending on the type of intention. Furthermore, these results suggest that individual differences in cognitive functioning may be important predictors for performance in the young, but not so much in the older adults, calling for research on possible compensatory processes.

While these findings shed some initial light on the vastly unknown pattern of age-related changes in real-world PM performance, several key issues remain open. First, and most important, even though Ihle et al. and Schnitzspahn et al. targeted real-world naturally occurring PM tasks, they still relied on self-report data. Thus, to properly test whether PM is compromised in old age (as suggested by the majority of laboratory studies) or whether PM functioning may be well preserved (as suggested by studies using diaries or naturalistic experimenter-given tasks) it would be necessary to – unobtrusively – measure inter- and intraindividual differences in real-world functioning of individuals' PM (without giving people a task that without the study they probably would never had the intention to do). Only such an approach would constitute an objective test of whether there actually is an age-PM-paradox that transfers to observable real-world behavior. Second, cognitive decline, and especially changes in PM, is not a linear function of (negative) changes in basic information-processing resources; clear associations exist between the rate of severity of decline in core outcome variables and a variety of notably modifiable factors, like high levels of stress, lifestyle, and social engagement (Ihle et al. 2015). Thus, an important consequence of these research lines is that while cognitive decline

**Prospective Memory, New Perspectives for Geropsychological Research, Fig. 1** (a) The state of the art: explaining PM performance (b) Explaining PM performance: the “missing link” of metacognition



is a major threat to individuals and the aging society, it is not inevitable and it is therefore necessary to study the predictors of everyday cognitive performance in general and of everyday PM performance in particular. This is especially important because – as demonstrated – these mechanisms have to explain not only more or less decline in PM but also possible age benefits in the realization of delayed intentions. One possibly core variable for explaining the diversity of PM age effects that has just recently received some attention and that is suggested in the final part of this chapter as promising target for future research is metacognition.

### Need for Extensions in a Geropsychology of PM – Part 2 (Explanatory Focus): Metacognition in PM

From existing research it seems clear that the differential aging effects on PM tasks do not simply reflect higher complexity of laboratory tasks: age deficits are found even on very simple laboratory tasks, while age benefits are retained in complex naturalistic tasks (see; Henry et al. 2004; Phillips et al. 2008). Further, the PM paradox holds even where naturalistic PM tasks are contrived (e.g., the time logging task used in Rendell and Thomson 1999) and laboratory tasks are plausible and contextualized (e.g., the Virtual Week

task used in Rendell and Craik 2000). Further, although the majority of naturalistic tasks require a PM response at a specific time, while most laboratory-based tasks require a PM response to a specific event, this time/event distinction cannot explain the pattern of age effects identified (Henry et al. 2004; Phillips et al. 2008; Rendell and Craik 2000). It is also not simply the case that increasing the ecological validity of any cognitive task inevitably reverses the direction of age effects (Aberle et al. 2010). Finally, it has recently also been tested whether the laboratory test situation itself represents a greater stressor for older adults which in consequence may then cause or enlarge age deficits, but this hypothesis could also be rejected (Ihle et al. 2014).

Thus, while so far a number of possible explanations could be ruled out, only a few positive results have been reported which carve out a potential pattern of processes involved in explaining the paradox (captured as situational or task factors; Fig. 1a). These are (i) the influence of a busy or unpredictable lifestyle in the everyday life of younger adults (Ihle et al. 2012), (ii) the emotional salience of the PM task (Altgassen et al. 2010), as well as (iii) the extent to which participants use reminders (see Phillips et al. 2008).

From a conceptual perspective, one critical element missing in the current literature is the link between situational and task related factors such as busyness of lifestyle or task importance

and the (meta-)cognitive processes employed by the (aging) individual in response to these context variables which actually may mediate the age and context effects in PM behavior (e.g., using more or less reminders) (see Fig. 1b for a conceptual overview). This idea was initially put forward in an exploratory study by Schnitzspahn et al. (2011b)). In short, the general conceptual hypothesis is that participants with a better awareness of their actual performance are able to better invest in the appropriate strategies (see similar findings in the domain of learning, e.g., Thiede et al. 2003; Vrugt and Oort 2008; Dunlosky and Connor 1997). As older adults have more experience in naturalistic PM tasks, they might evaluate their performance in those settings more precisely and might then initiate proper strategies to achieve an optimal level of performance. In reverse, the same might hold for younger adults in laboratory settings as they will be more familiar for the younger age group. In short, we are proposing that overconfidence may lead to faulty PM performance in the laboratory in older adults, and overconfidence in the field leads to low naturalistic task performance in younger adults.

### **How and Where is Metamemory Involved in PM Performance and is Metamemory Affected by Aging?**

In PM, effective ongoing performance monitoring is paramount as one needs to be able to be aware of our ongoing mental operations, while keeping active the planned intention. In the real world, one can readily compensate for any perceived PM difficulties, because our activities fit into a schema of expectations and habits, and environmental factors, or external aids, can help our PM. However, one can only invoke such measures if one detects the possibility of forgetfulness and are aware of our mental operations. Older adults show deficits in some aspects of metacognition, which is related with their deficits in executive function (e.g., Souchay et al. 2000 but see Eakin and Hertzog 2012; Hertzog et al. 2010). In particular, they show an overconfidence on most

assessments: thinking that they will perform better than they do on a wide range of tests (e.g., Crawford and Stankov 1996). This deficit is particularly clear on memory for cue-target word pairs. That is, when presented with a cue, older adults fail to accurately judge whether or not they can accurately recognize later the word that they learned was associated with the cue (e.g., Morson et al. 2015). Healthy older adults also fail to show the standard relationship between control and monitoring: when they judge items as more difficult to remember, they fail to allocate their cognitive resources accordingly (Dunlosky and Connor 1997). Finally, they show a deficit in using their memory to access specific information on which to base their monitoring (Souchay et al. 2007).

However, most importantly, there is not a uniform deficit in metamemory in older adults – their ability to accurately gauge performance on existing knowledge is unimpaired (e.g., Allen-Burge and Storandt 2000; Souchay et al. 2007), and there is evidence that monitoring of face-name pairs is unimpaired (Eakin et al. 2014), which means that where task-specific deficits exist, it may point to the ability to use intact processes to better control and monitor deficient processes. Of particular interest here is the idea developed in the memory literature according to which, if encoding fails, participants will not access sufficient information to monitor accurately and make accurate judgments (*Memory Constraint Hypothesis*, Hertzog et al. 2010). This could explain for example why metamemory is more impaired in older adults in episodic memory tasks than in semantic memory tasks. Considering these findings, the current chapter proposes that in natural contexts, older adults are more aware of the function of their PM and that this may be the key mechanism they can use to compensate for their loss in general processing resources (which would be in line with Schnitzspahn et al.'s (2016) recent findings that neurocognitive test performance only predicted PM performance in real-life intentions in younger but not in older adults). Thus, metacognition may be a core but so far mostly ignored factor in age-related PM performance and could be underlying the age advantage in PM in everyday life; this remains a priority for future research.

## Conclusions

Taken together, PM is an important function for maintaining autonomy and independence in old age. In terms of descriptive age effects on PM functioning, the current literature reveals potential for decline, stability, and sometimes even improvement. Yet, while most of the literature has studied PM performance in controlled laboratory tasks or providing participants with tasks to be performed in their everyday life, little is known about age effects in naturally occurring everyday PM tasks (which, by the way, holds probably true for a lot of cognitive domains). Future research will have to uncover whether the age-PM paradox extends beyond self-report data on real-life performance. In terms of developmental mechanisms associated with the variety of age effects, in this chapter, it has been argued that metacognitive awareness and subsequent control processes may be key in explaining the puzzle of inconsistent age-related effects in PM. Again, future research testing this proposal will have to reveal the validity of this hypothesis.

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## Cross-References

- ▶ [Aging and Strategy Use](#)
- ▶ [Everyday Cognition](#)
- ▶ [Executive Functions](#)
- ▶ [Memory, Episodic](#)

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## Psychodynamic and Humanistic Approaches

Douglas Warren Lane

Geriatrics and Extended Care Service, VA Puget Sound Healthcare System, Seattle, WA, USA

Department of Psychiatry, University of Washington, Seattle, WA, USA

### Synonyms

Person centered; Psychoanalytic

### Introduction

With the growth of the older adult segment of the population, there has been increasing attention given to the health and mental health needs of this cohort. In the arena of mental health care, it has become common knowledge, based on an expanding foundation of research, that older adults can and do benefit from psychotherapy for a variety of mental health needs. In general, they can make good use of the same therapeutic procedures employed with adults of all ages. Accordingly, in this article basic issues and processes in contemporary psychodynamic psychotherapy with older adults will be discussed. In so doing, psychodynamic aspects of some other therapies often used with older adults will be noted. Even if a therapist is not doing focused psychodynamic therapy with an older adult, there are issues common in aging that lend themselves to psychodynamic perspectives as part of overall case conceptualization and intervention.

### History and Ageism

Readers may recall that in 1905, Sigmund Freud expressed his view that adults over the age of 50 did not make good candidates for psychoanalysis (Knight 2004). However, in the decades to follow more encouraging contributions to psychodynamic work with older adults began to appear.

Likely the first of these was by Karl Abraham, who in 1919 reported, “to my surprise a considerable number of them [older adults] reacted very favorably to the treatment. I might add that I count some of these cures among my most successful cases.” In following years, more and more efforts were made to expand psychodynamic thinking to encompass older adults. These included works by individuals such as Carl Jung (Knight 2004), as well as declarations made by leading organizations in the profession. For example, in 1980 the Committee on Psychoanalytic Practice of the American Psychoanalytic Association observed that older adults were underserved by psychoanalysts and advised increased efforts to include them. In a 1986 summary, the American Psychoanalytic Association (Cath and Miller) declared further that, “evidence is accumulating from all over the world suggesting that chronological age, contrary to Freud’s impression, is not a valid predictor of analyzability; that throughout evanescence and senescence, new assimilation, leading to modifications in psychic structure, and new enthusiasm and vitality . . . remain possible” (Plotkin 2014).

In spite of these more hopeful perspectives, other authors have identified persistent ageist assumptions in the field that still discourage taking a psychodynamic approach to older adults. These include beliefs that older adults develop psychic rigidity, lose their sense of investment in the future, develop an excessive attachment to the past, and undergo a weakening of life-fulfilling drive. Such assumptions, based as they are in linear, stage models of lifespan development, become quietly reified into unquestioned truths. Also, there are unique, and sometimes daunting, transference and countertransference issues that can arise in working with older adults. The opportunity for these to emerge is especially ample when engaging psychodynamic perspectives, with their emphasis on fundamental human needs, fears, and longings (Wagner 2005).

### Definitions and Context

It is important at the outset to operationally define what is meant here by the term “psychodynamic”

care, and to emphasize that these characteristics apply as much to older adult care as to younger adult care. As described by Roseborough et al. (2013), contemporary psychodynamic approaches to therapy have seven core features: (1) emphasis on affect, (2) exploration of attempts to avoid distressing thoughts and feelings (attention to resistance and defenses), (3) identifying and working with recurring interpersonal “themes and patterns,” or what dynamic clinicians might call enactment, (4) attention to the past and a developmental focus, (5) attention to interpersonal relations (i.e., object relations and attachment), (6) attention to the therapy relationship as something potentially therapeutic and as a driver of change in itself, and (7) an invitation to explore one’s fantasy life (i.e., free association) (Roseborough et al. 2013).

Garner (2002) described psychodynamic work similarly, emphasizing its foundational beliefs as applicable to working with patients of any age. These include that symptoms and personality issues have meaning, that people have complex inner worlds, that people may be unaware of some aspects of their inner world, but that there is close interaction between this and conscious experience. Further, it is held that life is a developmental process, unfolding in stages across the lifespan, that at each stage there is an interaction between past history and current circumstances, and that the therapy relationship is both a diagnostic and therapeutic tool (Garner 2002).

Likewise, a brief review of the predominant models of aging can be useful in understanding psychodynamic work with older adults as well. An older approach is that termed the “loss-deficit model,” in which aging is viewed as a series of inevitable losses (loved ones, life roles, physical health, etc.) that erode the older adult’s selfhood and sense of value. The results are depression, emptiness, loneliness, and nihilism. The therapist who ascribes to this model would approach emotional symptoms as manifestations of losses, and likely take a “grief work” approach to mourning and adapting to these. Importantly, while the “loss-deficit model” is often endorsed by both

professionals and popular culture, the data available do not support its universal validity (Dalzell 2001).

In contrast there is the “developmental lifespan” approach to aging. From this perspective, older adulthood is viewed as but one of several stages encountered during the human lifespan. It holds its own challenges, offers its own rewards, and requires its own transitions. Because loss is indeed a common experience as we age, it is seen as one of the unique challenges an older adult patient might bring to therapy. However, it is not assumed to be the only reason an older adult might seek mental health treatment (Dalzell 2001). It is epitomized by the work of Jung (1929), who described a “psychology of life’s morning and psychology of its afternoon.” He viewed the second half of life as revolving around culture and spirituality, as opposed to the childhood experiences and relationships with parents examined in a younger patient. With an older adult, self-illumination was the ultimate goal. To use the phrase, Jung literally endorsed “growing old” (Garner 2002).

As noted by Plotkin (2014), perhaps most defining in the history of older adult work are the theories of Erik Erikson (1959), who extended notions of human growth and psychological change into the later decades of life. His was a true lifespan developmental perspective that directly countered the opinions of Freud. The last stage of his theory, entitled “Integrity vs. Despair,” reflects the belief that broader and more complex ego strength, nurtured and sustained in the context of significant others, is one of the potential gains acquired through aging. In 1956 Erikson wrote, “I have characterized the psychosocial gains of adult ego development with the terms intimacy, generativity, and integrity . . . their very alternative, isolation, self-absorption, and despair, can be held in check only by the individual’s fitting participation in social endeavors” (Plotkin 2014). As elaborated by Garner (Garner 2002), “Integrity” is the ability to hold esteem for one’s life experiences and one’s self, “to be through having been.” It exists in a dialectical tension with “Despair,” the notion that

sometimes we must face what we have not been, or what we did not do well in being (Garner 2002).

Knight (1996, 2004) proposed a model based in the “life-span developmental” approach termed the “contextual, cohort-based maturity/specific challenge” model. In this, older adults are viewed as having gained maturities that are not found in younger adults. As evidence, Knight cited findings that older adults tend to be less impulsive, to experience greater role competence, and to experience more complex emotions but in a less reactive way. These characteristics are developed only by experience across the lifespan. In contrast to the “loss-deficit model,” his maturity/challenge model emphasizes the need to reconstruct and improve life following a loss. More fundamentally, the maturity/challenge model does not view older adults as unavoidably prone to emotional difficulties. And, when they do enter therapy, they are seen as having significant potential for increased self-understanding and growth, both core components of psychodynamic therapy (Knight 1996).

### Empirical Support

Randomized, placebo controlled studies of psychodynamic therapy with older adults are few (Plotkin 2014; Roseborough et al. 2013). However, a systematic review of effective treatments for depression in older adults located six studies that evaluated psychodynamic treatments in a randomized, controlled fashion. This review found that psychodynamic therapy for depression in older adults was effective. Moreover, it was found to be as effective as cognitive behavioral therapy (CBT). Benefits were noted in immediate symptom relief as well as maintenance of change over years to follow. The conclusion of the review was that psychodynamic therapy is well supported as a treatment option for depressed older adults (Frazer et al. 2005). More generally, Plotkin (2014) summarized data from multiple points including case studies, longitudinal studies, and neuroimaging studies. In keeping with Knight’s (1996) work, these data suggested that older adults remain able to learn and change, and that

among the benefits of aging are improvement and stabilization in emotional life (Plotkin 2014).

### Core Psychodynamic Issues in Older Adulthood

Old age is notable for stresses that are unique, including physical changes, loss of significant others, changes in role status, and existential questioning. But, as noted previously, current conceptualizations of the later years of life are more complex than decay under stress. Rather than simply constricting with age, we have the capacity to become more diverse and individualized (Leigh and Varghese 2001). Thus, as described by Garner (2002), Hildebrand (1982) outlined an interrelated group of core developmental tasks that arise in later life. These are, working through fears of diminution and loss of potency, working through experiences of being replaced in one’s career by younger people, and remaking the marital and family relationships after children are grown. Also, an older person must confront and accept his or her own aging, and accept that there are things that will not be done or undone in life at that point (Garner 2002).

Furthermore, increasing dependency brings to the forefront the person’s capacity to trust and to tolerate a loss of autonomy. Those with problematic histories of malformed relationships or violated trust may become symptomatic at this point. Common reactions can be those of depression or anxiety, especially revolving around concerns that the caregiver is adequate, and whether the caregiver will grow to hate, reject, or be repulsed by the patient (Garner 2002). Doubtless the greatest developmental challenge in late life, though, is coming to terms with the end of that life. It has been referred to as the single event in life that is our “most own.” Nothing is our own like our own death; we share it with no one else. This degree of aloneness can be overwhelming and it is not an uncommon issue facing older adults in therapy (Leigh and Varghese 2001).

In keeping with the notion that aging offers growth through its difficulties, Garner (2002)

offered the words of Salzberger-Wittenberg (1970) who stated, "Some losses are an inevitable part of our life experiences and are indeed necessary for the attainment of mature adulthood. For the work of mourning can lead to greater integration, strengthening of character, the development of courage, and to deeper concern for others as we come to appreciate the preciousness of others' and our own time of life."

As people age, there are commensurate changes in relationships with family and other loved ones. Likewise, the roles the older person fulfills in his or her family system change, owing to a host of physical and psychological factors. Particularly notable change can occur in relationships with adult children. It is not uncommon for the roles to reverse as the parent ages, such that the adult child enters the caretaker role for the parent. For the older adult, this can be an uncomfortable dependant position. The ability to successfully make this transition can depend on the quality of earlier relationships with the children, how the older adult addresses and manages fears of dependency, and the degree of acceptance of limitations that can be achieved as age advances (Wheelock 2001).

Likewise, the notions of reciprocity and equity can, and hopefully do, enter into the family circumstance. The ability and willingness of an adult child to care for an aging parent can depend on that child's experience of being cared for by the parent in years past. In a related theme, so older adults may go as far as feeling entitled to such care, given the care and devotion they have given to the children. Other role changes that can occur in families include the transition away from a leadership role, to one more characterized by following (Wheelock 2001).

The issue of caregiver stress can be as important as any other. In large part, interventions for this population focus on enhancing behavioral coping skills and stress management. To be sure, these are vital components of care for caregivers. However, they can be undermined if the caregiver's internal dynamics related to caregiving are not respected. How did the caregiver come to

be in that role? Was it a choice made voluntarily, or involuntarily? What was the relationship between the older adult and caregiver previously? Was it hostile, dependent, distant, or mutually supportive? Lastly, how well integrated is the role of caregiving for the caregiver? Is it ego syntonic, or dystonic? (Garner 2002).

On the other hand, contemporary aging can also mean the assumption of new roles. Within a marriage, a spouse may find herself or himself having to assume functions filled by the other spouse, if that spouse becomes disabled in some way or dies. Chief among these is the role of caregiver for a disabled spouse. Or, needs in the younger generations of the family may require the older adult members to begin duties such as caring for young grandchildren. Especially in the current times, it is not uncommon to find an older adult still employed, having decided to delay retirement. Alternately, economic need can lead some older adults to come out of retirement. On a more positive note, some older adults find that they begin into a unique role in the family, that of the family historian, and the holder of a unique connection to the family past.

A unique relational issue that is sometimes a goal in therapy is assisting the older adult in negotiating successfully interactions with his or her other medical providers. The relationship with a physician, nurse practitioner, or the like can be pivotal in the life of an older adult. These individuals are a source of a unique type of nurturing and caring, and they can represent hope. Indeed, it is fair to say that these individuals can become internalized and incorporated among the older adult's self-objects. Being able to advocate and assert oneself with medical providers is a relational and interpersonal skill and one that older adults may have to work in developing.

Psychodynamic ideas, especially those from the object relations and ego developmental systems, have been used to inform an understanding of the subjective experience of advancing cognitive loss. Indeed, in a unique way, cognition loss is an area in which the role of neurology and neuropsychology in undergirding

psychodynamics becomes clear. From this perspective, cognition loss weakens ego functioning, and thus erodes mastery over the environment and increases dependency. The person's ego defenses (e.g., executive functions) become less potent, and may regress slowly over time. Along with reduced ability to manage current stressors, previously mastered emotional conflicts may return, as the person is no longer able to engage the psychological mechanisms that once contained them. Also, as cognition loss progresses the neuropsychological substrates (e.g., memory) for maintaining a coherent sense of selfhood via internalized self-object relations fade. In response the person comes to rely more and more on others for day-to-day ego functions and reinforcement of sense of self. Out of these changes can come the anxiety, depression, catastrophic reactions, highly dependent attachments, and related emotional challenges seen in people with advanced cognitive loss (Kasl-Godley and Gatz 2000).

### Process and Technical Aspects

As noted by Leigh and Varghese (2001), the elemental question of how to live as an older adult is, at least partially, answered by the story of one's younger life. Depending on the experiences of earlier life, older age can be a peaceful time, or one of profound dysphoria. Authors such as Jung have described a process whereby older adults can become more introspective, more accepting of the changes inherent in living, and more accepting of the finite nature of human existence. Out of such awareness can come a commitment to living life in the present moments, and it is this drive that psychodynamic psychotherapy seeks to potentiate (Leigh and Varghese 2001).

Thus, the overarching goal of psychodynamic therapy for an older adult is to support investment in current life and attachments, while minimizing as possible the degree of retrospective and anticipatory anxieties. Said another way, helping the older adult maintain investment in "nowness" is

felt to provide the best opportunity for expanding experience and integration into the world. If this connection with "the now" is broken, it can be seen as a form of psychological death, even predated physical death (Leigh and Varghese 2001).

Respect for the patient's autonomy and potential for growth are paramount. This is especially so for older adult patients, whose life circumstances may well have disempowering features that undermine their independence and autonomy. The therapeutic relationship can represent a vital exception, particularly in psychodynamic work, as it is a place where the older adult has more autonomy than they have elsewhere in life. Therefore, the therapist must be attuned to the therapeutic process unfolding so as to monitor for any signs of slippage into therapeutic paternalism (Leigh and Varghese 2001). The therapist and older adult patient have developed in different historical contexts, and these differences can actually become part of the therapeutic dialog, instead of an impediment (Wheelock 2001). As expressed by Knight, "understanding aging is about maturation; understanding working with older individuals is about understanding people who matured in a different era" (Knight 1996).

The concept of transference is at the core of psychodynamic therapy. Briefly, this refers to the phenomenon whereby a patient experiences and reacts to the therapist based on emotions and patterns laid down with significant figures from the patient's past. In the therapy, transference is used as a venue through which the patient can learn to reframe and respond to these forces in a new, more developed, and healthier way. Work with older adults is noted for some unique transference phenomena. For example, given that the therapist is commonly younger than the older adult patient, a so-called "reverse transference" can occur. In this, the patient reacts to the therapist as he or she might to their own adult child. This can manifest in feelings of protectiveness of the therapist, difficulty sharing sensitive or emotionally laden material with the therapist, or excessive interest in the therapist's personal life. As another

example, romantic transferences can occur in therapy with an older person just as they can with any patient. A challenge for the therapist in working with these can be even recognizing them in the first place, or being comfortable acknowledging them. This stems from widespread ageist assumptions that older adults are not sexually active or do not harbor romantic needs (Leigh and Varghese 2001). The older adult patient can also develop feelings of anger and envy towards the therapist who, by virtue of being younger, may be more physically vital and may have more life left to live.

Just as the patient can respond to the therapist based on experiences in previous relationships or other past circumstances, the therapist can respond in kind to the patient. The term countertransference as discussed here, though, refers to the therapist's experience of the patient, no matter its origins. This is a broader definition than some others, but is used here on the belief that all of the therapist's reactions to the patient can hold clinically meaningful relevance, not just those based solely in the therapist's own transference issues. Regardless of the definition, it is critical that the therapist be aware of these and process them appropriately. Otherwise they can affect the therapy and become harmful to the patient (Leigh and Varghese 2001).

Therapists can react to older adults in both positive and negative ways. As one example, "idealization" of the patient can occur, in which the older adult is experienced unidimensionally as someone with only the best of human qualities (wisdom, nurturance, contentment). Related to this, therapists can experience the older adult patient through the frame of a parent or grandparent. In either case, if these feelings are not managed, they can lead the therapist to limit the nature of the therapy and the treatment relationship. As related by Leigh and Varghese (2001), Hess (1987) explained that the therapist may fail to address, "the complex mixture of strength and frailty which is at the heart of these patient's psychic dilemma and which needs to be understood for change to occur and peace of mind to be restored" (Leigh and Varghese 2001).

Negative countertransference can also emerge in working with older adults. These can occur because of the therapist's own feelings about aging and death, or unresolved relational problems with their own parents or grandparents. Common examples include feelings of powerlessness and pessimism in the face of intractable issues such as chronic illness, rescue fantasies, internalizing the despair of the patient, or fear when confronting inevitable life changes and losses associated with aging (Leigh and Varghese 2001). For other therapists, working with older adults can engender feeling like a dutiful child rather than a competent adult (Dalzell 2001). Most fundamentally, younger therapists may need to confront their own guilt for simply being younger.

From a practical standpoint, it is important in working with an older adult to be aware of any physical or sensory deficits, and to accommodate for these accordingly. Something as simple as talking loudly enough to be heard can bring significant depth to the therapy relationship. Cognition changes (even normal age-related changes) likewise may require accommodations; or, may even reach a point where psychodynamic work is no longer appropriate. Important points in therapy can be written down in a journal, material can be distilled down to key points, and sessions can be slowed down or shortened. Also, collateral information from other significant individuals can facilitate gathering a good case history in the event the patient has some problems with recall or synthesis of information (Leigh and Varghese 2001).

Collateral others can also serve as a source of between-session coaching, helping the patient to maintain connection with information from sessions (Leigh and Varghese 2001). Older adults themselves are from a cohort for whom mental health care was mysterious or suspicious. On entering therapy, it can be helpful to explain the therapy process to the patient, describing what it is and is not, presumed mechanisms of action, goals of intervention, and the like. And lastly, but very critical, the physical changes of aging mean that symptoms such as memory problems, shortness of breath, headaches, or gastrointestinal distress

must be evaluated medically, before they can be assumed to be somatic experiences of emotion. Particularly when working with older adults, medical factors must be ruled out before attributing any symptom to psychic causation.

When making the determination whether or not an older adult is appropriate for a psychodynamic approach, the same general rules apply as with younger patients. First, the person needs good verbal skills. As a variation of this, a patient with a milder degree of aphasia might still be able to engage in psychodynamic therapy as long as adequate accommodations were made. Also, it is important for the patient to have good self-observation and self-reflective abilities. As noted earlier, older adults can develop these abilities over the course of their lives to an extent greater than younger adults. Lastly, it is important that the older adult can develop a trusting therapeutic alliance. This may require extra skill from the therapist. For example, the older adult may be reluctant to engage beyond a shallow level out of concern that the therapist, who is likely younger than the patient, cannot truly understand the patient's experiences. The patient has lived longer, experienced more things in life, and may be grappling with issues such as medical changes that are foreign to a younger, healthier therapist (Dalzell 2001).

Once a determination is made that the patient is a good candidate for psychodynamic work, there is a continuum of approaches from which to choose. These range from ego supportive therapy, such as those incorporating self-psychology, to full spectrum psychoanalysis. Only a small proportion of patients will be appropriate for an in-depth psychoanalysis, in keeping with this modality for adults in general. However, less intensive approaches can be helpful, whether as a primary intervention, or as part of an integrated case conceptualization. As noted by multiple authors, both in the psychodynamic arena and in geriatric mental health in general, it is critical that the therapist be able to work flexibly and to shift intervention styles as needed (Dalzell 2001).

Self-psychology, noted above, can lend itself to working with older adults given the issues they often face. It can articulate with other theoretical

systems as well, such as Acceptance and Commitment Therapy (ACT), Life Review, and Interpersonal Psychotherapy (IPT). Self-psychology is based on the tenant that older adults who are able to maintain a coherent sense of a congruent self, across time and circumstances, are best able to cope and maintain themselves psychologically. The "self" is conceptualized as the scaffold of personality. It is theorized to develop as the confluence of inborn traits, temperament, and interactions with the environment and those significant figures in it. These significant others are known as "self-objects" and are experienced by the person as almost an extension of the self. More than simply people that are known, these are figures that are metabolized and incorporated into the person's psychic world. Self-objects can meet a variety of potential needs, including those for reflection and affirmation (mirroring), soothing and guiding insights (idealizing), and sharing of interests and values (twinship). From the perspective of self-psychology, the stability, maturity, and health of the person psychologically rest on that of the self, derived from the quality of self-object relations (Dalzell 2001).

For some older adults, aging brings a reduced connection with self-objects, for example, through death. Furthermore, illness, functional limits, and other age related changes can interfere with positive self-object relations as well. The overall result is a weakened sense of self, or disgust with the perceived new self that is seen to have emerged, and increased vulnerability to psychopathologies. These include depression, existential crisis, anger, anxiety, and a host of others. For some, aging can mean the death of the self well before the actual death of the body (Dalzell 2001).

Thus, the role of the therapist is to become a newer self-object. The first step in this process is to create a therapeutic holding environment in which the patient can find the mirroring that forms the basis for the therapy as it moves forward. This can require the therapist to confront and manage potential countertransference issues without delay, as their operation can undermine the therapy before it even begins.

The development of idealizing transference, by which the patient is able to find soothing and reassurance in the therapeutic relationship, emerges from the soil of a rich therapeutic holding environment. The overarching goal of the therapy is to restore and reactivate the patient's sense of self-coherence. It is as if restarting a movie that had been assumed over, and finding that the story actually continues, and the lead actress or actor is still there and recognizable (Dalzell 2001).

This restoration may be facilitated by any of the number of specific techniques. It is here that psychodynamic work, ACT, Life Review, and IPT can mingle. Through the relationship with the therapist, the patient may learn to find-self acceptance and thereby develop more realistic yet fulfilling expectations for living. As stated by Carl Rogers, "The curious paradox is that when I accept myself just as I am, then I can change." Additionally, the patient may develop new skills to re-connect with previous self-objects or develop new ones. Or, the patient may enhance ego strength by developing new coping skills that function in spite of the limits imposed by functional changes (Dalzell 2001). Through positive Life Review (i.e., with an emphasis on positive recall vs. negative rumination), the older adult has an opportunity to cast back to past notions of selfhood, strengths and accomplishments, and core values that have transcended phases in life. These can then be brought forward to reinforce coping and, more fundamentally, sustain the person's sense of a coherent narrative.

## Conclusion

As the human lifespan lengthens and the older adult cohort grows, so must our options for understanding their complex lives and emotional experiences. At one time, the possibility that emotional life and growth could occur in later life was dismissed out of hand. It has only been through years of research and clinical work that these ageist assumptions have given way, albeit not entirely. With the aging of the "Baby Boom" will come new challenges for the mental health field, not only curative but preventative. What can

we say about optimal psychological and emotional health in aging? What strengths and resiliencies can facilitate a person's transitions and resolutions as they grow older? Psychodynamic thought, unique in its appreciation of the depth of human experience, is well positioned to inform these discussions.

## Cross-References

- ▶ [Narrative Approaches with Older Adults](#)
- ▶ [Interpersonal Psychotherapy](#)
- ▶ [Late Life Transitions](#)

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## Psychological and Personality Testing

Dawn La<sup>1,4</sup>, Katie Van Moorlehem<sup>3,5</sup> and Victoria Liou-Johnson<sup>2,5</sup>

<sup>1</sup>Palo Alto University/Pacific Graduate School of Psychology, Palo Alto, CA, USA

<sup>2</sup>University of California, San Francisco, CA, USA

<sup>3</sup>Palo Alto University, Palo Alto, CA, USA

<sup>4</sup>Sierra Pacific Mental Illness, Research Education and Clinical Centers at the Veterans Affairs Palo Alto Health Care System, Palo Alto, CA, USA

<sup>5</sup>Sierra Pacific Mental Illness Research Education and Clinical Center, VA Palo Alto Health Care System, Palo Alto, CA, USA

### Synonyms

Assessment inventories; Geriatric assessment; Personality measurement; Psychodiagnostic measurement tools; Psychological evaluation; Psychological inventories

### Definition

Psychological testing refers to the evaluation and identification of measurable behaviors using assessment tools. Psychological testing is often utilized to supplement a clinical psychological evaluation; however, psychological testing can also encompass broader interests, including educational and achievement testing, vocational testing, and intellectual testing. Individual tests are not suitable for diagnosing patients; rather, testing is used to provide quantifiable measurements of certain behaviors in order to complement a full evaluation (Edelstein et al. 2008; Lichtenberg 2010). In the geriatric population, psychological testing is generally used for psychodiagnostic clinical purposes (Segal et al. 1998). There

can be a variety of reasons for psychological evaluations in a clinical setting for a geriatric population, including assessment of current behaviors, severity of clinically significant behaviors, diagnostic implications, and treatment planning purposes. Psychological testing instruments or tools describe certain sets of behaviors or traits of clinical interest, and specific instruments have been developed for this population or have been applied to this population.

Personality testing is a sub-section of psychological testing that identifies individual personality characteristics or dispositions. Personality traits are believed to remain stable across the adult life span, including into older adulthood, and as such, there are no personality assessment measures that have been developed specifically for older adults, although many personality assessment tools can be applied to the older adult population (Edelstein et al. 2008). Currently, personality testing is less emphasized as a psychodiagnostic tool and more of an assessment of behavioral syndromes or profiles, which have been identified scientifically and empirically (Weiner and Greene 2008).

### Psychological Testing

There are important factors to consider involving psychological testing with older adults, including the psychometric properties of the measures and the appropriateness of the specific measure applied to an older adult population. In particular, issues to consider include reliability and validity of the measurement and whether the normative data include the older adult population. Popular psychological tests for assessing common mental health problems and issues in adults and older adults alike are enumerated below, namely depression, anxiety, anxiety-related issues, and psychosocial functioning.

### Depression

While prevalence rates for depression in community-dwelling older adults is approximately 2–5%, rates of depressive symptoms and

subsyndromal depression range from 8% to 37% (Edelstein et al. 2008). Many of the assessments used to measure depression in older adults were initially developed for use with younger adults. This can be problematic when using these assessments with older adults, as older adults are more likely to report somatic symptoms and are less likely to report affective symptoms such as sadness, dysphoria, and worthlessness (Edelstein et al. 2008). It is important for both clinicians and researchers to keep this in mind when choosing an assessment for use with older adults. Common measurements of depression are often self-report inventories that are clinically feasible and have support from research.

*Beck depression inventory.* The Beck Depression Inventory – II (BDI-II) is a 21-item self-report measure, widely used in both clinical and research settings (Edelstein et al. 2008). Each of the items measure for a specific symptom of depression, assessing behavioral, cognitive, and somatic symptoms that closely match the diagnostic criteria set forth in the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV). Studies have shown that the BDI-II has high internal consistency, moderate convergent validity, and low to moderate divergent validity (Edelstein et al. 2008). While the BDI-II is widely used and has been widely studied, its focus on somatic complaints may not accurately reflect depressive symptoms commonly experienced by older adults. Further, it could underestimate the prevalence and severity of depressive symptoms in older adult populations (Edelstein et al. 2008).

*Hamilton rating scale for depression.* The Hamilton Rating Scale for Depression (HRSD) has long been considered a gold standard for assessing depression. It is most typically used in the context of research. The HRSD is a clinician-rated measure that was originally developed in the 1950s and first published in 1960 to be used in research assessing the effectiveness of the first generation of antidepressant medication (Bagby et al. 2004). HRSD has good internal consistency and interrater reliability, as well as moderate convergent and divergent validity. However, intraclass correlations vary widely (Edelstein et al. 2008; Bagby et al. 2004). Although the

measure is cost-effective because it is in the public domain, it has been criticized as having poor psychometric properties and being outdated because the original measure was developed to assess depression outcomes from first generation antidepressant medication (Bagby et al. 2004).

*Patient health questionnaire.* The Patient Health Questionnaire (PHQ-9) is a nine-item depression screening instrument developed for primary care settings. It has a telephone administered version that can be read to the examinee, making it acceptable for use with older adults who have vision problems. The PHQ-9 has moderate internal consistency as well as moderate convergent validity and test-retest reliability in adults, but there is no psychometric data for older adult populations (Edelstein et al. 2008).

*Geriatric depression scale.* The Geriatric Depression Scale is a self-report questionnaire developed specifically to assess depressive symptoms in older adults (Edelstein et al. 2008). The GDS has a standard 30-item form as well as a 15-item short form, both of which are in the public domain. The short form is an effective screening tool in primary care, nursing home settings, or for use with patients with cognitive limitations. Patients answer items in a dichotomous yes/no format. The assessment focuses on cognitive and behavioral symptoms of depression and no items of the GDS assess somatic symptoms. Thus, the GDS may be a better measure of depressive symptoms most common in older adult populations. The GDS shows good internal consistency and moderate convergent validity. While the GDS was developed and normed with older adults, there are no items that address suicidal ideation and the dichotomous format could create difficulties if the patient cannot discriminate between a “yes” or “no” answer to the question (Edelstein et al. 2008). When using the GDS with older adults, it is important to also separately assess for suicidal ideation.

## Anxiety

Anxiety is more common in older adults than depression, with prevalence rates for anxiety in community-dwelling older adults ranging from

4% to 7% (Stanley et al. 1996). As is the case with assessments measuring depression, many assessments measuring anxiety were initially developed and normed with younger adults. Using these assessments with older adults can be problematic because medical conditions and their pharmacological treatments may affect the presentation of anxiety in older adults. Further, older adults tend to have different types of worries than young adults (Edelstein et al. 2008; Kogan et al. 2000).

*Beck anxiety inventory.* The Beck Anxiety Inventory (BAI) is a 21-item self-report measure of general anxiety (Kogan et al. 2000). Patients answer items about symptom severity using a 4-point Likert-type scale, ranging from 0 (not at all) to 3 (severe). Total scores range from 0 to 63, with higher scores signifying more severe anxiety. The BAI has high internal consistency; however, it has moderate concurrent and divergent validity (Edelstein et al. 2008; Kogan et al. 2000). The BAI has a two-factor (somatic and subjective subscale) structure for younger adults and a four-factor (cognitive, autonomic, neuromotor, and panic subscale) structure for older adults, suggesting that older adults experience different constellations of symptoms than younger adults.

*State-trait anxiety inventory.* The State-Trait Anxiety Inventory (STAI) is a self-report measure that consists of two 20-item scales measuring two factors of general anxiety: state anxiety, which is thought to be a situation-specific anxiety; and trait anxiety, a personality characteristic (Kogan et al. 2000). Patients answer items on a four-point Likert-type scale, with total scores for each scale ranging from 20 to 80. Higher scores indicate greater levels of anxiety. Further, the STAI shows moderate to good test-retest reliability and moderate convergent validity with the BAI (Edelstein et al. 2008; Kogan et al. 2000). While the STAI has good psychometric properties, psychometric data for older adults is limited. The two-factor state-trait structure may not apply to older adults (Kogan et al. 2000). Further, the two-factor structure does not align with the diagnostic criteria set forth in the DSM-IV, and the STAI does not provide a good indication of symptom severity. While the STAI might not be

appropriate for clinical evaluation of older adults, it is popularly used in research.

Hamilton Anxiety Rating Scale (HAM-A) and the Structured Interview Guide for HAM-A (SIGH-A). The Hamilton Anxiety Rating Scale (HAM-A) is a widely used clinician-rated measure of anxiety symptom severity, mainly utilized in a research setting. It is a 14-item measure of defined symptoms rated by a 5-point likert scale (Hamilton, 1959). Interrater reliability for individual items and total scores have been found to be sufficient (Maier et al. 1988). Although sensitivity is considered fair, criticisms of this measure include the lack of specificity (Maier et al. 1998). The Structured Interview Guide for the Hamilton Anxiety Scale (SIGH-A) is a corresponding guide of instructions for interviewers to aid in rating the HAM-A. The SIGH-A has been found to have good reliability (Shear et al. 2001).

*Geriatric anxiety inventory.* The Geriatric Anxiety Inventory (GAI) is a 20-item self-report questionnaire developed to measure general anxiety symptoms in older adults. The GAI was developed and normed with samples of community dwelling older adults and older adults seeking psychiatric services (Therrien and Hunsely 2012). The GAI employs dichotomous agree/disagree formatting, with the number of “agree” responses summed together for the total score. Total scores range from 0 to 20, with higher scores indicating greater levels of anxiety (Kogan et al. 2000; Therrien and Hunsely 2012). The original validation study showed excellent internal consistency for both the community dwelling and clinical samples (Kogan et al. 2000; Therrien and Hunsely 2012). Test-retest reliability data is limited, though one study showed moderate test-retest reliability (Therrien and Hunsely 2012). The GAI shows moderate to strong concurrent validity (Kogan et al. 2000). The GAI has a simple format, good psychometric data, and focuses on older adult symptoms of anxiety, making the GAI a good assessment option for use with older adults. Further, the GAI has been translated into many languages, making it available for use with older adults who do not speak English.

*Geriatric anxiety scale.* The Geriatric Anxiety Scale (GAS) is a 30-item self-report measure, developed for use with older adults. The scale contains 25 items related to symptoms of anxiety and five items related to common worries of older adults (Kogan et al. 2000). Patients rate symptoms on a four-point Likert-type scale for how often symptoms were experienced over the past week, with 0 indicating the symptom was not experienced to 3 indicating it was experienced all of the time. Total score range from 0 to 75, with higher scores suggesting greater anxiety. The measure consists of three subscales of anxiety symptoms (somatic, cognitive, and affective), which allows the clinician to better determine which symptom cluster is most bothersome for the patient, and thus adjust treatment to target those specific symptoms (Kogan et al. 2000). The GAS has shown good internal consistency, however, research has shown correlations between the somatic scale and self-reported medical problems. The GAS has a short form consisting of three questions from the somatic scale, three questions from the affective scale, and four questions from the cognitive scale (Mueller et al. 2014). Research has shown good internal consistency for the short form and high concurrent validity with the standard form of the GAS (Mueller et al. 2014). The short form of the GAS appears to be a good measure for use in clinical settings; however, more validation is needed. With more validation, the short form GAS may prove useful in primary care and nursing home settings, as well as with patients with cognitive limitations.

## **Anxiety-Related Measures**

### **Posttraumatic Stress Disorder (PTSD)**

PTSD prevalence rates in those above 60 years old in the general population have ranged from 1.5% to 4% (Acierno et al. 2007). PTSD symptoms can begin at a younger age and persist into older adulthood, or develop in late life. Traumatic life events in the context of aging may include issues related to death and loss, as well as chronic and comorbid medical conditions. Additionally, with

the onset of dementia, PTSD symptoms can develop as the individual undergoes changes impacting their concept of time and distant memories. Studies have also noted that older Veterans with PTSD had a higher risk of developing dementia (Yaffe et al. 2010).

There are different methods to assess for PTSD, however there is no measure developed specific to older adults, and so age-related issues must be conceptualized by the clinician as part of the overall assessment. Most common measurements for PTSD include interviewer-rated and self-report measures.

*Interview-rated measures.* Common interviewer-rated measures of PTSD include the Structured Clinical Interview for DSM-IV (SCID) PTSD Module and the Clinician Administered PTSD Scale (CAPS). With the recent criteria changes between DSM-IV to DSM-5, modified measures' psychometric properties remain under review, and thus current validated and standard interviewer-rated measures still utilize the criteria of DSM-IV. The most commonly used measures include the PTSD module from the SCID and DSM-IV CAPS (although the CAPS has been updated to correspond to the DSM-5 criteria, studies reviewing the psychometric properties are underway). The SCID is in a structured clinical interview format, with questions corresponding with each criteria of the specific diagnosis of interest. Lifetime and current profiles are assessed. It has adequate reliability and validity (Hyer and Sohnle 2001). The CAPS historically is viewed as the most empirically supported measure for assessing PTSD (Hyer and Sohnle 2001). It is an interview-rated measure that reviews not only the onset of symptoms but also the intensity and frequency of specific PTSD symptoms (Hyer and Sohnle 2001). Psychometric properties of the DSM-IV CAPS have also been found to be adequate in adults, although psychometric data on older adults is limited.

*Self-report measures.* The PTSD Checklist (PCL) consists of items that correspond directly to that of the criteria as set by the DSM-IV and has different versions. PCL-M is a military version, PCL-S is a nonmilitary version that identifies a specific traumatic event, and PCL-C is for the

general civilian population that does not identify a specific event. Again, a modified version (PCL-5) has been developed to correspond with the DSM-5, but it has yet to undergo validation studies. The PCL items are each rated along a five-point Likert-type scale as an indication of symptom severity (Flack et al. 2002). It is considered to have high reliability and intern consistency, and it correlates strongly with other common measures of PTSD. The Mississippi Scales for PTSD has two versions, a combat related version and civilian. These are 35-item scales that have been highly correlated with other PTSD measures. It has also been extensively studied in the older adult military population and found to be an accurate diagnostic measure (Stanley et al. 1996; Flack et al. 2002). Lastly, the Impact of Event Scale (IES) is another common self-report. A traumatic event is identified, frequency of each symptom is assessed and severity measured along a four-point scale. It is often utilized due to its strong convergent validation (Flack et al. 2002). Most of the outlined self-report measures were developed for the general adult population yet has been used to assess older adults. Although there is limited validation with older adults for most of these self-reports, studies involving the use of the Mississippi Scales for combat related trauma have been found to be adequate for the older adult military population.

### Fear of Falling

Fear of falling has been defined as low perceived efficacy or confidence at the ability to avoid or prevent a fall (Tinetti et al. 1990). It has been estimated that one in three older adults falls each year, and that these falls are a leading cause of both fatal and nonfatal injuries in older adults (Tromp et al. 2001). The gold standard in assessing the fear of falls in older adults is the Fall Efficacy Scale (FES). The FES is a ten-item scale that assesses a patient's confidence in their ability to avoid falling while completing nonhazardous activities of daily living (Tinetti et al. 1990). The FES-I, a 16-item scale, has been developed for use with many different languages and in many cultural contexts. The FES-I has shown to have moderate reliability and

construct validity. The Activities-specific Balance Confidence Scale (ABC-16), is a 16-item face-to-face clinician administered interview that does not explicitly measure fear of falling, but instead measures a patient's confidence in their balance when completing 16 specific daily activities (Tromp et al. 2001). The ABC-16 also has a short form, consisting of six of the most feared daily activities from the standard version. Both the ABC-16 and the ABC-6 have shown good internal consistency as well as good sensitivity and specificity (Tromp et al. 2001).

### Psychosocial Measures

In addition to psychodiagnostic measures, psychological testing can also obtain information regarding individuals' psychosocial circumstances. There is a wide range of psychosocial measures relevant to the elderly population. A few in particular can be used to help assess pertinent issues such as resiliency, caregiver burden, psychosocial support, health concerns such as fear of falling and sexual functioning.

*Resiliency.* Resiliency is a concept that could help explain psychological responses in the face of stressors and challenges across the lifespan. There remains the need to develop validated and reliable measures of resiliency in the older adult population. The Resilience Scale is a self-report specifically developed to identify the personality characteristics of resilience in the older adult population, however further validation and reliability studies remain recommended (Resnick and Inguito 2011). The Connor-Davidson Resilience Scale (CD-RISC) is clinical self-report developed to analyze coping styles for stress and includes older adults in its sample population (Windle et al. 2011). Although not specifically developed for older adults, the CD-RISC has empirical support regarding sound psychometric properties.

*Caregiver burden.* Caregiving can be very demanding and stressful, and as family members become informal caregivers for their aging loved ones, or an elderly individual must care for their aging significant other, caregiver burden or stress is an important issue to assess as it relates to the

health of the caregiver. A review of approximately 28 self-report measures of caregiver burden concludes that the majority of self-report measures have inadequate validity (Deeken et al. 2003). Nonetheless, a widely used measure in aging agencies is the Zarit Burden Interview, which is a caregiver self-report. It has 22 items, in which the caregiver is asked to endorse an item using a five-point scale. However, given poor psychometric properties its utility remains limited (Deeken et al. 2003).

*Perceived psychosocial support.* Perceived social support is important to assess for in older adult populations, as higher levels of perceived social support are correlated with better physical and mental health, as well as perceived quality of life and positive adaptation to serious life stressors. There are a number of ways to assess for social support, however, it is most often assessed using self-report measures. One of the most common measures used is the Duke Social Support Index (DSSI). This is a 35-item self-report measure that examines social networks, social interactions, subjective support, and instrumental support. Abbreviated versions containing 23 items and 11 items have been created. All versions of the DSSI have shown good reliability and validity with use in older adult populations (Koenig et al. 1993).

*Sexual functioning.* The sexual function and sexual activity of older adults is an uncommonly researched area, and an area often overlooked by clinicians. There are no formal measures to assess for sexual function in older adults; however Zeiss, Zeiss, and Davies have suggested that best method of assessment is a comprehensive interview with the patient and his or her partner (Zeiss et al. 1999). Zeiss, Zeiss, and Davies have also written semi-structured interviews to assess for sexual quality-of-life and sexual dysfunction (Peretz et al. 2006; Zeiss et al. 1999). Special care should be made when working with patients whose partner may have dementia.

In summary, psychological testing with older adults can be utilized for psychodiagnostic purposes and gathering psychosocial information. Aspects of reliability, validity, and normative data remain important considerations when

choosing appropriate measures for the older adult population and for particular clinical settings. Furthermore, depending on the abilities of the patient and the context of the clinical setting, issues such as ease of use and question response style can be important considerations when choosing the best measure. This section briefly sampled common psychological test measures and reviewed their psychometric properties and normative sample qualities. Cautious interpretation of results should be taken when psychometric properties of the measure are limiting and the normative sample does not incorporate older adults.

## Personality Testing

Another aspect of psychological testing includes personality assessment. Often, personality testing is administered through self-report questionnaires. Research studies have identified response pattern profiles, which attempt to profile major personality traits. The common measures described below were developed based on empirical methods. Historically, personality measurements have not been developed specifically for use with an older adult population, but they can be used with this population given the underlying theory that personality traits remain stable throughout adulthood.

### Common Personality Measures

*Minnesota multiphasic personality inventory-2.* The Minnesota Multiphasic Personality Inventory-2 (MMPI-2) is one of the longest standing self-report inventories still being used today. It is a 567-item, self-report inventory, consisting of true-false questions. Originally published in 1943 (MMPI), it underwent a significant revision in 1989 (MMPI-2). The MMPI-2 was standardized on over 2,600 people who represented the makeup of the US Census. Although older adults were included in the sample, older adults over the age of 85 are underrepresented, and therefore, results may be skewed for adults in this age group. The revisions to the MMPI that led to the MMPI-2 were based on a new statistical approach with an updated normative sample. The MMPI-2

measures symptoms and creates profiles accordingly. Unlike some of the other self-report inventories, it is not intended to diagnose disorders based upon the Diagnostic and Statistical Manual of Mental Disorders; rather, it is meant to be a guide for treatment and case conceptualization. Additionally, it must be noted that because the MMPI-2 focuses only on symptoms, issues faced by older adults (e.g., increased health problems, increased physical pain) may result in apparent pathology (Greene 2011). Therefore, physical and health related scale elevations (e.g., Scales 1, 2, and 3) should be considered along with the patient's medical condition and history before making conclusions regarding pathology. The MMPI-2 Restructured Form (MMPI-2-RF) was developed in 2008 (Ben-Porath 2012) and although based on the same normative sample as the MMPI-2, important changes were made in removing significant cross-loading of items throughout the inventory and revising certain scales (PSY-5). Additionally, this most recent version has fewer items 338 items compared to the original MMPI-2 567 items, which would likely make administration easier for older adults who might become cognitively or physically fatigued more easily.

*Million clinical multiaxial inventory.* The Million Clinical Multiaxial Inventory (MCMI-II) is a relatively short self-report inventory containing 175 true-false questions. It was originally published in 1983 and has been revised several times, with the most recent revision in 1997 (MCMI-III). The MCMI-III was revised to better correlate with DSM-IV diagnoses; however there are some subtle discrepancies in personality disorder conceptualization (Weiner and Greene 2008). The MCMI-III was standardized on a clinical sample (e.g., patients seen in a variety of clinical settings, such as private practice, hospital, forensic, and so on), while most other personality tests were standardized with "normal" samples. The authors of the MCMI suggest that it should only be used on clinical populations, in general, due to the normative samples being of a purely clinical population. Even so, many clinicians still find it useful for use with nonclinical populations.

*Personality assessment inventory.* The Personality Assessment Inventory (PAI), published in 1991, was standardized with both clinical and normal patient groups, and assesses multiple domains, which are correlated with the DSM-IV. The PAI is a 344 item self-report inventory, with each item rated on a four-point Likert-type scale (ranging from "false, not at all true" to "very true"). The PAI has become more popular due to its ability to be used in a variety of settings, ease of use, and validity.

*NEO Personality Inventory-Revised.* The NEO Personality Inventory-Revised (NEO PI-R) is based upon the five-factor model of personality, empirically derived general personality factors, which includes the domains of Neuroticism, Extraversion, Openness, Agreeableness, and Conscientiousness. It is a self-report inventory containing 243 items that are rated on a five-point Likert-type scale, which ranges from "Strongly Disagree" (SD) to "Strongly Agree" (SA). This inventory includes a self-report form (Form S) and an observer form (Form R), which should be completed by someone who is very familiar with the person being evaluated. Criticisms of the NEO PI-R have included the fact that it was based on an atheoretical model of psychology and there is no reliable method of assessing validity. Additionally, all items on the evaluation are face-valid, or transparent, and therefore may be easily manipulated to garner a more, or less, favorable profile (Weiner and Greene 2008). The NEO PI-R is less commonly used in the clinical setting, perhaps due the possibility that it can be easily distorted. It is, however, often used in educational, organizational, and research settings. The NEO PI-R was not normed on any particular population, nor does it correlate with any particular diagnoses or psychopathology. However, it may be a useful tool to inform the administrator about more positive aspects of the older examinee, and may aid with treatment planning by understanding the patient's personality dimensions.

### Other Personality Tests

Less common measures of personality include the Personality Diagnostic Questionnaire – Fourth

Edition Plus (PDQ 4+) and the Coolidge Axis II Inventory (CATI). PDQ 4+ is a relatively short self-report inventory, which contains 99 true-false items. The PDQ 4+ is based upon the diagnoses from the DSM-IV. It includes two validity scales (“Too Good” and “Suspect Questionnaire” scales). Nonetheless, due to the weak psychometric properties (tendency to give false-positives and weak validity scales), it is best used as a screening measure, rather than a comprehensive assessment. The CATI is a 225-item self-report inventory that is rated on a four-point Likert-type scale, which ranges from “Strongly False” to “Strongly True.” This scale was designed to correspond with the DSM-IV-TR, but also includes some descriptions from the appendices of the DSM-IV-TR and DSM-III (Sadistic and Self-Defeating Personality Disorders; Passive-Aggressive and Depressive Personality Disorders, respectively). The CATI is set apart from other measures because it includes an 18-item neuropsychological dysfunction scale and an informant report, allowing informants to report any observed traits or behaviors that the patient may be unaware of. Additionally, the CATI views personality disorder as dimensional, making it possible to utilize the test for both clinical and normal populations.

Other forms of personality testing include projective measures, which are characterized by the examinee’s responses to ambiguous and unstructured stimuli. The interpretations of these responses are believed to reveal aspects of the examinee’s personality or innermost feelings and beliefs. Common projective personality tests include the Rorschach and the Thematic Apperception Test (TAT). These particular projective measures however were not designed specifically for the older adult population, yet they have been applied to this population nonetheless (Segal et al. 1998). Studies have shown variable results in terms of the validity of these measures for this population. More specialized measures such as the Senior Apperception Test and Geriatric Sentence Completion Form have been developed with what is believed to be more relevant stimuli for the older adult cohort (Segal et al. 1998).

## **Clinical Considerations in Testing Older Adults**

### **Health Considerations**

Various health conditions can impact the accuracy and proper interpretation of psychological testing with older adults. Medical issues related to vision and hearing deficits as well as physical limitations are highly common in the older adult population and can interfere with the administration of the aforementioned test measures (Edelstein et al. 2008; Segal et al. 1998). Thus, it is often necessary to provide or inquire about accommodations that will allow older adults to properly respond to questionnaires, including larger size font for questionnaires or assistive hearing devices.

Additionally, a medical workup is highly recommended to rule out medical conditions that can impact mood. Medical and laboratory workup is important when assessing older adults given the increased likelihood of comorbid medical illnesses that can also influence psychological conditions. For instance, thyroid dysfunction is known to impact mood, wherein hypothyroidism can cause depressive symptoms; hyperthyroidism can cause anxiety symptoms (Thakur and Doraiswamy 2009). Furthermore, as previously mentioned, it remains important to note the difficulties of distinguishing between somatic symptoms related to mood and comorbid medical illnesses as well as the tendency of older adults to report somatic complaints compared to affective symptoms (Edelstein et al. 2008).

### **Cognitive Impairment**

Cognitive functioning in older adults is another clinically significant factor that impacts psychological testing. As one ages, the vulnerability for dementia can impact cognition and judgment and thus responses to psychological test measures. The current DSM-5 refers to cognitive disorders as neurocognitive impairments, and further delineates between minor and major severity. Dementia, a syndrome of cognitive and functional impairments, is subsumed under this diagnosis.

Dementia can be assessed through cognitive screens and neuropsychological evaluations, of which cognitive functioning across multiple domains is assessed along with impairments in managing activities of daily living (Segal et al. 1998). By assessing cognitive abilities, decisions on what psychological test measures would be most helpful for treatment planning purposes.

### Cultural Factors

Cultural factors are also important to note with regards to psychological testing. Education level and specifically reading level would impact the patient's ability to read and possibly understand the questions from the test measures. Depending on the historical context in which the older adult was born, older patients might have a range of reading and educational experiences. Clinicians may have to rephrase questions so that some older patients can comprehend what is being asked (Segal et al. 1998). Also, based on the qualities of the normative sample, education level of the normative sample may be significantly different than the patient assessed. Furthermore, the cultural background of the older patient can impact the validity of the test itself. For instance, if English is not the primary language or the patient is of a certain ethnic background, its compatibility with the respective normative sample would be questionable. The common measures as outlined may not be reflective of different ethnicities and thus the generalizability of the measures should be with caution.

### Conclusion

With increased rates of older adults seeking medical services and the move toward integrated health care settings that include a team of medical and mental health providers, mental health services may witness an influx of older adults. Psychological disorders in the aging population can develop in later in life or may be long-standing chronic conditions. Nonetheless, psychological testing with the aging population is an essential

aspect of a full evaluation and can be helpful in quantifying and monitoring behavioral symptoms. Furthermore, personality testing can help identify key character traits that can aid intervention approaches and treatment planning. This section reviewed common clinical disorders as well as test measures that often used and considered suitable for working with older adults. As noted by the brief sampling of measures, close examination of the psychometric properties is important to ensure the appropriateness of the test measure. However, special accommodations and cautious interpretation of results may be warranted despite measures developed specific to older adults given possible medical conditions, cognitive limitations, and cultural background that may impact the test results.

### Cross-References

- ▶ [Anxiety Disorders in Later Life](#)
- ▶ [Comorbidity](#)
- ▶ [Mental Health and Aging](#)
- ▶ [PTSD and Trauma](#)

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## Psychological Aspects of Diabetes

Anna Chapman

RDNS Institute, Melbourne, VIC, Australia  
School of Primary Health Care, Monash  
University, Melbourne, VIC, Australia

### Synonyms

Anxiety; Depression; Diabetes mellitus; Mental health; Psychological interventions

### Definition

“Psychological aspects of diabetes” refers to the psychological aspects that should be considered when providing care or treatment to an older person with diabetes mellitus. Throughout this chapter, the term “psychological” relates to an individual’s thoughts, emotions, feelings, and ability to cope with their environment or medical condition. Additionally, “diabetes” refers to a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both (American Diabetes Association 2015).

## Introduction

Diabetes mellitus (DM) is among the most common noncommunicable diseases globally, and the number of DM cases is rising in every country (International Diabetes Federation 2013a). The prevalence of diagnosed and undiagnosed DM has consistently been shown to increase with age up to 80–85 years, after which time a plateau or slight decrease is commonly observed. Estimates from the USA indicate that within the age groups 70–74, 75–79, 80–84, and  $\geq 85$  years, the prevalence of DM was shown to be 20%, 21.1%, 20.2%, and 17.3% respectively (McBean et al. 2004). In China, similar increases in prevalence have also been found. For the age groups 40–49, 50–59, 60–69, and  $\geq 70$  years, the prevalence of DM in 2013 was 11.3%, 17.6%, 22.5%, and 23.5%, respectively (Xu et al. 2013). The burden of DM among older adults is expected to grow substantially in the coming years alongside global population aging.

There are two major categories of DM relevant for the older adult: type 1 diabetes mellitus (T1DM) and type 2 diabetes mellitus (T2DM). Although T1DM is present in older populations, T2DM is the most prevalent form of DM, accounting for approximately 90–95% of all DM cases (American Diabetes Association 2015). As such, the DM category of interest throughout this chapter will be T2DM.

The primary aim of T2DM management for functionally independent older adults is to maintain blood glucose, blood pressure, and cholesterol levels within normal ranges in order to prevent or delay T2DM-related complications (Association to American Diabetes Association 2015; International Diabetes Federation 2013b). Considerable emphasis has typically been placed on the prevention of acute and vascular complications associated with T2DM, but it is now well established that older adults with T2DM have a higher prevalence of clinical and subclinical levels of mental health disorders compared to the general population. Additionally, individuals are likely to exhibit psychological vulnerability upon diagnosis, when their medical status changes, when the need for intensified treatment (e.g.,

insulin) is apparent, and when physical complications are identified (American Diabetes Association 2015). Throughout this chapter, the most salient psychological problems associated with T2DM among older adults will be examined.

## Psychological Comorbidities Associated with Type 2 Diabetes Mellitus

### Depression

Depression is a common mental disorder, characterized by sadness, loss of interest or pleasure, feelings of guilt or low self-worth, disturbed sleep or appetite, feelings of tiredness, and poor concentration. According to the Diagnostic and Statistical Manual of Mental Disorders-5 (DSM-5), an individual can be diagnosed with major depressive disorder (MDD) when five or more of the symptoms listed in Box 1 have been present for the majority of days within the same two-week period and at least one of the symptoms is depressed mood or loss of interest or pleasure. These symptoms must also cause clinically significant distress or impairment in functioning and may not be attributable to the physiological effects of a substance or to another medical condition (American Psychiatric Association 2013). Among individuals with T2DM, the distinction between the physical symptoms of T2DM and those attributed to the diagnostic criteria of MDD (such as weight change, fatigue, etc.) can be difficult for health professionals. This poses significant challenges to detection and diagnosis of clinical and subclinical levels of depression.

#### Box 1: Associated Symptoms of Major Depressive Disorder

- Depressed mood most of the day, nearly every day, as indicated by either subjective report (e.g., feels sad or empty) or observation made by others (e.g., appears tearful)
- Markedly diminished interest or pleasure in all, or almost all, activities most of the

(continued)

day, nearly every day (as indicated by either subjective account or observation made by others)

- Significant weight loss when not dieting or weight gain (e.g., a change of more than 5% of body weight in a month) or decrease or increase in appetite nearly every day
- Insomnia or hypersomnia nearly every day
- Psychomotor agitation or retardation nearly every day (observable by others, not merely subjective feelings of restlessness or being slowed down)
- Fatigue or loss of energy nearly every day
- Feelings of worthlessness or excessive or inappropriate guilt (which may be delusional) nearly every day (not merely self-reproach or guilt about being sick)
- Diminished ability to think or concentrate, or indecisiveness, nearly every day (either by subjective account or as observed by others)
- Recurrent thoughts of death (not just fear of dying), recurrent suicidal ideation without a specific plan, or a suicide attempt or a specific plan for committing suicide

Adapted from the American Psychiatric Association (2013)

Prevalence rates of MDD among older people are relatively low (1–3%) compared to younger age groups (~15%); however, much larger numbers of older people experience clinically significant depressive symptoms (8–27%) (Nouwen and Oyeboode 2009). Despite often falling short of the diagnostic threshold for MDD, studies have indicated that older adults with clinically significant depressive symptoms have a comparable disease burden with regard to functional impairment, poorer health outcomes, as well as increased health-care expenditure and utilization (Park and Reynolds 2015).

Elevated depressive symptoms and MDD are also common among individuals with T2DM, and prevalence rates have been estimated to be twice that of the general population. These estimates have largely been based on adults with T2DM as the majority of research has not specifically targeted older samples (Poulsen and Pachana 2012). A limited number of studies have examined the incidence of depression in older adults with T2DM; however, findings have been mixed. Although some studies have identified an increased risk of up to 30% in the incidence of depressive disorder and depressed mood in older people with T2DM, other studies did not support these findings. Where studies did observe an increase in incidence, older adults with inadequate glycemic control (HbA1c  $\geq$  8.1%) were found to have the highest risk of developing recurrent depressive symptoms (Nouwen and Oyeboode 2009).

A multitude of risk factors have been identified that increase the likelihood of developing depression in later life. Consistent with those observed in younger age groups, being female, unmarried, of low socioeconomic status, and/or socially or geographically isolated are relevant for the older population. A previous diagnosis (or family history) of depression, as well as the presence of a chronic condition (e.g., T2DM), can also enhance an individual's risk. Specific risk factors that are considered particularly important for older adults include bereavement, loss of certain roles, caregiver burden, a fall event, family conflict, limited social networks, and/or those living in residential or nursing homes. Conversely, strong social support, religious participation, spirituality, as well as partaking in social activities have been shown to decrease depression risk. For older individuals classified as medically ill, the risk of depression is also higher among individuals with cognitive impairment, active alcohol dependence, lower educational attainment, and those of advanced age (>75 years) (Nouwen and Oyeboode 2009; Park and Reynolds 2015).

Previous research has demonstrated a link between depression and T2DM-related outcomes

such as regimen adherence, health-related quality of life, glycemic control, T2DM-related complications, health-care costs, and mortality (Nouwen and Oyeboode 2009; Park and Reynolds 2015). Increases in depressive symptom severity scores have also been found to be incrementally associated with decreases in T2DM self-care behaviors, including lower adherence to general diet, physical activity recommendations, self-monitoring of blood glucose, and prescribed medications (Nouwen and Oyeboode 2009).

The early identification of depression among older adults with T2DM should be prioritized given the increased potential for this population group to experience depressive symptoms and the negative consequences associated with such comorbidity. While a number of scales assessing depression exist for use in the general adult population (i.e., Center for Epidemiological Studies Depression (CES-D) scale, Beck Depression Inventory (BDI)), one of the most widely used measures for older adults is the Geriatric Depression Scale (GDS). Both the 30-item GDS and its shorter 15-item scale have been found to have good internal consistency, and scores correlate highly with clinical diagnoses of depression. Four-item versions of the GDS scale are also available that are reasonably accurate and are particularly suitable for use within routine clinical consultations. For older adults with dementia, however, the Cornell Scale for Depression in Dementia (CSDD) is better suited than the GDS (Nouwen and Oyeboode 2009).

### Anxiety

Anxiety disorders encompass a suite of mental disorders that share features of excessive fear and anxiety and related behavioral disturbances. Generalized anxiety disorder (GAD) appears to be the most common anxiety disorder among both older adults and individuals with T2DM. However, within both of these patient groups, anxiety disorders have received much less research attention compared to depression or dementia (Poulsen and Pachana 2012). According to the DSM-5, an individual can be diagnosed with GAD when they have experienced at least

six months of excessive and uncontrollable worry, as well as three or more of the symptoms listed in Box 2 for the majority of days within the same six-month period. These symptoms must also cause clinically significant distress or impairment in functioning, may not be attributable to the physiological effects of a substance or to another medical condition, and should not be better explained by another mental disorder (Nouwen and Oyeboode 2009). Similar to that noted for depression, distinguishing between the physiological effects of T2DM and the symptoms associated with GAD is often complicated.

#### Box 2: Associated Symptoms of Generalized Anxiety Disorder

- Restlessness or feeling keyed up or on edge
- Being easily fatigued
- Difficulty concentrating or mind going blank
- Irritability
- Muscle tension
- Sleep disturbance (difficulty falling or staying asleep, or restless, and unsatisfying sleep)

Adapted from the American Psychiatric Association (2013)

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Studies comparing the prevalence rates for GAD among different age groups generally report a decline in prevalence with age. For example, previous research comparing GAD prevalence across the lifespan have found for the age groups 45–64 and  $\geq 65$  years; the 12-month prevalence of GAD ranged between 3.2–4.2% and 1.0–2.3%, respectively (Wolitzky-Taylor et al. 2010). However, rates of clinically significant symptoms of anxiety are much higher in older populations (15–20%), and among older individuals with a disability or chronic medical condition, prevalence rates have been reported to be  $>40\%$  (Tampi and Tampi 2014). It is also well

established that among older adults, anxiety often co-occurs with other mental disorders, particularly depression (Wolitzky-Taylor et al. 2010).

While the majority of anxiety research has not specifically focused on older adults with T2DM, substantially higher rates of GAD (14%) have been reported for adults with T2DM when compared to the general population (3–4%) (Poulsen and Pachana 2012; Gonzalez et al. 2011). Adults with T2DM have also been found to have higher rates of clinically significant symptoms of anxiety (40%), and not surprisingly, these rates are similar to that observed for older adults with a disability/chronic condition (Poulsen and Pachana 2012). Even at subclinical levels, individuals with T2DM who experience anxiety are more likely to develop T2DM-related emotional distress (i.e., worries about long-term complications, burnout symptoms, and anxiety when self-management problems occur). Consequences of such distress have been associated with reduced glycemic control, increased T2DM-related complications, greater disability, and reduced quality of life (even after adjusting for the effects of comorbid depression) (Poulsen and Pachana 2012; Gonzalez et al. 2011).

A number of risk factors have been associated with an increased likelihood of having an anxiety disorder in late age. Many of these risks are consistent with that observed for depression and include being female, unmarried, of low educational attainment, and having multiple chronic conditions. Stressful life events, impaired subjective health, physical limitations in daily activities, concerns about personal safety, adverse events in childhood, and neuroticism are additionally pertinent for anxiety (Wolitzky-Taylor et al. 2010). Individuals who are taking insulin to control their blood glucose levels have also been associated with increased levels of anxiety, which is predominantly attributed to fear of hypoglycemia. Certain aspects of the T2DM self-care regimen, such as frequent self-monitoring of blood glucose, may also exacerbate anxiety symptoms (Gonzalez et al. 2011).

Although older adults with a chronic condition (including T2DM) commonly experience anxiety, GAD and elevated anxiety symptoms frequently remain unrecognized and untreated. Health professionals need to be alert to the aforementioned risks

and symptoms of anxiety among older adults with T2DM. Where there is heightened potential for elevated symptoms of anxiety, adequate assessments should be performed. A vast number of screening and assessment scales have been utilized in adults with T2DM (e.g., Generalized Anxiety Disorder (GAD-7) scale, Beck Anxiety Inventory (BAI)); however, the Geriatric Anxiety Inventory (GAI) is a 20-item measure that has specifically been designed for use within older populations. The GAI has been validated in a range of older populations and has performed well psychometrically (Poulsen and Pachana 2012).

### **Psychiatric and Other Psychological Disorders**

Relative to anxiety and depression, psychiatric and other psychological disorders (i.e., eating disorders and substance use disorders) are not frequently observed among older adults with T2DM. While an in-depth discussion of these additional disorders is outside the scope of this chapter, the consequences of these comorbid disorders can be substantial and therefore warrant brief mention.

There is an increased prevalence of T2DM among individuals with major psychiatric disorders such as bipolar disorder and schizophrenia. Rates of T2DM are more prominent among younger individuals with schizophrenia, but individuals with bipolar disorder and comorbid T2DM tend to be older. Screening for T2DM should be performed for older adults with psychiatric disorders. Following diagnosis of T2DM, adherence to components of the T2DM self-care should be adequately assessed. Obesity, physical inactivity, smoking, poor treatment adherence, and reduced diet quality frequently occur among individuals with psychiatric disorders. All of these factors have the potential to increase T2DM-related complications and reduce quality of life (Gonzalez et al. 2011).

When present, eating disorders and substance use disorders among older adults with T2DM have the potential to reduce adherence to the T2DM self-care regimen and increase the likelihood of acute and long-term complications. As such, the screening and assessment of these

additional psychological disorders should be routinely performed as part of standard T2DM care.

## Evidence-Based Treatment

The current evidence base supports the use of both psychological and pharmacological approaches for the treatment of depression among individuals. These studies have predominantly included samples of adults with T2DM, and consequently, it is not yet clear which approaches are most effective for older adults. Additionally, studies investigating the effects of psychological and/or pharmacological interventions for the treatment of anxiety disorders are largely missing for individuals with T2DM (adults and older adults). Despite this lack of evidence, a vast number of self-management interventions have been implemented over the last two decades that have aimed to enhance adherence to the T2DM self-care regimen and prevent or delay T2DM-related complications. These interventions can broadly be classified as largely having an educational or psychological basis.

## Diabetes Self-Management Education for Type 2 Diabetes Mellitus

A large portion of the T2DM self-management interventions that have been published to date are based on diabetes self-management education (DSME) principles. DSME refers to “the ongoing process of facilitating the knowledge, skill, and ability necessary for diabetes self-care...The overall objectives of DSME are to support informed decision making, self-care behaviours, problem solving, and active collaboration with the health-care team to improve clinical outcomes, health status, and quality of life in a cost-effective manner” (Association to American Diabetes 2015). DSME interventions range from didactic lectures through to interventions that require individual participation (e.g., problem-solving, goal setting) and collaboration (e.g., cooking classes and walking groups) and are delivered in both individual and group formats. Current best

practice of DSME is a skill-based approach that focuses on empowering and assisting individuals with T2DM in making informed self-management choices (Association to American Diabetes 2015).

The effectiveness of DSME in the management of T2DM have been assessed, and three widely cited meta-analyses have concluded that DSME training has short-term (<6 months) positive effects on knowledge, frequency, and accuracy of SMBG, self-reported dietary habits, and glycaemic control (Norris et al. 2001, 2002). However, these observed benefits declined between 1 and 3 months post-intervention (Norris et al. 2002). The efficacy of delivery mode (individual/group format) was also assessed in subsequent reviews (Duke et al. 2009; Deakin et al. 2005; Steinsbekk et al. 2012). For group-based DSME programs, significant improvements were found for glycaemic control, DM knowledge, blood glucose concentration, and body weight in both the short (4–6 months) and long term (12–24 months) (Deakin et al. 2005; Steinsbekk et al. 2012). Significant improvements were also observed for self-management skills and self-efficacy at 6 months (Steinsbekk et al. 2012). In contrast, individual education programs (compared with usual care) were only found to be effective for glycaemic control in individuals with inadequate glycaemic control ( $HbA1c \geq 8\%$ ) (Duke et al. 2009). Despite the positive associations observed within these reviews, the number of included studies for some of these analyses was small (two to four), particularly for outcomes assessed at 24 months and for measures of self-efficacy and self-management skills. The active ingredients of DSME interventions were also not able to be determined by these reviews due to large variety in program content across included studies.

Evidence-based guidelines endorse the periodic assessment of an individual’s self-management knowledge and skills, yet the majority additionally recommend the incorporation of behavioral strategies and psychological interventions into routine care, as well as the routine assessment of psychosocial factors (Association to American Diabetes 2015). Previous reviews of DSME interventions have also called for further research that better defines effective interventions for sustaining

behavior change and maintaining long-term glyce-mic control in individuals with T2DM. It has been suggested that these interventions should focus on identifying the predictors and correlates of glyce-mic control (particularly psychological attributes such as depression) (Norris et al. 2001, 2002).

## Psychological Interventions for Type 2 Diabetes Mellitus

In contrast to DSME interventions which aim to improve DM-related knowledge and skills among individuals with T2DM, psychological interven-tions “use the therapeutic alliance between the patient and the therapist to bring about change in emotional, cognitive, and behavioural function-ing, including adherence” (Ismail et al. 2004). The term “psychological interventions” is a broad one and encompasses a wide range of tech-niques that can be delivered in both individual and group formats, including supportive or counseling therapy (i.e., nondirective counseling/client-centered therapy), motivational interviewing (MI), brief psychodynamic therapy, interpersonal psychotherapy, and cognitive behavior therapy (CBT), and its associated techniques including contract setting, goal setting, problem-solving, activity scheduling, stress management, and relaxation (Alam et al. 2009).

The efficacy of psychological interventions on T2DM-related outcomes has been assessed in two widely cited meta-analyses (Ismail et al. 2004; Alam et al. 2009). Ismail and colleagues (Ismail et al. 2004) identified 25 clinical trials for inclu-sion in their review (twelve of which assessed glycated hemoglobin, eight assessed blood glu-cose concentration, nine assessed body weight, and five assessed psychological status). The majority of the clinical trials ( $k = 21$ ) utilized CBT or its associated techniques, four utilized counseling techniques, and no trials were identi-fied that used either a psychodynamic or interper-sonal model of therapy. This review found significant associations between psychological interventions and glycated hemoglobin and psy-chological status; however, blood glucose

concentration and body weight were not signifi-cant. Of particular clinical significance was the reduction in glycated hemoglobin, which resulted in an absolute decrease of 0.76% HbA1c. Addi-tionally, when studies were excluded from analy-sis in which the control condition was a less intensive psychological therapy, a difference of 1.00% in HbA1c was observed. This finding is similar to that of the landmark United Kingdom Prospective Diabetes Study (UKPDS) which uti-lized pharmacological therapies, indicating that psychological interventions are as effective as pharmacological therapies in reducing glycated hemoglobin.

As a follow-up to the 2004 review, Alam and colleagues (Alam et al. 2009) utilized the original 2004 review protocol and additionally compared the effects of psychological interventions when delivered by generalist clinicians compared to psychological specialists. In addition to the origi-nal 25 clinical trials, a further 10 clinical trials were identified for inclusion in the updated review ( $k = 7$  glycated hemoglobin,  $k = 5$  psychological status). Consistent with the original review, the majority of the ten studies utilized CBT or its associated techniques ( $k = 7$ ), two trials utilized counseling techniques, and one trial used psycho-dynamic therapy. With regard to psychological status, the meta-analysis of 13 trials found statisti-cally significant improvements favoring the intervention  $-0.56$  (95% CI,  $-1.00$  to  $-0.13$ ).

The abovementioned meta-analyses have dem-onstrated that psychological interventions are effective in improving glycemic control and psy-chological status; however, the type of therapy that is most effective and the subgroups of patients most likely to benefit are not yet clear. The major-ity of included studies within previous reviews have utilized CBT or its associated techniques, and there is a pressing need for studies to be conducted that utilize additional psychotherapies (e.g., MI). This would allow for meta-analyses to be conducted for each of the specific therapeutic types rather than grouping psychological inter-ventions as a whole. Additionally, previous reviews have combined depression, anxiety, well-being, and quality of life into one outcome.

As a result, the differential effect of psychological interventions on each psychological outcome has not previously been noted.

## Conclusion

Clinically significant symptoms of depression and/or anxiety are common among older adults and among individuals with T2DM. Although the majority of research has not specifically focused on older adults with T2DM, a multitude of risk factors place this population group at increased psychological risk. The negative consequences associated with comorbid depression and/or anxiety necessitate the routine screening and assessment of these disorders among older adults with T2DM. The GDS and the GAI are valid and reliable measures that have been specifically designed for use within older populations. Additionally, psychological interventions are promising tools for the improvement of T2DM-related outcomes; however, their effectiveness within older populations needs to be established.

## Cross-References

- ▶ [Aging and Psychological Well-Being](#)
- ▶ [Aging and Quality of Life](#)
- ▶ [Mental Health and Aging](#)
- ▶ [Quality of life in older people](#)

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## Psychological Interventions in Long Term Care settings

Victor Molinari and Michelle L. Ellis  
School of Aging Studies, University of South  
Florida, Tampa, FL, USA

### Synonyms

Role of geropsychology in long-term care; State of mental health in long-term care

### Definition

Long-term care may be defined as care for frail older adults with chronic medical or psychological problems. This entry will discuss the various mental health conditions that a geropsychologist must treat in long-term care settings and then discuss the important role geropsychologists play in integrated care, flourishing of residents, and staff and professional training. A focus on services provided by geropsychologists in institutional long-term care settings will be made, but it should be noted that in the USA and worldwide, more long-term care is delivered in home settings. The principles of assessment, intervention, and consultation underlying long-term care for frail older adults in institutional settings can easily be transferred to services delivered in the community.

### Long-Term Care Settings and the Aging Population

Although aging demographics and worldwide increases in longevity have been known for many years (WHO 2001), many countries have not adequately prepared. Over the next century, the 30 oldest countries in the world will reside in Europe, with the oldest country in the world, Japan, remaining an outlier. The USA, in comparison, will continue to feel the effects of the baby boomers transitioning into late age until 2050

(Laidlaw and Pachana 2009). The predicted growth of those 80 years and older is a global concern as the oldest old will increase the demand for care and social resources in both community and institutional settings. Some countries are aging faster than others, but all are dealing with the important public health issues of caring for those who cannot care for themselves (Vongxaiburana et al. 2014).

Nursing homes and assisted care facilities have a high proportion of residents with significant mental health problems. More than half of all nursing home residents have cognitive impairment and half of these have significant behavior problems (Magaziner et al. 2000). Despite the Preadmission Screening and Resident Review (PASRR) process as mandated by the Omnibus Budget Reconciliation Act (OBRA) to triage those with serious mental illness (SMI) to the least restrictive environment, approximately 10% of nursing home residents in Florida have SMI. However, there is significant variability across the USA regarding these rates depending upon narrow or wide definitions of SMI (Grabowski et al. 2009). Many nursing home residents are reeling from the psychological sequelae of medical problems causing impairments in daily living necessitating institutional care. Adjustment disorders with depressed and/or anxious mood are thereby quite common. Other individuals with long-standing exaggerated characterological traits may be admitted to nursing homes due to deaths or aging stressors because they have worn out already strained social supports and no one is available to take care of them in a community setting. In the USA, assisted living facilities also admit a high proportion of individuals with dementia and psychiatric problems, with less than optimal rates of recognition and treatment (Rosenblatt et al. 2004). Compared to the medical model of care that has traditionally guided nursing home culture, assisted living facilities operate under a service care model, resulting in even less qualified staff to tend to the wide-range of resident conditions. Indeed, long-term care settings can be considered psychiatric institutions without the trained staff to effectively and humanely deal with the residents living in them.

## Treatment of Patients with Severe Mental Illness in Long-Term Care

Those with SMI are often admitted to nursing homes without a primary mental health diagnosis and without a full PASRR diagnostic screening. In contrast to those with SMI living in the community, individuals in nursing homes with SMI have great functional impairment and symptom burden (Bartels et al. 2003). These individuals are often feared by the nursing home staff because they tend to be male and younger than the typical nursing home resident, with particular concern over aggressive behavior toward feeble women. SMI residents often do not “fit in” with the other nursing home residents, and activities are less geared to meet their needs. Nursing home aides may have a tough time discriminating between a resident with dementia and one with SMI, and thereby they may have low expectations regarding improvement or stabilization in status over time for those with SMI. It should be noted that mental health professionals have been unduly pessimistic about the outcomes for older adults with SMI and that improved quality of life may be achieved in a variety of settings with the proper environmental modifications and staff training. Geropsychologists should be guided in their assessment and treatment decisions by the recovery movement principles of self-direction, empowerment, not being defined by the limitations of one’s illness, and living in the least restrictive environment so that those with SMI manage their life choices as much as possible and are engaged in meaningful life activities.

## Dementia in Long-Term Care Services

Caring for persons with dementia will be of national and international concern as the prevalence of dementia rises worldwide from 35.6 million in 2010 to 115.4 million in 2050, with the highest growth of cases in low- to middle-income countries with less established long-term care services (Alzheimer’s Disease International 2013). Still developing regions rely on informal caregiving systems that can benefit from many

of the strategies and frameworks put forth to improve care in nursing homes and institutional settings.

Lawton and Nahemow (1973) promoted the idea of a person-environment match to enhance quality of life for residents with dementia through an ecological gerontology. Nursing home residents are often at different stages of cognitive impairment, and person-centered care guides the geropsychology professional working in long-term settings to individualize care and provide supportive services commensurate with (but not more than) the needs of the individual. It is now recognized that a person-centered assessment approach which honors the client as the main focus of the evaluation and emphasizes strengths as well as weaknesses will yield the maximal information to assist with intervention decisions based on a choice of these models.

There are a variety of conceptual models to guide a geropsychologist when trying to manage the behavioral problems that may arise during the course of dementia. The most fundamental learning-based framework is the antecedent-behavior-consequences model (A-B-C approach). After describing a particular disruptive behavior, geropsychologists must determine what occurs before and after in order to define and change reinforcement contingencies. Kunik et al. (2003) identified mutative and non-mutative factors that are related to behavior problems and emphasize the need for a thorough assessment of the mutative variables such as depression, psychosis, pain, delirium, anxiety, etc. Volicer et al. (2007) view non-aggressive agitation as caused by understimulation and lack of engagement in meaningful activities. On the other hand, aggression is caused by poor caregiver technique such as rushing the person with dementia and not communicating with the person in a clear fashion. Algase et al. (1996) understand disruptive behavior as being caused by an “unmet need”; the job of mental health professionals in long-term care settings is to identify the need and organize the system to satisfy the need. All of these models may be viewed as complementary and not mutually exclusive. The role of the geropsychologist is to choose between these options on the basis of

which yields the most appropriate and viable interventions fitting particular residents.

There are a variety of studies documenting the effectiveness of behaviorally based psychological methods to reduce the problem associated with dementia and to help them engage in more prosocial attitudes. However, it should be emphasized that the existence of evidence-based interventions alone is not sufficient and that systemic change is necessary for an overall program to be sustained over time. For example, it has long been known of the necessity of “buy-in” from the administration to maintain ongoing training to uphold behavioral programs (Burgio and Burgio 1990). Making use of learning chunks and principles of immediate differential reinforcement, Camp et al. (2002) document many innovative strategies that mental health professionals can use to prompt residents to engage in more prosocial activities. In one recent large randomized controlled trial study that took place in a variety of Veterans Affairs sites across the USA, a combination of meaningful activities, teaching nursing aides improved communication skills, and the A-B-C approach produced statistically and clinically significant improvements in resident behavior (Karlin et al. 2014).

### **Treatment of Patients with Adjustment Disorders (Anxiety, Depression)**

In the recent years, there has been a growth in the evidence base for the treatment of depression and anxiety, often caused by difficulties in adjustment to long-term care settings. Cognitive behavioral therapy (CBT) is one such evidence-based strategy for use in the treatment of depression in older adults, as well as a variety of other psychological problems across the lifespan (Gallagher-Thompson et al. 2008), but needs to be modified for frail older adults. There is an accumulating body of knowledge that such CBT adaptations work and that treatment of depression may also yield benefits in self-esteem and functional abilities, although it is unclear how long such effects last. Another intervention that has been used to decrease depressive symptoms in long-term care

residents with depression is reminiscence. Haight et al. (2000) conducted a study of 52 newly admitted nursing home residents who were not severely cognitively impaired and who received a life review intervention. The authors found reductions in depression and improvements in quality of life and self-esteem that maintained for 3 years.

Research on the treatment of anxiety disorders in long-term care settings has lagged behind research on depression, even though anxiety disorders often co-occur with physical and psychiatric conditions such as depression. It should be noted that in general the treatment of anxiety in community-dwelling older adults has yielded somewhat disappointing outcomes in terms of effect sizes compared with younger adults. Nonetheless, evidence-based interventions that have been used with some success for older adults in community settings may be altered for implementation in long-term care settings. Creative non-pharmacological strategies such as mindfulness, commitment therapy, and spirituality are currently being piloted with older adults and may then be modified for use in long-term care.

Existing chronic conditions in addition to normal, age-related declines in sensory systems may impair the identification of adjustment disorders. Left undetected or untreated, adjustment disorders can exacerbate comorbid medical or psychiatric conditions, extend recovery time, and increase risk for mortality (Prince et al. 2007). Successful treatment of depression and anxiety through a combination of non-pharmacological and pharmacological interventions suited to the needs of the infirm individual will reduce disease burden and improve quality of life.

### **Residents with Personality Disorders**

Residents with personality disorder (PD) are frequently brought to the attention of nursing home staff. Lifelong behavioral patterns that grate on others may be further exacerbated in a communal living situation which the individual with PD often feels was involuntarily imposed and unnecessary. Those with Cluster B PDs (i.e., borderline, antisocial, histrionic, narcissistic) have particular

difficulties in these settings where long-suffering spouses or relatives no longer buffer their impulsive, self-indulgent personality styles. Geropsychologists may be forced to generate treatment options that take into account the limited strengths of their overall personality profile and must model a way of engaging with the resident in a respectful manner without endorsing their disagreeable behaviors. They must work closely with the rest of the treatment team to coordinate plans of care and prevent the splitting which transforms staff members into adversaries rather than collaborators in providing consistent care. However, those with Cluster A (schizoid, schizotypal, paranoid) PDs stay to themselves and may become reclusive. Although such isolation may not cause problems for the staff and other residents, it could maintain a low quality of life for the resident if active attempts are not made to engage with the resident. It should be mentioned that Cluster C dependent PDs may do well in the hierarchical environment of the nursing home where they can easily find some staff member willing to tell them what to do. One other note regarding PDs in long-term care settings is that geropsychologists must use their expertise in assessment to determine when psychiatric symptoms are exacerbating premorbid personality traits. In these cases, protocols that address both symptoms and interpersonal styles should be recommended.

There is little controlled research on the treatment of PDs in long-term care, but dialectical behavior therapy and schema therapy, which address a PD person's core beliefs about oneself, relationships, and the world, hold promise for the treatment of older adults with PD in community settings and may be adapted for use in institutional settings for those with significant cognitive impairment.

### **Interdisciplinary Treatment Teams**

Although it has been known clinically for many years, a growing science now supports integrated care, suggesting that the coordination of care in interdisciplinary settings is especially effective for older adults. Countries where the long-term care

continuum is still developing should establish coordinated care systems throughout the formal and informal network that encourage an interdisciplinary team-based approach. This affords these countries an opportunity to set interdisciplinary treatment teams as the standard for care practices, avoiding any resistance that may occur when incorporating treatment teams into existing health-care systems. Bartels et al. (2002) maintain that a multidisciplinary team approach with a psychiatrist integrated into the team framework (combining education of staff and consultation with residents) trumps a traditional consultative model. In like manner, as a member of an integrated team, geropsychologists must be aware of the roles of the other team members, respect the professional activities of the other disciplines, and yet also provide the psychological specific aspects of care. For example, responding to a national Centers for Medicare and Medicaid Services (US government-sponsored health programs) initiative to reduce antipsychotic medications in nursing homes, geropsychologists are now working with geriatricians, pharmacists, nurse practitioners, and social workers to achieve this worthy goal. This initiative requires a coordinated effort from a variety of disciplines, but geropsychologists have a specific role to play to educate other professionals, particularly long-term care staff, regarding how to implement learning principle-based psychological protocols to reduce the behavior problems that so often trigger the prescription of psychoactive medications.

### **Flourishing: Quality of Life in Long-Term Care**

Long-term care settings frequently stir negative images of aging and of dying without proper care. However, it is important to realize that there are many long-term care geropsychologists who believe that humans are very adaptable and can have a good quality of life at any developmental stage given the proper environmental support. Individuals who endorse the Pioneer Network philosophy adhere to the idea that those with dementia should always be accorded respect and

be allowed to make decisions consistent with their own unique pattern of abilities and interests (Fagan 2003). The Eden Alternative philosophy promotes a person-centered positive relational environment to counter the “three scourges of loneliness, boredom and meaningfulness” (Thomas 1994). In recent years, “small houses” have been built that further humanize the environment and allow more of a homelike atmosphere where the boundaries are further broken down between resident and formal caregivers. Kane et al. (2007) evaluated these programs and find that they do promote better care and better quality of life, although the specific ingredients of “edenization” that are core components of successful outcomes have not yet been identified.

### Training in Long-Term Care

As experts on mental health care in the long-term care setting, geropsychologists must spend time educating nursing home staff about the psychological needs of residents and particularly how to prevent mental health problems. Nursing aides are the least educated nursing home staff, yet spend more time with the residents than any other staff members. There are a number of excellent online programs that can help train nursing home staff to address the psychological needs of residents with dementia, and geropsychologists can play a role in moderating discussions of the content of these programs as well as consulting with difficult “live” cases. They will need to supplement this material on dementia with presentations on SMI, depression, anxiety, PD, etc., to satisfy hardworking and motivated administrators and staff who try to “do the right thing” and yearn for more knowledge in these areas.

Perhaps an even more important issue is the lack of geropsychology training in psychology graduate school programs and specifically regarding mental health in long-term care. Standards of practice for long-term care psychological services have been published, and there are a number of books and edited volumes in this area. However, many psychiatrists providing services in long-term care settings may not be aware of the growing evidence base in this area, especially if they have

not taken formal coursework in graduate school or supervised externship, internship, or fellowship practice in long-term care. Psychologists in Long-Term Care (PLTC) is a group of psychologists who provide services, do training, and conduct research in long-term care settings. This organization is a wonderful resource with an active LISTSERV that serves all those who work in long-term care. Unfortunately, a well-defined set of competencies in long-term care has not been delineated from basic geropsychology competencies. Such an examination sponsored by PLTC is now in process and may set the stage for psychologists without formal long-term care training to recognize their strengths and weaknesses so that continuing education credits or supervised consultation can target and remedy deficits. In this way, geropsychologists will be able to deliver state of the art assessment and intervention services to this most vulnerable population.

### Cross-References

- ▶ [Aging and Psychological Well-Being](#)
- ▶ [Mental Health and Aging](#)
- ▶ [Training Psychologists in Aging](#)

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## Psychological Theories of Successful Aging

Hans-Werner Wahl<sup>1,2</sup>, Jelena S. Siebert<sup>1</sup> and Benjamin Tauber<sup>1</sup>

<sup>1</sup>Department of Psychological Aging Research, Institute of Psychology, Heidelberg University, Heidelberg, Germany

<sup>2</sup>Network Aging Research (NAR), Heidelberg University, Heidelberg, Germany

## Synonyms

Active aging; Healthy aging; Positive aging; Productive aging

## Definition

The construct of successful aging has found a number of definitional efforts. In the most established ones, high physical and mental functioning, low risk for disease and functional loss, high engagement with life, and high well-being are emphasized.

## Successful Aging and Psychological Aging: Historical Context

The vision to develop successfully lies at the heart of lifespan developmental psychology and

developmental science at large. Successful development in early life and across the first half of life, particularly early adulthood, has been a major target of theory construction and empirical research in developmental psychology. However, the issue of successful development entered psychological aging research rather late, although the concept of successful aging has been treated since the beginning of the 1960s by scholars such as Robert Havighurst (1961). Indeed, Havighurst argued that both the disengagement theory and the activity theory may be seen as opposing explanations for successful aging. It is also remarkable that even earlier lifespan-oriented ideas such as those expressed in Carl Gustav Jung's radio essay "Die Lebenswende" (Life Transition) held in 1930 and those in the widely acknowledged life-stage model of human development suggested by Erik H. Erikson (1950) were optimistic in that developmental and personality growth and thus successful aging can happen through the very end of life. Gerontology's view of old age in the 1950s and 1960s was dominated by deficit-oriented perspectives, and geropsychology was no exception. For example, research related to cognitive performance, sensory functioning, social relations, health occurrences, and the influence of "pressing" environments – as well as some of the findings related to the aging self and "remaining" coping modes in old age – saw major loss components accompanying the psychological experience of old age. Emerging research on advanced old age since the middle of the 1980s (and what some have called the "fourth age") further strengthened more negative views of psychological aging and the pronounced limits of the human condition in very late adulthood, hence possibly undermining any "successful" developmental pathway connected with growth (Baltes and Smith 1999).

At the same time, it also became apparent that interindividual variability in all major psychological systems is large in old and very old age; calendar age is among the less important predictors of key development outcomes such as well-being. In other words, considerable portions of old as well as very old individuals are able to preserve psychological functioning to a major extent until

death. Furthermore – what now has found its place in psychological aging research as the paradox of well-being – even very severe threats to human development, such as chronic health impairments and interpersonal losses, are not able to durably undermine a given degree of well-being as people age (Kunzmann et al. 2000). Also, rates of major depression in those 65 years and older are lower as compared to younger ages (Zarit 2009). Most importantly, it also became clear that old age is accompanied by considerable developmental reserve capacity and thus plasticity, although it could be that many older adults are not in a position to fully unfold their latent developmental reserves due to persisting age-unfriendly environments, disengagement-provoking ecologies, and negative age stereotypes (Baltes and Baltes 1990; Miche et al. 2015). Finally, the reserve capacity argument found additional support by relying on and cultivating ideas of individuals as producers of their own development (Lerner and Busch-Rossnagel 1981). A major area has been illness prevention, for which longitudinal data revealed that even very serious negative outcomes such as cancer, disability, and dementia-related disorders are to a significant extent dependent on controllable behavioral factors across the lifespan (Fries et al. 2011). Hence, resources as well as lifespan-long behavioral options to shape aging for the better seem available; thus, successful development through very old age increasingly moved from being a vision to an empirical reality. However, controversies about successful aging, what is meant with this term, and whether it can be achieved by a majority of older adults or is the privilege of an elite group of older adults remained until present.

The aim of this entry is to offer in a rather balanced way a number of perspectives on successful aging, some of which may not be commensurable with others. Indeed, the array of successful aging is full of ambiguities, but nevertheless important to consider in geropsychology. First, a number of fundamental ideas and issues related to successful aging as well as its definitions and theoretical avenues are highlighted. Then a differentiation between outcomes and processes is used to address key issues related to

successful aging, such as variants of well-being research (outcome oriented) and models of developmental regulation (process oriented). Next also specific subgroups (e.g., minority groups) are addressed by asking for the relevance, potential, and risk of applying the concept of successful aging to such populations. This entry ends with recommendations such as better following a pluralistic understanding of successful aging instead of being too narrow from the start.

### **Fundamental Issues Related to Successful Aging as a Psychological Concept**

To begin with, one may question the usefulness of the term “success” at large for the behavioral sciences. Success generally seems to be quite an ambiguous term in science as well as in everyday contexts (Baltes and Baltes 1990). Even in sports, success is not always clearly defined and is a relative qualification in many areas, such as career, income, educational pathways, social relationships, or what is called “life success.” Such ambiguity notwithstanding, success is (at least in Western societies) also generally accepted to indicate unusually positive development and often also a “better than others” qualification in whatever area considered. “Successful” may also be (and is most frequently) applied not solely to individuals but also to characterize groups or entities (e.g., the baby boomers may be characterized as more successful agers as compared to previous cohorts; societies may be qualified as more or less successful in dealing with their demographic aging challenges).

In psychology, terms such as successful coping or “successfully” coming to a solution in a cognitively framed experiment can be found, but it seems that reservations exist in using the term too frequently and too broadly. A major reason for being cautious with the term “success” in psychology is the difficulty in relying on generally accepted criteria for success while avoiding being extensively normative. On the other hand, psychology also made strong cases in regard to value judgments – for instance, in positive

psychology, which stresses the role of virtues such as altruism or mindfulness as criteria for a “good life.”

In light of psychology’s caution to restrict the use of the term “successful,” it is an interesting observation that it found extensive use particularly in geropsychology, given the prevailing existence of negative stereotypes of old age. However, Baltes and Baltes (1990), as well as Rowe and Kahn (1997) – both important promoters of the idea of successful aging – have argued that it may be important to use a strong term such as “successful” to efficiently counteract negative views of aging. Going further, both of these author teams also made it very clear that the distinction between “normal” and “successful” aging is a critical one. According to these scholars, normal aging is what one sees in the majority of older adults in terms of well-being, autonomy, how they view their own aging process, how long they live on average, how their physical and mental health and multimorbidity unfold, and how they die. Think of well-being and the robust and paradoxical finding that older adults report high well-being to a large extent (Kunzmann et al. 2000). In addition, a considerable number of older adults also describe their subjective health as good – even in the face of serious disease and functional loss – which seems to be a key source for maintaining well-being (Baltes and Smith 1999). In some contrast, successful aging means that available reserve potentials in various areas (e.g., cognitive function, health, functional ability) are used as much as possible. As is further assumed, this in turn leads to increased longevity, less and shorter late-life health occurrences, and less and shorter periods of dependency on others. This discussion brings one to the important question of which criteria one might use for successful aging.

### **Successful Aging: Definitional and Criteria Issues**

In terms of content, a number of definitions of successful aging have been suggested, though researchers continue arguing which of the concepts describes “aging successfully” best

(Cosco et al. 2014). An influential definition has been proposed by Rowe and Kahn (1997), a geriatrician and a social psychologist. Their concept is based on three components: 1. low risk of disease and related disability, 2. high cognitive and physical functioning, and 3. continued active engagement in life. Despite its conceptual impetus, impact on previous definitions, and linkage with empirical insights – particularly, the MacArthur Studies of Aging – critical voices are constantly accumulating. For example, Villar criticizes that defining criteria of successful aging in such conceptions are seen as supposedly universal and objective, which renders only a small privileged group to meet the required standards of aging successfully (Villar 2012). According to this critique, solely relying on “hard” criteria of successful aging may make the group of successful agers a surprisingly small population in empirical reality (e.g., Hank 2011); in particular, this approach runs the risk of excluding major parts of the population, such as the very old, the socially disadvantaged, or those with severe functional impairment, many of whom enjoy their lives despite their aging under challenging conditions (see also below). That is, omitting subjective criteria in defining successful aging may neglect a person’s perceptions and evaluations of their lives. Furthermore, only relying on hard criteria may ignore the “agentic” nature of individuals and their ability to cope and adapt and by this means produce their own desired development (see again Lerner and Busch-Rossnagel 1981).

In line with Baltes and Baltes’ (1990) now classic chapter on successful aging, we argue that a multiple-criteria approach is needed that encompasses objective and subjective criteria. Objective criteria frequently addressed as indicating successful aging include length of life, biological health, mental health, and cognitive efficacy, whereas subjective criteria cover cognitive and affective well-being, control and mastery, and fulfillment in terms of social relations. There are also criteria that fall in between the objective and subjective realm, such as productivity and

engagement for others. Although consensus on the range and content of such criteria has been achieved to a large extent including the need to consider objective as well as subjective criteria, no consensus has been achieved on the relative weight and importance of these criteria. Seen in the light of Baltes and Baltes’ view (1990), models such as the Rowe and Kahn (1997) approach may be seen as containing only a subset of the realm of criteria related with successful aging and should therefore be treated with caution, when used as stand-alone models of successful aging.

Additional views on successful aging include the question whether geropsychology should rely on circumscribed normative or ideal state-oriented value judgments or should prefer a more general understanding that addresses successful aging rather content free (e.g., no defined single outcomes or goals) in terms of the adaptational efficiency. A classic example for the first position would be the already-mentioned theory of lifelong personality development by Erikson (1950), according to which generativity, ego integrity, and wisdom are the ultimate goals of late human development (e.g., Erikson et al. 1986). Now classic views for the second position are established models of human development, such as the model of selective optimization with compensation (Baltes and Baltes 1990; see also below). Both the normative and the general adaptation-oriented views also argue that “successful” must always include the planning and optimization of environments of aging; thus, development-enriching contexts able to unfold a maximum of reserve capacity of late human development are important for any consideration of successful aging.

Finally, studying laypersons’ perspectives underlines that the understanding of successful aging by older adults themselves is facet rich (Bowling and Dieppe 2005; Phelan et al. 2004). Jopp et al. (2015) found that, compared to existing psychological theories, laypersons’ view on successful aging indeed reveals more subdimensions, encompassing health, activities, social relations,

finances and psychological resources (such as well-being), and attitudes and life management skills.

### **Outcome Perspective of Successful Aging: Promises and Limits of Well-Being-Related Constructs**

Even though the conceptualization of successful aging proposed by Rowe and Kahn (1997) covers two inarguably basic elements, i.e., good health and activity at large the question remains who decides whether someone is living a good life and, therefore, is “aging successfully”? The answer to this question may not the least come from the older person her- or himself, hence how she or he experiences aging. Therefore, a central aspect in the ongoing discussion on successful aging has been the suggestion that an important complementary (psychological) view to models such as the Rowe and Kahn one (1997) would be the consideration of a subjective well-being judgment.

There are various conceptions of subjective well-being. A well-established differentiation is the one between a cognitive and an affective component, which divides well-being into (cognitive) judgments about a person’s satisfaction with life (and life domains) and an affective balance, which is described by high levels of positive affect and low levels of negative affect (Diener 2000). Well-being has also been separated into hedonic and eudaimonic well-being (Deci and Ryan 2008). While hedonic well-being is affect oriented, eudaimonic well-being is about “living well,” hence the actualization of one’s potentials and the achievement of personal happiness by referring to generally accepted virtues. The concept of eudaimonic well-being obviously adds much to the concept of successful aging, particularly shown by Carol Ryff’s multidimensional model of psychological well-being (Ryff and Singer 2008). Ryff’s six dimensions of psychological well-being – self-acceptance, autonomy, personal growth, purpose in life, environment mastery,

and positive relationships – offer important differentiations to understanding successful aging in more subjective terms (e.g., Ryff 1989). One may argue that Ryff’s conceptualization lacks a definite description explaining how successful aging can be achieved in accordance with the six dimensions. Nevertheless, Ryff’s model appears as rather comprehensive, in terms of psychological understanding of successful aging, while mostly operating at an “advanced” descriptive level of successful aging.

In conclusion, a comprehensive theoretical and empirical psychological approach to the concept of successful aging underscores the importance of defining respective outcomes in terms of a multidimensional understanding of well-being. Although it continues to be important to reconcile the hedonic versus eudaimonic view of well-being to infuse psychological models of successful aging, there is a clear need that mostly objective medical views (Rowe and Kahn 1997) should be extended by the older adults’ subjective evaluations of what successful aging means for them.

### **Process Perspective of Successful Aging: Promises and Limits of Emphasizing Adaptational Dynamics**

Instead of an optimal state characterized by specific criteria (or outcomes), some scholars view successful aging as a dynamic process, emphasizing the importance of adaption and self-regulation across the lifespan (see Baltes and Baltes 1990). A fundamental issue in this regard is that human development implies the constant interplay of losses and gains; however, as one ages, one’s balance changes with losses and threats becoming more pronounced (Baltes 1987). Given this inevitable double-track, defining successful aging merely as an attainment of gains or absence of illness may be a too narrow view. In order to do justice to the complexity involved, four of the most prominent lifespan theories are briefly addressed that describe optimal human development in light of the gain-loss balance.

Within the framework of selective optimization with compensation (SOC model, Baltes and Baltes 1990), successful development is conceptualized as minimizing losses while maximizing gains across one's lifetime via selecting areas of functioning, optimizing the use of available and selected resources, and compensating deficiencies with alternative means to maintain functioning. As is also argued, selection can be *elective* (if guided by individual preferences) or *loss based* (if goals are given up or are reorganized due to losses or resource restrictions). From the vantage point of the SOC model, successful aging therefore means the optimal orchestration of all three processes according to remaining resources and possible constraints imposed by external forces or the experience of critical life events.

How the perception of a shrinking time horizon contributes to successful aging has been addressed by Carstensen's socio-emotional selectivity theory (SST, e.g., Carstensen 2006). SST maintains that when future time perspective becomes shorter, people invest more time and energy in emotionally meaningful goals and activities to satisfy their needs. In particular, older adults become more selective in choosing close relationships (over knowledge-related goals) and in optimizing positive emotional experiences at large by wise selection of respective ecologies able to support such searched experiences. Although the shortened time horizon is a given in human development, SST assumes that developing individuals are proactively and flexibly shaping their search for the positive in life and thus their successful aging process.

Dealing with goals also lies at the heart of two other well-established lifespan developmental theories: the dual-process model of assimilative and accommodative coping (Brandtstädter and Renner 1990) and the motivational theory of lifespan development (Heckhausen et al. 2010). The dual-process theory, (Brandtstödter and Renner 1990) posits two mainly antagonistic coping modes that enable aging individuals to maintain a positive identity across the lifespan. Assimilation reflects persistent efforts to actively modify life circumstances to one's preferences and goals

("changing the world"), whereas accommodation involves a flexible adjustment of personal values and aims to situational constraints or limitations ("changing the self"). A major means to age successfully according to this model is the tendency to increasingly engage in accommodation modalities as people age.

The motivational theory of lifespan development views the maximizing of primary control as the key to successful aging (Schulz and Heckhausen 1996). The model distinguishes between two control-enhancing strategies: primary control (targeting the external world and changing the environment to fit one's particular needs) and secondary control (focusing on the self and changes within the individual). If goals are increasingly blocked due to the experience of aging, switching to secondary control is a major means to secure successful aging. Thus, successful aging in this process predominantly appears as the "art" of giving up or altering goals no longer attainable at the right point in time, but to continue to maintain goal striving wherever possible and feasible, thus stabilizing the lifelong striving for primary control.

Though these shortly reviewed lifespan theories differ in their specification of which adaptive mechanisms are relevant to successful aging, they converge in their assumption that successful aging is embedded in a lifelong process emphasizing agency and the possibility of the human choice potential (for a profound comparative review, see Boerner and Jopp 2007). Going further, according to these models, adaptive self-regulation is achieved through engagement in processes of goal setting and goal pursuit, disengagement of unattainable preferences, or reengagement in valued alternative goals. Although it seems helpful that lifespan adaptational models do not assume specified outcome criteria for successful aging and therefore have flexibility in their application to individual developmental trajectories, it is questionable whether they can operate without outcome criteria such as well-being or depression. Indeed, these and similar concepts are frequently used while empirically testing these models (e.g., Haase et al. 2013).

## Successful Aging and Specific Groups of Older Adults: Examples

### Minority Groups and Socioeconomically Disadvantaged Older Adults

There is high consensus that minority status has an important impact on various dimensions of living, but there continues to exist a lack of data on aging minority populations (see Federal Interagency Forum on Aging-Related Statistics 2004). Elders belonging to minority groups are described to have fewer psychological and social resources, which may result in higher vulnerabilities to life stressors (e.g., Thoits 1982). However, the evidence on health, physical activity, and subjective well-being of aging minority groups is mixed. For example, Kessler and Neighbors found in the 1980s that African American older individuals report more psychological distress than whites, when suffering from low income, but the gap was smaller when income increased (Kessler and Neighbors 1986). More recently, a study showed the opposite, i.e., African American older adults were significantly less distressed than their white counterparts in this study (Kubzansky et al. 2000). Most importantly, one may question whether established models of successful aging are equally applicable to minority groups and different cultures at large or whether a more differentiated and culturally informed perspective may be in place.

Being socioeconomically disadvantaged increases the risk for experiencing health problems and lowered well-being in old age (Britton et al. 2008). It is also an empirically well-established fact that although high income and education cannot buy happiness, having a certain level of both of these resources seems to infuse basic personal thriving, at least in Western society (e.g., Britton et al. 2008; Strawbridge et al. 1996). However, Palmore's classic (but now dated) study (1979) found neither intelligence nor years of education to influence successful aging, whereas social and physical activity revealed as highly predictive. More recently, McLaughlin, Connell, Heeringa, Li, and Roberts (2010) examined the prevalence of successful aging predominantly seen through the lenses of Rowe and Kahn's

approach in the USA and found that higher percentages of white as compared to African American and Hispanic older adults are classified as aging successfully. At the same time, increasing level of education and income considerably affected the percentage of adults aging successfully in all researched groups. Importantly, education and income remained noteworthy and significant predictors of successful aging, while the racial-ethnic disparities diminished, when taking both of these variables into account.

### Can Older Adults with Dementia-Related Disorders Age Successfully?

Dementia is a chronically progressing brain disease that causes major decline in cognitive and behavioral abilities and has become one of the most feared diseases (Kessler et al. 2012). When asked how long one wishes to live after being diagnosed with dementia, the answer of older adults aged 70 years and older is expressed in days rather than even in weeks not to mention longer periods (Lawton et al. 1999). Obviously, dementia has a great impact on the quality of life of those affected, accompanied by increasing dependency, burdened social relationships, and possible transitions to long-term care institutions. All this seems to exclude the possibility of successful aging. On the other hand, it may be too strict to exclude dementia-related disorders by default solely relying on a set of hard criteria as described above. For example, although respective evidence is limited (e.g., Birks 2006; Sitzer et al. 2006), it may be argued that impacting the "natural" course of the disease by means of pharmacological and non-pharmacological intervention in terms of prolonging a phase of relative independence may be seen as successful aging for this specific group. Going further, studies indicate that people with dementia, at least to some extent, try to adapt to and cope with the experiences of changes caused by the illness and are not just pawns of the disease (Bahro et al. 1995; Clare 2003). Also, studies targeting the quality of life of individuals with dementia have found that meaningful social and other activities, spirituality, as well as a pleasurable daily routine may remain a

possibility even in the face of dementia, although this may only apply to subpopulations of the demented (e.g., Ettema et al. 2005; Kane 2001). Hence, although a lot of conceptual and ethical questions remain open, it may be that even in extreme cases and, as many would say, highly restricted conditions of human aging, the possibility of successful aging should be considered.

### **Outlook: Does Geropsychology Need the Concept of Successful Aging?**

It has been the goal of this entry to address the complexity and ambiguities related to the concept of successful aging. For example, one may raise the question as to whether the term “successful” is a good term for the psychology of aging. It seems obvious that we are far from coming up with the final answer regarding which kind of role successful aging should play in future geropsychology. However, some recommendations may be in place as follows: First, a pluralistic approach to successful aging is advisable. In particular, a profound and facet-rich discussion on successful aging is an intellectually and practically enriching resource for geropsychology per se. Second, it is recommended that researchers referring to constructs such as successful aging should make – in light of various approaches described above – their own approach very clear and explicit. Third, it is of the utmost importance to consider the full multidimensionality of successful aging, including subjective and objective criteria, as well as lay people’s descriptions. Any conceptualization coming with proposals to reduce this set to a subset of dimensions in whatever direction must be challenged to make the rationale behind its selection as explicit as possible. Fourth, a visionary component of what is possible in late life is an important element of any concept of successful aging. Here, the idea of latent reserve capacities and forms of expression of aging are taking up, which need additional effort to become fully unfolded (see also Rowe and Kahn 1997). This idea also corresponds with Riley and Riley’s concept of structural lag and the

assumption that there may be forms of successful aging already appearing in older adults still not reflected in societal institutionalizations and policy (Riley and Riley 1994). At the individual level, successful aging explicitly addresses the possibility of developmental growth and potentially questions the assumption that growth is more the exception than the rule in old age (Baltes et al. 2006). Hence, the fundamental distinction between “normal” and “successful” may lose some of its importance in the future. Instead, it may become more critical, whether older adults, in whatever kind of situation, are using potentials still available or not. Consequently, as a fifth point, it is suggested that any conceptualization of successful aging must take major challenges of aging into consideration, such as aging as a member of a minority group or as a demented individual with pronounced care needs.

In conclusion, geropsychology should not abandon or even ban the construct of successful aging from its portfolio of key concepts due to all its ambiguities and possibly its tendency to further elite thinking in psychological aging research. However, a highly differentiated use of the concept of successful aging is essential and may indeed significantly infuse the conceptual and empirical future of geropsychology.

### **Cross-References**

- ▶ [Activity Theory, Disengagement Theory, and Successful Aging](#)
- ▶ [Aging and Psychological Well-Being](#)
- ▶ [Adaptive Resources of the Aging Self, Assimilative and Accommodative Modes of Coping](#)
- ▶ [Motivational Theory of Lifespan Development](#)
- ▶ [Life management through Selection, Optimization, and Compensation](#)

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## Psychological Theories on Health and Aging

Susanne Wurm<sup>1</sup> and Benjamin Schüz<sup>2</sup>

<sup>1</sup>Institute of Psychogerontology, Friedrich-Alexander Universität Erlangen, Nürnberg (FAU), Germany

<sup>2</sup>Division of Psychology, University of Tasmania, Hobart, TAS, Australia

### Synonyms

Healthy aging; Psychological adjustment; Psychological concepts

### Definition

Psychological Theories on Health and Aging refer to approaches that explain how healthy aging can be promoted and how diseases can be prevented or delayed. They provide starting points for interventions to support adaptation to health-related changes that become more and more prevalent in later life.

### Introduction

Since the mid-twentieth century, the world population has experienced a significant increase in life expectancy and in the proportion of older adults in the total population. Population aging is essentially driven by increasing longevity and reflects that more people will survive to the oldest ages (United Nations, Department of Economics and Social Affairs, Population Division 2013). A general and global increase in average life expectancy implies the question of whether these additional years will be spent in good health and highlights that the understanding of health in old age needs to be improved.

As people grow older and older, their health changes. There are obvious age-related physiological changes including changes in hearing, vision, lung function, bone density, digestion,

and a range of other physiological structures and functions (Aldwin and Gilmer 2013). From an epidemiological perspective, increasing age also indicates an increasing likelihood of having multiple illnesses. One of the most important questions is whether the increasing life expectancy in the total population is associated with a net gain of years in good health (compression of morbidity) or more years spent with increasing health problems (expansion of morbidity). Psychological theories on health and aging can help to explain how older adults experience, understand, and behave towards their health. With the help of these theories, an understanding can be gained of how health in older adults differs from younger adults, how subjective perceptions of aging and health interrelate, and whether there are factors that are specific to explaining and improving health and health behaviors in older age. This entry aims at describing some of these age-related phenomena in more detail, reviews key theories and frameworks of health and aging (for an overview of the selected theories and frameworks for this entry see Table 1), and shows how the potential for health promotion in old age can be tapped into using appropriate psychological theory and evidence.

## Health in Old Age

The terms *health* and *illness* are often associated with medical classification systems, in particular the International Classification of Diseases and Related Health Problems (currently ICD-10). According to such classification systems, a person is ill if a physician diagnoses a disease and considered healthy otherwise. However, health is more than the absence (or nondiagnosis) of diseases, as acknowledged in the World Health Organization's (WHO) definition of health. Adopting a biopsychosocial understanding of health, health in old age is the result of an interaction of protective and risk factors on the biological, psychological, social, and the environmental level. This means that the consequences of and the reasons for a disease depend both on the physiological state and on psychosocial resources of the older individuals themselves as well as their personal

setting, access to medical care, and the societal context in which they live. The International Classification of Functioning, Disability and Health (ICF) of the WHO (2002) considers these dynamic and complex interactions between a health problem and the respective personal and environment-related factors. The ICF can be applied to examine functioning, disability, and health in all age-groups, but its range of meanings becomes more important in old age due to health changes that often accompany aging in later life. In the following, two major changes of health in later life will be introduced briefly before considering psychological indicators and predictors of healthy aging.

## Multimorbidity as Particular Challenge in Old Age

One particularly relevant aspect of health in old age is an increase in the likelihood of suffering from multiple illnesses at the same time, and these can either be physical or mental illnesses or a combination of both. The majority of adults in the age-group of 65 and older have two or more chronic illnesses.

With multiple illnesses come multiple challenges. Older adults with multiple illnesses are more likely to experience further health deteriorations, face the burden of symptoms of different illnesses, are in particular need of being able to access health care, and often experience lower quality of life than people in the same age-group with fewer or single illnesses (for an overview, see Fortin et al. (2007)).

## Is There a Decrease or Increase in Morbidity?

The high prevalence of illnesses and multimorbidity in old age together with increasing life expectancy has raised the question of how healthy people are in their final years of life. Are these additional years of life a net gain in lifetime that people remain active and in good health, or are these primarily years in which they face disabilities? The discussion about compression versus expansion of morbidity started in the late 1970s and is still alive and well. In broad terms, three scenarios dominate the discussion (for an overview, see Laditka and Laditka (2009)).

**Psychological Theories on Health and Aging, Table 1** Theories and frameworks relating to health and aging

Main focus of theory (outcome or process)	Name of theory	Concepts and predictions	Authors	Specific to age?
I. Health and well-being	Ia. Successful aging framework	Successful aging = low probability of disease + high functional capacity + active engagement with life	Rowe and Kahn (1997)	Yes
	Ib. Response shift theory	Differential change processes – alpha change (change in health), beta change ( <i>recalibration</i> of the underlying scale assessing health) or gamma change ( <i>reconceptualization</i> of the meaning of health) – allow people to maintain similar levels of self-rated health despite objective changes in health	Schwartz and Sprangers (2000)	Yes
	Ic. Common-sense model of health and illness	People draw on subjective representations of illnesses and treatment when faced with a health threat – and these representations guide their response to illness in that e.g., being diagnosed with an illness that is perceived as more controllable will lead to less distress and more control efforts such as adherence to treatment	Leventhal et al. (1992)	No
II. Coping with developmental challenges	Iia. Life management strategy of selection, optimization, and compensation	Individuals manage their lives through three processes of developmental regulation: Selection focuses on setting goals, optimization refers to investment in goal-relevant means, while compensation includes alternative means to maintain a given level of functioning when primary goal-relevant means are no longer available	Baltes and Baltes (1990)	Yes
	Iib. Dual-process model of developmental regulation	In the face of diminishing resources, people can either increase goal pursuit (tenacious goal pursuit) or adjust goals to current resource level (flexible goal adjustment). If resources are sufficient, goal pursuit leads to more adaptive outcomes, if resources are scarce, goal adjustment	Brandtstädter and Renner (1990)	Yes
	Iic. Motivational theory of life-span development (MLD)	Key criterion for adaptive development is the extent to which individuals experience primary control of their environment in different life domains and across the life span. From midlife to old age, capacity of primary control declines. A large challenge for individuals is therefore to adapt to these changes and to choose due goals to engage with and to give up unattainable goals	Heckhausen et al. (2010)	Yes
	Iid. Lines of defense model	Based on the MLD, the model identifies specific health goals and functioning goals as well as control strategies, dependent on the level of disease. Three lines of defense are proposed: (1) maintain disease free status, (2) avoid chronic disease, and (3) maintain functioning in everyday life. According to the model, individuals strive at holding the respective line of defense as long as possible, and adjust when it cannot be maintained anymore	Heckhausen et al. (2013)	Yes

(continued)

**Psychological Theories on Health and Aging, Table 1** (continued)

Main focus of theory (outcome or process)	Name of theory	Concepts and predictions	Authors	Specific to age?
III. Stress and resources	IIIa. Broaden and build theory	Positive affect leads to an increased repertoire of behaviors and social bonds which in turn improve health and well-being	Fredrickson (2006)	No
	IIIb. Conservation of resources theory	Resource loss and expected resource loss lead to stress. The theory proposes that resource losses have a primacy to resource gains, i.e., individuals are highly motivated to conserve their resources in the light of losses	Hobfoll (1989)	No
IV. Cognitions related to health and aging	Stereotype embodiment theory	Societal images of old age (age stereotypes) are implicitly internalized over the lifespan resulting in self-perceptions of aging. Both age stereotypes and self-perceptions of aging are predictive of various health outcomes, including physical health, physical functioning and mortality. Physiological, psychological and behavioral pathways are used to explain how these views on aging and old age can turn into self-fulfilling prophecies	Levy (2009)	Yes

A first scenario, *expansion of morbidity* (E. M. Gruenberg, M. Kramer) argues that due to medical advances, disease-related fatality rates decrease in contrast to incidence rates, which is why more and more people survive severe illnesses and accidents. A second scenario, *compression of morbidity*, was developed by J. F. Fries. Fries argued that health problems could be postponed due to primary and secondary prevention and the time of impairments to health could be compressed to a shorter time before death. Finally, a third and integrative scenario assumes a dynamic equilibrium (K. G. Manton), that is, an increase in the number of diseases together with a decrease in the severity of these diseases. Compression of morbidity would stress the importance of prevention for healthy aging (e.g., how health behaviors can be promoted up to old age), whereas the expansion of morbidity would draw more attention to the question how people cope with enduring health problems and limitations. Both health promotion and psychological adjustment in later life are important topics of geropsychology.

There are some good reasons to expect better health in later birth cohorts, for example, higher average educational attainment, improved living

standards, or advances in medicine and public health. The latter, however, could also point toward an expansion of morbidity as better medical care also implies earlier and more reliable diagnosis of diseases as well as higher survival rates in case of severe health problems. Better medical diagnostics can be associated with an increasing number of diseases *without* an increase in the subjective burden of disease, because the increase might just reflect better knowledge of the diseases and improved diagnostic tools. Higher survival rates in the face of severe health problems, however, are more likely to be associated with increasing burden of disease in terms of long-term disabilities and activity restrictions. For example, a series of recent studies published in *Lancet* in 2012 based on The Global Burden of Disease Study 2010 suggest an expansion of morbidity by showing slower increases in *healthy* life expectancy than *overall* life expectancy based on 187 countries (Salomon et al. 2012). However, conclusions about compression or expansion of morbidity largely depend on how these terms are defined. The study cited above defined expansion as an increase in the *absolute* number of years lost to disability while the authors report that the findings are less clear and consistent for different

countries if *relative* measures (e.g., ratio of healthy life expectancy to life expectancy) are used (Salomon et al. 2012).

This illustrates that an unambiguous answer on the question of compression or expansion of morbidity is difficult. Existing studies suggest that now and for the foreseeable future, multimorbidity and disability will remain an important challenge and will become even more important due to the increasing number of older people in many societies around the world. At the same time, socioeconomic variations in healthy life expectancy point to the malleability of health in old age and to the potential for prevention. However, the consequences of multimorbidity and disability for autonomy and quality of life do not only depend on health care but also on how society as a whole and each single individual is able to deal with it.

### Theories on Psychological Adjustment Processes to Declining Health in Later Life

Apart from compression or expansion of morbidity, there are a range of closely related concepts that describe health in aging using terms such as “healthy aging,” “successful aging,” “optimal aging,” or “active aging.” Sometimes, these concepts are used interchangeably, as they all describe a state that includes good physical health, high functional and cognitive status, and active social participation. What these concepts have in common is a radical shift in the focus from deficit-oriented perspectives on health-related issues in old age, exemplified in the definition of *successful aging* by Rowe and Kahn (1997, p. 433): “We define successful ageing as including three main components: low probability of disease and disease-related disability, high cognitive and physical functional capacity, and active engagement with life.” (cf. Table 1, Ia).

#### Differences Between Being Healthy and Feeling Healthy

Both the age-related increase in (multi)morbidity and the increase in years spent with disabilities

(expansion of morbidity) pose the question of how these phenomena affect quality of life in old age. A psychological starting point that helps to explain the generally high levels of subjective quality of life in old age despite high prevalence of multiple illnesses is the concept of *self-rated health*. Most often, self-rated health (SRH) is measured with one single question asking individuals to rate their overall health on a scale from “excellent” to “very bad.” Studies have repeatedly shown that many people maintain good SRH up to old age despite worsening physical health. Correspondingly, the relationship of physical health indicators and SRH is closer in younger age-groups, while it diffuses in older age-groups (Pinquart 2001). In addition to the effects on health-related quality of life in old age, a large number of studies have shown that this single question on SRH is an independent predictor of mortality in later life, even after other health-related indicators such as medical or cognitive status and social status are controlled for (Idler and Benyamini 1997). This does not only mean that people with poor SRH are at higher risk for mortality, but also that those who maintain good SRH despite poor physical health may reduce their risk of mortality. Besides mortality, SRH has been shown to predict other health outcomes as well, for example, functional health, cognitive impairments, or recovery from diseases.

In the following, four approaches are presented to understand the high validity of SRH as a predictor for other health outcomes all of which are well evidenced by recent studies (Benyamini 2011): *First*, SRH is more inclusive than many other health indicators. It seems to reflect all possible states on the continuum from illness to wellness and therefore more than the existence (or absence) of a disease. This is also mirrored in the fact that SRH is correlated with physiological processes (e.g., inflammatory processes) that might indicate clinical or preclinical stages of a disease. *Second*, rating one’s health can be considered a dynamic evaluation process. People are able to maintain good SRH despite major health events which is explained by *response shift* theory (Schwartz and Sprangers 2000). Response shift encompasses a variety of cognitive processes

that lead to changes in the meaning of one's self-evaluation in SRH allowing stability in SRH despite declines in the objective health status. Such cognitive processes can include changes in internal standards of measurement (i.e., *recalibration* of what is considered good or poor health), changing importance of domains constituting SRH (e.g., higher *value* of positive affect or depressive symptoms for SRH in later life; (Spuling et al. 2015)), or a redefinition (*reconceptualization*) of SRH (cf. Table 1, Ib.). A *third* explanation for the validity of SRH lies in its relation to more preventive health behaviors, although this explanation is the least researched so far. *Finally*, SRH is related to a number of internal and external resources such as optimism, social support, or education. Better SRH could both be due to higher optimism or better education and could also lead to higher resources such as optimism or social support. The current state of knowledge suggests that SRH is a highly important health indicator that helps us to understand the potentials people have to adjust to adverse health outcomes and to live longer and better than their objective health status would give reason to expect. While concepts of healthy aging such as the successful aging framework focus more strongly on objective criteria such as physical and cognitive functional capacity, response shift theory is focused on the question how people adapt their subjective standards in order to maintain good self-rated health and quality of life.

### Adaptation to Illness

Psychological theories to understand individual adaptation to illness such as the Common-Sense Model developed by Leventhal et al. (1992) are also based on lay models, that is, they examine health threats from the perspective of the affected person. The Common-Sense Model of Self-Regulation of Health and Illness (Common-Sense Model for short, cf. Table 1, Ic.) assumes that adherence to treatment is a function of how an individual manages to make sense of his or her illness based on subjective illness representations. If someone experiences symptoms such as a runny nose and elevated temperature, this might activate illness representations pertaining to influenza in

this person. These subjective influenza representations could then (based on the person's knowledge and background factors) evoke beliefs about an acute rather than chronic course of the illness or a virus as the cause of the illness – which in turn could suggest to the individual that antiviral medication is the treatment of choice. Another set of symptoms, for example, being short in breath when climbing the stairs might be attributed to one's increasing age rather than indicating an illness – whether accurate or not. Currently, this and similar theories of adaptation to illness explain individual reactions and coping attempts to *one* illness. However, as mentioned above, most older adults suffer from multiple illnesses at the same time, which means that theories and models need to be adapted and extended in order to be useful tools to understand how people make sense of multiple illnesses. While response shift theory is mainly used in epidemiological and quality of life research, the commonsense model is popular in health psychology because it facilitates understanding the subjective reasons for (health-related) behavior of individuals with a diagnosed illness.

### Self-Regulation and Coping with Developmental Challenges

A number of theories on life-span development and aging also consider self-regulatory processes. Three prominent theories are the model of *selection, optimization, and compensation* (SOC, Baltes and Baltes (1990)); the *dual-process model of developmental regulation* (Brandtstädter and Renner 1990); and the *motivational theory of life-span development* (Heckhausen et al. 2010; see Table 1, IIa–c). These developmental theories are important tools to understand health in old age, because they focus on strategies for dealing with developmental losses such as the worsening of health. As all theories are described in more detail in other entries in this book, we will only focus on their commonalities. All three theories share the assumption that personal goals play a central role in development. Goals can refer to growth, maintenance, and recovery of already achieved goals, or the regulation of losses. While gain-related goals take center stage during the first

half of life, midlife marks a motivational shift from growth-related goals to an increasing focus on maintaining functioning and avoiding losses. Probably the most recent addition to these theories is the lines-of-defense model for managing health threats (Heckhausen et al. 2013) which is based on the motivational theory of life-span development. It identifies specific health goals and functioning goals as well as control strategies as a consequence of these goals, dependent on the severity or burden of disease. The model describes three lines of defense: (1) maintain disease-free status, (2) avoid chronic disease, and (3) maintain functioning in everyday life (cf. Table 1, II.d.). According to the model, individuals strive at holding the respective line of defense as long as possible and adjust when it cannot be maintained anymore. These approaches can improve our understanding how people face developmental challenges and how adaptive goal adjustments might look like.

### Resource-Based Stress Theories

Resource-based stress theories such as the *Conservation of Resources Theory* developed by Hobfoll (2011; cf. Table 1, III.a.) argue in a similar vein but have not been developed with a specific life-span perspective in mind. According to Conservation of Resources Theory, stress experience occurs when resources are threatened or lost. Physiological changes associated with aging as well as the increasing likelihood of severe diseases undermine important resources but also warrant investment of psychological, social, or financial resources to protect against resource loss, to recover from losses, or to gain resources. The theory also assumes that people are more motivated to avoid resource losses than gain new resources. As aging is linked to losing resources, individuals who are well equipped with resources will cope better with the challenges of aging than individuals with lesser resources. Within these approaches, resources encompass both tangible (money, social support) and intangible (psychological). The *Broaden-and-Build* theory (Fredrickson 2006; cf. Table 1, III.b.) poses that psychological resources such as positive emotions widen repertoires of imagination and action by

allowing the individual to explore the world, to practice skills, and to strengthen social bonds. The theory assumes that positive emotions do not only indicate but also produce health and well-being.

### Age Attributions and Self-Perceptions of Aging

Because irreversible losses become more and more likely with increasing age, the ability to accept inescapable losses and to give up unattainable goals becomes more and more important with age. However, aging itself is generally perceived as an unchangeable process that has to be accepted. Hence, if someone believes that physical losses are mainly caused by age, this might prevent the identification of symptoms as illness warnings and thus deplete motivation to avoid the losses feared. Several studies have addressed the propensity of older adults to attribute symptoms to “old age” and not to illnesses. These studies revealed that the attribution of symptoms to old age involves greater acceptance of illness symptoms, more passive coping, lower optimism, more detrimental health behavior, and higher mortality (Leventhal and Prohaska 1986; Prohaska et al. 1987; Stewart et al. 2011; Sarkisian et al. 2002). Similar findings exist for age stereotypes and self-perceptions of aging, suggesting that older adults with more negative views of old age in general and their own aging process in particular are less likely to invest in their health and face the risk of self-fulfilling prophecy (cf. Table 1, IV.). In recent years a number of longitudinal studies have shown that individuals with more positive self-perceptions of aging maintain better physical, functional, and self-rated health over time and also live longer than those with more negative self-perceptions of aging (Westerhof and Wurm 2015; Westerhof et al. 2014). These studies also show possible pathways explaining the impact of self-perceptions of aging on health and longevity; for example, a psychological pathway links personal control beliefs, will to live, and developmental regulation (SOC) to health, whereas physical activity has been shown to be an important behavioral pathway (Westerhof and Wurm 2015).

## Applying Psychological Theories to Promote Health in Old Age

Having argued that health changes with age, it is reasonable to ask how detrimental changes in health can be prevented or whether and how health in old age can be improved. There is compelling evidence that physiological aspects of health are amenable to improvements even to old age, for example, via increases in physical activity for those who are able to increase activity, or activating care that targets improved participation in everyday life. At the same time, these two examples highlight that the goals of health promotion in old age change as well. In many cases, improving health is not a realistic option, whereas stabilizing health is. In health promotion, this would correspond to a gradual shift from primary prevention (where the goal is the prevention of new illness) toward secondary (prevention of worsening) or tertiary (prevention of recurring illness) prevention in older age (Scholz et al. 2015).

The theories and frameworks discussed above can be applied to health promotion in old age. For example, Rowe & Kahn's Successful Aging framework outlines indicators (low probability of disease and disease-related disability, high cognitive and physical functional capacity, and active engagement with life) that can be translated into health promotion goals by examining the determinants of these indicators. Theories of health behavior such as the Health Action Process Approach or the Theory of Planned Behavior (for an overview of health behavior theories, see, e.g., Conner and Norman (2015)) outline such modifiable determinants and suggest that in particular self-efficacy or goal setting are relevant for physical activity in older adults.

These determinants can then be applied to improve aspects of successful aging such as social participation – for example, a recent study found that low-threshold social-cognitive interventions based on the Health Action Process Approach can increase volunteering behavior in older adults (Warner et al. 2014). Thus, theories of health and aging not only improve our understanding of age-related changes in health and

health concepts but provide a framework for improving health in age as well.

## Conclusions

Beginning with particular challenges for healthy aging such as multimorbidity and expansion of morbidity, this entry provided an overview of different psychological theories that can explain how older people are able to adapt to declining health. The discrepancy between physical and self-rated health (SRH) that increases with age may reflect a prominent ability of many older people. The ability to maintain good SRH in light of physical losses is able to predict future health outcomes, including longevity. However, more research is needed to better understand how people adjust their health assessment. For example, under which circumstances do people use the one or the other of the different types of response shift and how much is this related to health behavior? Moreover, how much does response shift depend on the socioeconomic and psychosocial resources and how much differ the adaptation processes not only by age but also between different birth cohorts?

Theories on adaptation to illness so far have focused on single illnesses. Thus, due to the increasing number of people with multiple illnesses our understanding of the lay models that people with multiple illnesses apply to their health status needs to improve. Do people, for example, view their illnesses separately or in their entirety, are they mostly concerned with one illness or with multiple illnesses, and do they perceive treatments and medications for multiple illnesses to complement, interact, or work against each other? Finally, how does this affect their overall health status?

The different psychological theories on healthy aging emphasize that there are multiple ways how people can adapt to health changes. As suggested by a number of theories, being ready to change the frame of reference and changing goals might be one of the most important adjustment tasks in old age, with health only being one of many domains where these principles can be applied.

However, finding one's own way and the right timing between goal engagement and giving up unattainable goals is a difficult balancing act in many cases. Current research suggests that positive emotions as well as positive self-perceptions of aging on health and longevity seem to be protective for health in later life. In contrast, the attribution of symptoms to old age seems to have detrimental effects, although this could also be considered a way of positive adaptation. More research is therefore needed to get better insight into how these different psychological mechanisms turn into health-relevant behaviors such as, for instance, exercise or health care utilization.

This entry outlined the relevant theories on health and aging originating from different psychological disciplines such as life-span developmental psychology, health psychology, or health-related quality of life research. The theories presented in this entry provide pathways to improve or stabilize health in old age by outlining determinants of health that can be targeted in interventions, and the entry has highlighted some examples of research where theories of health and aging have been successfully applied to improving health in old age.

## Cross-References

- ▶ [Age Stereotyping and Discrimination](#)
- ▶ [Age, Self, and Identity: Structure, Stability, and Adaptive Function](#)
- ▶ [Age Stereotyping and Views of Aging, Theories of](#)
- ▶ [Aging and Psychological Well-Being](#)
- ▶ [Aging and Quality of Life](#)
- ▶ [Attitudes and Self-Perceptions of Aging](#)
- ▶ [Comorbidity](#)
- ▶ [Disability and Ageing](#)
- ▶ [Life Span Developmental Psychology](#)
- ▶ [Motivational Theory of Lifespan Development](#)
- ▶ [Psychological Theories of Successful Aging](#)
- ▶ [Selection, Optimization, and Compensation at Work in Relation to Age](#)
- ▶ [Stress and Coping Theory in Geropsychology](#)
- ▶ [Resilience and Aging](#)
- ▶ [Social Support and Aging, Theories of](#)

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## Psychology and Politics

Andreas Kruse and Eric Schmitt  
Institute of Gerontology, University of  
Heidelberg, Heidelberg, Germany

### Synonyms

Policy counselling; Political consulting

### Policy Advice: Definitional Issues

In Anglo-American political science, it is common to distinguish between politics, polity, and policy (in German language, there is no similar distinction). Politics refers to a procedural dimension, i.e., processes of consent formation and conflict resolution that may result in intentional political action as well as “nondecisions.” Policy refers to a contextual dimension, i.e., specific fields of politics and respective tasks, challenges, and aims to be reached by intentional political action. Polity refers to values and institutions as underlying circumstances of policies, e.g., constitution, laws, communities, or administrative units. This entry focuses primarily on the contents of politics, more precisely on the impact of geropsychological knowledge and perspectives on aging policy. Aging policy depends on policy-makers’ – politicians responsible for shaping aging policy – appraisal of the actual situation of older people and age-related changes in society, including both judgments on status quo and actual discrepancy. Perceptions of actual discrepancy do not only refer to existing design possibilities (including intergenerational relationships) but also to cost-benefit considerations and aspects of generational equity. Obviously, aging policy cannot be based on “subjective aging theories” and incidental more or less adequate reception of scientific knowledge. Instead, sustainable aging policy requires continuous and institutionalized processes of political advice.

Policy advice is applied in a wide range of domains in municipal, provincial, and federal

politics. If one looks for the uniform, i.e., a characteristic feature for all the tasks of policy advice, the involvement in the *preparation* of policy decisions needs to be mentioned, whereby these decisions (a) are related to a narrowly defined, *specific* area, (b) have to be carried out quickly as action is needed, (c) are related to a comprehensive area and (initially) express a general tendency or orientation, and (d) can be carried out late, because there is no immediate need for action. The *wide range of fields of responsibility* can be characterized as follows: (a) elucidation of a comprehensive area, a detailed, “in-depth” representation; (b) the answer to a specific political issue (here too, a detailed “in-depth” representation often proves to be necessary); (c) the answer to a specific political issue with a “pro and contra” structure (here, specific arguments are presented and analyzed in detail and evaluated); (d) the evaluation of political decisions, which have already been executed, with the aim of continuing the corresponding measures which resulted from these decisions; (e) participation in the preparation of a decision which relates to a specific measure, a more comprehensive measure, or a whole range of measures (e.g., establishment of a comprehensive infrastructure for older people); and (f) discussions with political decision-makers on a specific topic, whereby the focus is on elucidation (in this discussion, experts can try to promote certain policy measures or to warn against certain policies). This discussion should be *continuously* developed.

### What Is Understood by Policy Advice?

Policy advice describes the process of (a) engaging an “expert” with the processing of a politically relevant issue, considering the aspects which are important for the political debate; (b) coordination between the principal and the “experts” in respect of those aspects of the subject to be discussed; (c) research on those aspects of the subject, the processing of which has been agreed by the principal and the expert; (d) analysis of the obtained data and collected findings from the research with the aim of reaching a theoretical, methodological, and empirical reasoned statement; (e) development

of recommendations as a basis for policy debate and – on this basis – the political decision; (f) discussion of the expertise statements and recommendations with political decision-makers (where appropriate, revision of said expertise); (g) additional expert advice to the political decision-makers (insofar as they are dependent on the advice) up until the decision; and (h) advising the political decision-makers (insofar as they are dependent on advice) in respect of the use or implementation of those statements that were made in the expertise.

Policy advice is *not* (or vice versa: the false understanding of policy advice is) (a) the attempt to have a *direct* influence on the policy decision (this would mean that fact and value levels would be integrated in an inadmissible way and objectivity significantly reduced); (b) the *value-orientated selection* of data and findings with the aim of wanting to have a direct influence on the political decision (this would significantly reduce the objectivity); (c) the unilateral *concentration* on political recommendations without a detailed explanation of the data, findings, and analysis from which these recommendations can be derived; (d) orientated on the (suspected or immediately exploitable) expectations which the principal has of the *content* design of the data, findings, and analyses (e.g., in terms of the selection of “certain” data and findings, as well as the undertaking of “particular” analyses), as well as of the statements on the *content* in the recommendations; (e) the design of the expertise in a style of thought and language which could not be understood by a layperson (in this case, it would not be a consultancy as such); (f) the formulation of policy recommendations which are, in their form and implementation, not adapted to the typical requirements that are characteristic of politics (keyword: unrealistic recommendations); and (g) the formulation of recommendations that basically have little or nothing to do with political decisions.

### Which Questions Occupy the Psychology of Policy?

The psychology of policy advice is concerned with information processing in terms of political and policy-relevant content, whereby it assumes

the influences of motivation, values, beliefs, and attitudes on the information processing. Furthermore, it deals with the question of to what extent information processing and political discussions and decisions are influenced by prejudices and stereotypes. Finally, it studies the psychological processes in the communication between advisers and the political decision-makers.

Political psychology is concerned with the process of the genesis, maintenance, and change of political attitudes and beliefs and with the motivation behind the process. It is also concerned with the importance of more general, value-laden attitudes, beliefs, prejudices, and stereotypes for political decision-making and action, whereby psychology assumes that the motivation for taking certain decisions and actions is often not (to a full extent) understood.

Political psychology, and the psychology of policy advice, also delves into the question of how the politically significant or relevant information in hot processes (i.e., emotionally and affectively important and thus “loaded” situations) is received and processed.

### **What Aspects of Policy Advice Should Be Particularly Considered from a Psychological Perspective?**

There are seven aspects that must be taken into account: (I) frequent high expectations of the experts with regard to the clarification of problems, expectations which can hardly be met. (II) These exaggerated expectations often have to do with the fact that policy-relevant statements and indeed also specific decision aids are expected of the experts. (III) Experts should make it clear from the outset how their expertise could be useful in the policy-making process; they should emphasize from the outset that they will not make direct political statements. (IV) Basically, no immediate recommendations in relation to specific policy decisions should be made as this can trigger reactance (postulate: do not diminish the freedom of the decision-maker). (V) Experts should be aware of their great responsibility especially when their statements do, in fact, not only serve as the basis for policy recommendations but could also quite possibly influence politicians’

decisions. (VI) Experts should be aware of the differences between value statements and factual statements; these two levels have to be considered in all phases of policy advice. (VII) Care should be taken not to overburden politicians with information as it can cause them to orientate themselves solely on value statements (and not on factual statements).

### **To What Extent Is Gerontopsychology a Special Field in Policy Advice?**

Politicians often have only little knowledge of gerontology and yet, in this area, there is a great need for advice. Aging is a relatively new cultural phenomenon – for this reason there is uncertainty on the part of the politicians in respect of finding solutions to the demands posed by aging. Due to this uncertainty, many assumptions, positive or negative prejudices, and stereotypes prevail with regard to aging. Older people constitute *not quantitatively* but *expressively* a minority; thus there is the risk of discrimination in political decision-making (and thus also in the distribution of resources). It can be assumed that the establishment of seniors’ coordination centers in the future will increasingly become an alternative within districts or counties; however, these coordination centers will be confronted with a wide range of demands.

### **Policy Advice in the Context of a Value Judgment Dispute**

This contribution touches upon a historical discussion, which has gone down in the history of science under the term, “value judgment controversy” (Turner and Factor 2014). In the period before the First World War, there was intensive debate in the *Verein für Socialpolitik* (Association for Social Policy) as to what the relationship between science and politics should be: may, or indeed can, science, in its own understanding, form the basis of political decisions by making *normative* statements? Can science, by its very nature, make value judgments that convey policy orientation? Or must science always refrain from any value judgments? In the *Verein für*

*Socialpolitik*, it was mainly Max Weber and Werner Sombart who represented the belief that science must, in principle, argue *free from value judgments* and must wholly refer to empirical findings. The counterpart was formed by scientists who, with a view to *questions of social justice*, felt that it was an important obligation of science to comment on social issues, thereby also making normative statements. After all, against a background of social inequality, science could and should be allowed to address societal issues and *not be value neutral*. Moreover, according to the counterpart, society was dependent on scientific disciplines for the resolution of social problems, disciplines which possessed the potential to contribute to the solution of these problems (Weber and Dreijmanis 2008).

The statement that science, in its own understanding, was not in a position to make any normative statements or value judgments was often misinterpreted in the sense that the values corpus basically defied systematic scientific debate. Following Max Weber, values are actually *not the result* of empirical research, but the research can and should systematically deal with the question of what influences the forming and changing of values and, above all, with the question of which paths should be taken to realize values and the related objectives. Other tasks of empirical research arise precisely in this context, such as evaluating the *appropriateness* of values and goals in the given situation at the time (do these appear to be at all realistic, and can they actually be realized?), as well as the answer to the question as to what extent existing values and objectives are *compatible or incompatible* and how far the values expressed are *traceable to even more fundamental values*, which are not articulated in public discourse and are not disclosed. In addition, it must not be overlooked that values are realized in the decision for a specific research topic: the distinction made in the theory of science between the discovery and the context of justification takes up this very point (Šešelja and Straßer 2014). The interest in a particular question (“context of discovery”) may well be connected to the values of a human being, but the empirical analysis of this question

(“context of justification”) needs to be free from values.

The findings of empirical research are essential for political objectives. National reports on aging do not only inform about situations of older people in the respective countries but also about possible antecedences and consequences of inequalities and expected effectiveness of alternative intervention measures. Moreover, scientific policy advice is regularly expected to give guidance on how specific policy aims might be reached. Here, however, scientists have to exercise restraint when it comes to *how their findings are used in politics*. Much like in the ethical discourse, it is necessary to distinguish between *is* and *ought*: while empirical research is directed at the formulation of “existence statements,” politics leans toward “ought statements,” in much the same way that ethics does. It frames its questions in terms of how the social world *ought* to be created and what might be meant by a *good life* from a social perspective. Such questions cannot be derived from empirical research. For instance, the question relevant to how the social world *ought* to be is not one that can be answered empirically.

However, scientists are then faced with a *potential conflict* of which they always need to be aware: they are not only scientists but also citizens. Accordingly, they do not just live in the *scientific* area but also in the *public* space, which is also a *political* space. The conflict is particularly exacerbated when scientific findings are misunderstood, overgeneralized, or even *instrumentalized*, i.e., used for policy objective definitions, such as in the case of taking empirical findings on the stability of specific personality traits in old age or increasing definiteness of narrative selves as alleged evidence for lack of psychotherapeutic treatability of older adults. Likewise, taking increased rigidity, shorter remaining lifetime, higher dependency, and vulnerability of older adults as evidence for decreasing benefits that older adults would receive from possible intervention measures (e.g., hip replacement surgery) is similarly unfounded. Findings on general satisfaction with the accessibility of health-care services might contribute to reducing

awareness of disadvantaged smaller groups (e.g., older people with constrained ability). The aforementioned examples illustrate that chronological age is often used to justify claims to rationalize services, whereas heterogeneity of aging processes and respective chances and limits of possible intervention measures are regularly neglected. Here, a clear limit needs to be drawn between research objectives and research statements on the one hand and policy objectives and policy statements on the other.

### Two Basic Functions of Scientific Policy Advice

Firstly, policy advice has an *enlightening* function: it should explain to the political decision-makers, as well as to the administration, how a specific phenomenon is factually presented (“being statement”). It should also explain how the phenomenon is significant for defining and prioritizing potential policy aims and needs for political action, including the design of the public space and thus for political action (e.g., the fifth and sixth German National Report on Aging focused on potentials of old age for economy and society and images of old age and aging). Here, it must be questioned whether there is a need for “ought-to-be statements” to be that far removed from “being statements.” Otherwise, the idea of what the social world should be becomes unrealistic and results in political action being guided by illusions rather than implementable goals. This enlightening function can be used to define *realistic* objectives. However, this does not mean that the scientific (i.e., the being) statements stress more, primarily or exclusively, the *limits* of political action goals. No, scientific statements can also clarify *potentials* of political action by demonstrating how a social phenomenon *could* itself be presented, if its potentials were to be recognized and these potentials then promoted in the implementation thereof in the design of public spaces. To give an age-related example here: the physical, cognitive, emotional, and social plasticity of age – in the sense that a significant opportunity for designing the physical, cognitive,

emotional, and social development is present in old age (Cavanaugh and Blanchard-Fields 2014) – may reach their limits if the appropriate opportunity structures for the realization of physical, cognitive, emotional, and social plasticity are not even available. This may be due to the appropriate education and engagement opportunities are not politically “wanted,” or are not created politically, and/or because the reduction in social inequality in *all* age groups is not defined as a real political objective or else not enough is done for the realization of this objective or the measures introduced are inadequate (Vincent 2014). In other words, the possibilities and limits of plasticity are always *also* provided through the design of public space and thus politically.

In addition to this enlightening function, policy advice has a *critical* function. It is an *empirically checked and exposed* function. Empirical (i.e., “being) statements” are required to determine how far these normative statements are actually value judgments. Taking an age-related example, it has been argued by some that the possible effects of medical-rehabilitative or psychotherapeutic measures in older age have to be examined, because older people – especially the very old – no longer have the necessary physical, cognitive, and emotional plasticity (Gutchess 2014). Scientific expertise can and should unmask such a statement for what it is: a value judgment, an age-based statement which is motivated by “hidden” objectives such as age-related rationing, or a general devaluation (discrimination) of age (Anderson et al. 2013). By using scientific expertise to provide counterevidence to this statement, it fulfills a *critical* function and thus creates the basis for a significant extension of the policy planning, decision, and action spectrum.

This critical function of policy advice also comes into play when it questions whether certain political goals are *realistic* or not or whether these goals are a *contradiction* or not. Here, too, age-related examples are mentioned: for example, if retirement age is raised to 70, or even abolished, then there is the question (*to be empirically examined*) as to whether such a goal is even realistic (Vanhuysse and Goerres 2013). With regard to the resources, potentials, and skills in old age, it is

quite often assumed that *everyone is* able to continue their profession up to this age. Empirical research advises caution here – not only with regard to the heterogeneity of abilities and skills in old age but also, more specifically, by elucidating the challenging labor market circumstances for at-risk populations of older people, particularly displaced older workers; older workers with disabilities, prolonged or episodic illness, mental health issues, or injuries; low-skilled and low-literacy older workers; older workers with unpaid caregiving responsibilities; and recent older immigrants (National Seniors Council 2013). The (given or lack of) consistency of the objectives then constitutes an important issue if, on the one hand, intergenerational solidarity – considering the needs of all the generations – is described as a policy objective but, on the other hand, with reference to the freedom order, the discussion of the question is blocked as to what extent a stronger social commitment of those older people, who do have the necessary resources (keywords: work longer, redistribution of financial resources within the older generation), can relieve the social security systems to such an extent that their sustainability can actually be secured (Torp 2015). Moreover, changing labor market circumstances for older people also has an impact on younger generations. Provided that jobs are a finite resource, chances for older and younger workers have to be balanced. However, this does not mean that increasing labor market participation of older people restricts developmental possibilities of younger workers or even endangers generational equity. Instead, when usage of human capital in older people increases productivity and competitiveness, additional or longer employment of older workers can also contribute to improved job opportunities for younger workers.

### **An Example of Policy Advice: The International Plan of Action on Aging**

#### **First International Plan of Action on Aging**

Demographic change needs to be understood as a global phenomenon. The time in which more old

than young people live on our earth is within reach and even emerging, and developing countries are not excluded from the aging population. Although the time horizons and intensities of these changes differ, we are dealing with a global development. Only gradually are international solutions sought globally for comparable problems, and only very rarely are joint strategies developed (Ezeh et al. 2012).

Exceptions are the approaches of the United Nations. As early as 1982, an almost pioneering action plan on the part of the international community was adopted at the World Assembly on Aging in Vienna (United Nations 1983). In this document, goals and policy recommendations are outlined in seven areas of concern to aging individuals, i.e., health and nutrition, protection of elderly consumers, housing and environment, family, social welfare, income security and employment, and education. The positions and guidelines formulated therein have, even from today's perspective, lost none of their relevance. For the early 1980s, the document included innovative ideas relevant to the global consequences of demographic change:

The trend towards the successive ageing of population structures is bound to be one of the main challenges to international and national planning efforts during the last decades of this century and well into the twenty-first. In addition to the general consideration outlined above on the status and predicaments of the elderly sections of societies, and the review of the needs and potentialities of the elderly, attention should be given to the vast and multifaceted impact which the ageing of populations will have on the structure, functioning and further development of all societies of the world [...]. (17, Para 33)

At this point in time, gerontology, with its study of aging processes, had already undergone a considerable development boost. However, beyond the universities, the sociopolitical impacts to date have only been taken up individually. The International Age Plan has thus been instrumental in the understanding and acceptance of the fact that the issues of aging are an immediate political task area. During the following period, the continuation of the systematic processing of the objectives and recommendations in the document

was unsuccessful. It was not possible to comply with the therein requested evaluation in a 4-year cycle. Only in the form of isolated initiatives does the subject of age and aging emerge on the agenda of the United Nations again.

Only in 2002 – after 20 years – was the importance of the International action plan recognized and adapted to the current situation, as part of the second world assembly. The signed agreement, also called the Madrid Plan, revealed the problems, objectives, and possible sociopolitical action areas. Among the key themes was an improvement in the living conditions particularly of older people by fighting poverty, sociopolitical participation, individual self-fulfillment, respect for human rights, and equality of men and women. At the same time, adjustments in the areas of employment, social security, health, and well-being were required (United Nations 2002). However, the action plan remained, as did its predecessor, without international legal liability. Building upon this, the efforts toward achieving regional implementation initially created the impression that supranational policies toward aging could succeed. First and foremost, the Economic Commission for Europe (UNECE) gave essential stimulus and guides for positive action. Retrospectively, however, it is sobering to note that, at the time, the chance of an international view of age was not consistently followed up and brought to life. Even in the immediate UN follow-up documents on the associated social policy topics, one looks in vain for a connection to the new International Age Plan.

### **Second International Plan of Action on Aging (Madrid Plan of Action)**

The respective social and cultural contexts of a society and the associated images of age therein must be taken into account, particularly when it comes to the question of the use of potential resources of age for society. For this reason, the United Nations established a technical committee to prepare the Second International Plan of Action on Aging – which was adopted by the General Assembly of the United Nations in 2002 (United Nations 2002) – in which 15 scientists from five continents submitted proposals for the

development of strategies in the areas of education, labor, health, and social services, with the aim of creating “age-friendly environments.” (The first author (Andreas Kruse) had been a member of this committee.)

Similar to the First International Plan of Action on Aging adopted in 1982, the Second International Plan of Action on Aging also states that, within the international community, there are extremely large differences, both in prosperity and in the related prosperous living conditions, as well as in the design of the spatial, social, and infrastructural environment, whereby these differences become even more evident when comparing the living conditions and environments of older people to the living conditions and environments of people at earlier ages (Sidorenko and Mikhailova 2012).

Accordingly differentiated are the policy recommendations that have been developed in the two International Age Plans. In addition to the diversity of political strategies resulting from the aforementioned differences, similarities between countries in relation to the social issues of age can also be seen. These not only concern the provision of societal resources to reduce the health, social, and financial risks in old age but also the creation of an infrastructure for the social use of the resources of age. The technical committee has set forth five principles in its proposals for the development of strategies for the realization of the theme, “Society for All Ages” (Walker and Maltby 2012):

1. Life course development: Development potential is identifiable in every life phase. The process of the realization of these potentials is influenced by the typical social roles and social status in the specific life phases. Age-specific individual development potential can be used to benefit society.
2. Development and age: This principle combines the social and economic aspects of aging. Older people have an active part in development processes, benefit from these, and are quite possibly marginalized due to this.
3. Cultural/ethnic diversity: This principle depends on the ideal of basic human rights,

accentuates tolerance toward all ages, and points out the dangers which are connected with focusing exclusively on the respective dominant culture.

4. Gender: This principle refers to the fact that women are particularly affected by the negative aspects of aging and age. Accordingly, both preventative measures and measures which contribute to an immediate improvement in the living conditions in old age are required.
5. Intergenerational relations and social cohesion: This principle refers equally to the micro- and macro-levels. At the microlevel, family-related subjects are dealt with; at the macro-level, the focus is on solidarity, citizenship, and intergenerational justice. These reciprocity, solidarity, and development need to be supported equally.

National and International Expert Reports on Aging are regularly considered important and helpful because of informative, elucidating, and stimulating content. However, certain reports have had only little impact on aging policy. For example, in a resolution adopted by the United Nations General Assembly (United Nations 2010), it is recognized “that, in many parts of the world, awareness of the Madrid Plan of Action (Second International Plan of Action on Aging) remains limited or non-existent, which limits the scope of implementation efforts.” As a consequence, the aforementioned resolution explicates a total of 23 recommendations to further improve the implementation process; e.g., in recommendation (Anderson et al. 2013), the resolution “encourages Governments to pay greater attention to building capacity to eradicate poverty among older persons, in particular older women, by mainstreaming aging issues into poverty eradication strategies and national development plans, and to include both aging-specific policies and aging-mainstreaming efforts in their national strategies”; recommendation (Ardelt et al. 2013) “encourages Member States to strengthen their efforts to develop national capacity to address their national implementation priorities identified during the review and appraisal of the Madrid

Plan of Action, and invites Member States that have not done so to consider a step-by-step approach to developing capacity” (Turner and Factor 2014, p. 350).

### **“Age-Friendly Culture” as a Principal Aim of Aging Policy and Respective Guidance**

The definition of an age-friendly culture emphasizes three aspects in particular. First, when society is spoken of, it is referring specifically to the elderly who form a significant and, in the future, an increasingly important part of society. Second, in the creation of framework conditions for the realization of potential, there must be recognition that older people, as active citizens, should be able to express their rights of participation. Finally, the same applies to vulnerability; older people should be able to show this without having to worry about being excluded from their participatory rights or opportunities in society as a consequence.

A profound reservation against old age in Western societies is reflected in the domain of employment (Finkelstein et al. 2015). Early retirement programs are still an often preferred solution for problems of productivity and competitiveness. Displaced older workers still regularly suffer from longer unemployment. Older workers still have particularly low rates of participation in extended vocational training. In addition, the aforementioned reservations toward age are clear in the current discussion of necessary reforms of the social security system. The risks of old age and the resulting financial burdens are unilaterally emphasized (Kruse 2013). With a view to civic engagement, it can be seen that the existing engagement of older people is just not acknowledged but, above all, that older people are only too rarely approached as jointly responsible citizens whose contribution is indispensable for society (Kruse and Schmitt 2015). The fact that people in old and very old age continue to develop and make a contribution to our society’s human capital (e.g., through their experience and knowledge) (Ardelt et al. 2013) is just not sufficiently recognized.

Drawing attention to existing potentials does not mean that an optimistic forecast in the aging processes in future cohorts, the development of the labor market and innovation capacity, or the sustainability of existing support systems has been made. The potentials of age refer much more to a twofold design option, which is to be understood in the sense of an opportunity and a challenge (for the individual and for society). From an individual perspective, on the basis of the stated potentials, and when compared to previous generations, there are now clearly significantly better possibilities for older people to fulfill their own life plans, goals, and values, as well as to participate in social development and to engage themselves for others and the community. From a societal perspective, the potentials of age refer firstly to the opportunity to contribute, by means of motivational, social, cultural, and institutional conditions, to the growing proportion of older people being able to lead an independent, self-, and jointly responsible life for as long as possible, whereby attention must be directed at the reduction in social inequality – not just in old and very old age but also in the preceding stages of life (Kruse and Schmitt 2015).

Moreover, the question arises as to what extent a society can also benefit from the experiences of older people when dealing with critical situations that are increasingly unavoidable, especially in old and very old age. At an advanced age, the increased experiencing of limitations – the “radicalization of the physically captured basic situation of the people” – also offers the chance of a qualitatively new fulfillment of individuation in which the individual can experience his or her own life as “the coming into existence of the singular totality” or as a “will to himself or herself” (Rentsch 2014).

A major social issue that is addressed with the potential and the vulnerability in old and very old age relates to intragenerational justice, which has consequences for the design of intergenerational relations. Potentials of age can and should be used in a socially responsible manner, i.e., this society should be in a position to effectively support those older people who find themselves in distress, be this health, social, and/or financial distress.

How can the term *age-friendly culture* be defined?

- (I) First of all, age-friendly refers to the involvement of older people in the social, political, and cultural discourse, as well as in social and cultural progress. Only too frequently in public discourse, there is the tendency to talk *about* the elderly, but not *with* them. This is an expression of the neglect of older people, if not hidden discrimination. Talking *about* the elderly, but not talking *to* them, suggests the assumption that older people are not perceived as active, co-responsible parts of society and that their potentials are not being taken seriously. In an age-friendly culture, elderly women and men are equally heard and are treated with as much respect as younger people. An age-friendly culture does not make generalization about the group of “older people” but respects the “uniqueness of being” of older women and men.
- (II) Related to the first-mentioned feature of an age-friendly culture, but with a slightly different emphasis, is the intergenerational perspective which forms the second feature of an age-friendly culture. We elucidated that age must be integrated into an intergenerational perspective, whereby it must be explicitly stated – and empirical findings support this statement – that there is an active exchange of ideas, knowledge, experience, assistance, and sympathy between the generations. This being embedded in a generation sequence is an important expression of participation, more so for the elderly than for the young. Moreover, the generativity and transcendence motivations, which are so important in old age, can be realized. Prominent examples of this intergenerational perspective are generation tandems and mentoring opportunities in the workplace, as well as sponsorships of older people in civic matters.
- (III) An age-friendly culture articulates the vital interest in the potentials of age (which can, of course, vary considerably from person to

- person) and creates conditions and public spaces that are conducive to the realization of such potentials – to be mentioned here is the introduction of the flexible retirement age in the world of work (which is not to be construed as a relinquishment of legally defined age limits), as well as the removal of all age limits in the field of civic engagement. Also important are the opportunity structures, such as community centers, where the generations can meet, enrich, and support each other: an important incentive to realizing potentials in old age.
- (IV) An age-friendly culture encounters older women and men, in whom vulnerability is clearly expressed, with respect and sensitivity. It provides socio-spatial contexts that promote independence and self-responsibility and secure participation – to mention are places to meet in the living quarters and to mention too are differentiated, target-group-specific service systems, as well as barrier-free environments, all of which have a positive impact on the maintenance or recovery of independence and mobility (Sharratt, M., Menec, V., *Age-Friendly Communities*, this Volume).
- (V) In the case of severe physical and cognitive losses in an older person, an age-friendly culture respects the individual's uniqueness, expresses their respect for the dignity of this individual, avoids trying to externally determine the quality of life of this person, and neither denies the individual the fundamental right of participation nor expert and ethically sound medical care. A "grading" of human dignity is avoided, as is an age-determined "downgrading" of the extent and quality of the medical and other care. Decisive for this provision is the diagnosis made by an expert alone, not the age of the individual concerned. We elucidated that continuous and institutionalized policy advice is particularly important because aging policy cannot be based on subjective aging theories and policy-makers' incidental reception of scientific knowledge.
- (VI) An age-friendly culture is determined to reduce social inequality among the group of older people and to ensure that every person – regardless of education, income, or social class – receives the social and medical services which are known to be necessary for his or her specific life situation (Liou-Johnson, V., Moorleghem, K., Mills, B., O'hara, R., *Ageing, in Equalities and Health*, this Volume). Apparently, social inequalities do not decrease with age. We elucidated this point particularly by referring to at-risk groups of older people in the labor market.
- (VII) An age-friendly culture does not deny the rights, claims, or needs of younger people, rather it endeavors to identify and recognize the rights, claims, and needs of all the generations, whereby no single generation is preferred or disadvantaged. We elucidated this point referring to the labor market where sometimes chances of older and younger workers have to be balanced and sometimes increasing opportunities for older workers go hand in hand with vital interests of younger workers.

## Conclusion

Building an intervention-friendly society for all ages depends on policy-makers' appreciation of resources and malleability of lifelong development. Policy-makers' deliberations and decisions not uncommonly reflect unacknowledged preferences and value judgments, elucidating both the informative and critical functions of science in general and scientific counseling in particular. This entry provided basic reflections on the role of policy advice in the context of the philosophical value judgment dispute and discussed the aforementioned functions of scientific policy advice in more detail. The explicated understanding of age-friendly culture should be regarded as a desirable vision of society development that might function as a background for appraisal of the status quo, actual discrepancy, and priority goals of aging policy.

## Cross-References

- ▶ [Active Aging](#)
- ▶ [Human Resource Management and Aging](#)
- ▶ [Retirement and Social Policy](#)
- ▶ [Social Policies for Aging Societies](#)

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## Psychology of Longevity

Boo Johansson and Pär Bjälkebring  
Department of Psychology, University of  
Gothenburg, Gothenburg, Sweden

## Synonyms

Later life; Old age; Survival

## Definition

Longevity denotes especially long-lived members of a population. It is separated from life expectancy which focuses on the likely mean age of death within a population.

## Introduction

There is no overarching theory of aging and longevity or a specific psychological theory targeting longevity as the main outcome. Survival into

advanced ages is determined by multiple influences of genes interacting with environmental conditions over the entire life span. Already from embryonic life, individual experiences and behavior influence health, functioning, and the likelihood for longevity. To capture all these dimensions in a single theory seems impossible.

Biological theories focus on evolutionary aspects and underlying mechanisms for life and typically define longevity as the potential life span under ideal conditions. Foci in social theories are contextual influences related to survival, especially the socioeconomic environment that humankind has designed in the format of roles, institutions, and principles for age stratification over the life course. From a psychological perspective, longevity can be considered in relation to cognitive abilities, personality, and various aspects of well-being. The interactions of these psychological domains are expressed in our adaptation to everyday environmental demands and in later life to age-related biological changes, which in turn produce differential conditions for survival. In this respect, the psychology of longevity represents a nondeterministic approach in the crossroad of biological and social influences with a focus on biological constraints and socioeconomic prerequisites for cognition, personality, and affective components. There are several theoretical accounts proposed in biobehavioral and social sciences of relevance also for our understanding of the psychology of longevity. However, these theories and models do not typically focus on longevity as the main outcome.

The manifestation of a survival advantage becomes visible when an individual lives longer than the average person, from the same birth cohort. Thus, longevity needs to be related to the actual life expectancy in a certain population. A substantial gap between the average life span and a long-lived person directs our attention to factors that may contribute to the observed differences. To conduct such a search, we have to compare mortality rates within an older population and examine whether we can identify shared psychological characteristics and behaviors among those who live the longest.

Early ideas about longevity were typically based on the assumption that genetic influences and age-related biological changes produced unavoidable neurobiological changes and thereby changes in behavior. Later research gradually acknowledged that psychological characteristics and behavior are formed and expressed differently in various environmental contexts. Life-course influences, coping strategies relative to environmental demands, and more general lifestyles are therefore currently considered for their relevance to longevity. In this less deterministic view of longevity, psychological factors may have a more significant role.

A general psychological stress model of aging provides a broad theoretical framework for the psychology of longevity. Coping strategies in the broadest sense can here be seen as the psychological mechanisms we employ to fit our own perceived resources to demands and challenges in the external environment and changes due to our own age-related bodily change. Unlike a stochastic theory that views aging and death as a result of stressors that cause wear and tear on cells and disrupt function, a stress model emphasizes that both external and internal psychological stressors can cross the mind-body barrier with effects on overall health, survival, and longevity.

In the first section, we review empirical studies that illustrate the significance of cognitive “”functioning, personality, various aspects of self-perceived health and well-being in aging, as well as social connectedness. The focus is restricted to the potential role of these psychological factors as predictors of differences in survival rates in aging. At the end of the chapter, we synthesize these findings and suggest an overall theoretical account and model for the role of psychological factors in producing variance in survival and especially psychological predictors of longevity.

## **Cognition and Longevity**

Cognition or the ability to think, learn, and remember is the basis for how we reason, judge, concentrate, and plan our daily lives. In geropsychology, cognitive health refers more specifically to cognitive test performance, self-perceptions, and others’

evaluations of memory and other cognitive abilities in everyday life.

An increasing body of empirical studies provides support for an association between higher cognitive abilities, already early in life, and a lower risk for subsequent mortality, less morbidity, and overall better health. These findings suggest a general life-course perspective in which cognitive abilities are viewed as significant for longevity. Among potential accounts, Deary (2012) proposed that this association may even be ascribed to a general body system integrity in which better performance on cognitive tests also reflects the vitality of other bodily systems that make individuals adapt better to their environment. However, this assumption is not new, and 2400 years ago Hippocrates even assumed that good cognition and appetite have prognostic value for survival. Two millennia later, St. John and Montgomery (2014) confirmed these thoughts. Using brief data from the Manitoba Study of Health and Aging, they compared individuals with normal cognition and good appetite with those with either poor cognition or poor appetite. They found that these two factors also were able to significantly predict death in a modern population.

Cognitive ability is a strong predictor of survival across the entire life span, and in cases with more severely compromised cognition, an elevated mortality risk can be observed (e.g., Johansson and Zarit 1995). The most convincing evidence of an association between cognitive ability and later survival is provided by studies applying a distance from death time metric in the analysis. These longitudinal analyses can, however, only be conducted in samples followed until death. Studies of the terminal decline hypothesis, originally proposed by Kleemeier (1965) in the 1960s, are largely based on the idea that cognitive change is a more informative marker of the likelihood for subsequent survival or death compared with information about chronological age or time from birth. According to this hypothesis, also referred to as terminal change or terminal drop, one can also expect an acceleration of cognitive decline in the years prior to death.

The first generation of studies on terminal decline typically focused on levels of cognitive

performance in relation to the likelihood of later survival (e.g., Bosworth and Siegler 2002). Cognitive test performance was generally found to be associated with subsequent survival in between-person analyses. In later studies, analyses are more often conducted using a within-person perspective, focusing on intraindividual change trajectories in relation to survival.

Using longitudinal data from the H70 study in Gothenburg, Sweden, in which 70-year-olds were followed until death, Thorvaldsson et al. (2008) examined the time of onset and rate of change in terminal decline in tests of verbal ability, spatial ability, and perceptual speed. The sample comprised 288 individuals without dementia. Change-point analysis was performed to identify inflection points, and a profile likelihood method was used to identify change points for each of the three cognitive abilities. The results demonstrate that the onset of terminal decline was identified more than 6 years prior to death for verbal ability, close to 8 years for spatial ability, and as early as almost 15 years for perceptual speed. Thus, both the time of onset and rate of terminal decline can vary considerably for various cognitive abilities.

The lesson to be learned from an increasing number of studies based on the terminal decline paradigm is that cognitive change is related to survival, although fluid abilities are more prone to show change than crystallized or verbal abilities that are more robust to change.

The findings of an association between cognitive functioning and survival also extend into the range of compromised cognition and subsequent dementia. Data from two Swedish population-based longitudinal studies was used to more specifically examine change trajectories in different abilities before a clinical diagnosis of dementia. The analyses revealed an onset of accelerated decline in the fluid domain of speed and memory approximately 10 years before dementia. The corresponding interval was about 5 years before diagnosis in tests of verbal or crystallized ability. An early onset of change in fluid abilities can predict subsequent onset of dementia as well as indicate an elevated mortality risk almost a decade in advance. These changes are, however, more difficult to detect due to substantial normal

age-related decline, compared with the more aging robust crystallized abilities (Thorvaldsson et al. 2011). Evidence is currently accumulating that shows that terminal decline is more universal and can account for change also in other domains of cognitive functioning (e.g., Wilson et al. 2012).

Since the early days of the so-called “use-it or lose-it” hypothesis, the assumption was that cognitively stimulating activities could preserve cognition and perhaps even have a neuroprotective role. Although an appealing assumption, the empirical evidence for this hypothesis is less convincing. For example, a coordinated analysis based on data from four major longitudinal aging studies, in which cognitive outcomes were studied for more than 20 years, showed that baseline cognitive activity and engagement at earlier ages did not predict the rate of decline later in life. Change in cognitive engagement, however, was associated with change in cognitive performance, suggesting that cognitive activity from a previous level has at least a transitory association with cognitive performance measured at the same point in time (Mitchell et al. 2012).

A theoretical approach related to the use-it or lose-it (or disuse) hypothesis is that of a greater cognitive reserve among individuals who have experienced more complex mental activity over the life span. Crystallized abilities are per definition associated with practice, training, education, and other influences that promote cognitive functioning. As repeatedly shown, these abilities are less prone to age-related change. In older ages, however, cognitive performance tends to become more dependent on preserved brain integrity and the amount of neuropathology that has accumulated over the years. After a certain inflection point, a cognitive ability might start to decline, but the decline is likely to start later and with a faster rate for those with a higher cognitive reserve (Stern 2012). The empirical evidence for a more universal and protective role of an assumed cognitive reserve, however, is still weak.

*In sum, cognitive abilities are highly associated with survival and longevity, but the evidence for modifiability for the sake of an increasing life-span is less convincing.*

## Personality and Longevity

In the five-factor model of personality, the following core dimensions are distinguished: (1) extraversion with characteristics such as sociability, talkativeness, excitability, assertiveness, and high amounts of emotional expressiveness; (2) neuroticism expressed in emotional instability, anxiety and depressive mood, and irritability; (3) agreeableness, including attributes of trust, altruism, and various forms of prosocial behavior; (4) openness, shown as imagination and insight and in a broad range of interests; and (5) conscientiousness, which includes thoughtfulness, impulse-personal control, and goal-directed behaviors with the awareness of details in a broader context (e.g., Costa and McCrae 1992).

Among these personality characteristics, conscientiousness is typically found to be the most significant dimension associated with longevity. In addition, conscientiousness is also a predictor of more healthy behaviors and overall physical health (e.g., Friedman et al. 2014).

An interesting study on the role of conscientiousness for longevity was reported by Friedman et al. (1993). In using data of mortality in Terman's study from the 1920s, they found that conscientiousness in childhood was significantly related to survival decades later. Kern and colleagues (2009) also examined conscientiousness measured in young life, as well as later career success and the mortality risk over a 65-year period. They found that personality moderated the success-longevity link and that conscientiousness was the best predictor for survival among the least career successful individuals. This finding was confirmed by Terracciano and colleagues (2008) in their analyses of individuals followed for nearly 50 years in the Baltimore Longitudinal Study of Aging. Interestingly, they found that the association between personality traits and longevity was largely independent from health risk factors like smoking and obesity.

Along the lines of a life-span developmental inquiry, Eaton and colleagues (2012) proposed a more detailed investigation of personality as a nexus for connecting genetics, environment, and health outcomes, including longevity. The general idea is that personality reflects psychological

mechanisms that predispose individuals to engage in various health or unhealthy behavior across the life span, which in turn affects the likelihood for later survival.

Hill et al. (2011) designed a study to better understand the conscientious and longevity link. Using a 10-year longitudinal sample, they tested whether physical health and cognitive functioning mediated the association in the Health and Retirement Study of aging adults. Their measures included, in addition to conscientiousness, self-reported health conditions and measures of cognitive functioning (word recall, delayed recall, and vocabulary). Conscientiousness directly predicted greater longevity, even when the two mediators were included. They also found that cognitive functioning partially mediated the relationship.

Although personality largely remains stable over the life span, certain changes have been linked to longevity. Higher neuroticism is associated with more negative emotions and lower capacity in regulating emotional stressors, and increased neuroticism within a person has been linked to physical health problems as well as increased mortality (Mroczek and Spiro 2007).

Another aspect of personality linked to mortality is extroversion, higher extroversion with decreased mortality (Wilson et al. 2004). The link between extraversion and mortality is typically accompanied with greater social embeddedness. Our personality hence influences how we relate to others; trust, a subfacet of agreeableness, has been shown to be especially important. Barefoot et al. (1998) used scores on Rotter's Interpersonal Trust Scale to predict subsequent survival in a sample followed for mortality over 14 years from baseline. The analysis revealed a weak, but significant, association, suggesting that trust is a psychological dimension worth considering in relation to personality and longevity.

*In sum, among the personality dimensions discerned in the five-factor model, conscientiousness is repeatedly found to be the dimension most strongly associated with longevity. However, behavior promoting longevity always reflects an interaction between underlying personality dimensions, situational and broader contextual variables that may prevent or allow the expression of core personality.*

## Subjective Aging and Longevity

Individuals typically have reference points that guide our perception of experienced age: some feel older than their chronological age, and some feel younger. In addition to being an alternative marker of development, subjective age is theorized to be a possible personal dimension that can be used to explore individual behavior and functioning (Montepare 2009).

Focusing on subjective life expectancy within a biopsychosocial framework, Griffin et al. (2013) found that individuals' ideas of their likely age at death were significantly related to biomedical and genetic factors (age, health diagnoses, parental longevity), health behaviors (exercise, smoking, alcohol use, diet), and psychosocial factors (optimism, distress, social connectedness), but not to socioeconomic factors (income, education). The findings show that individuals have the ability to construct an understanding of personal life expectancy that is largely based on significant predictors actually proven to be associated with actual life expectancy.

A study that specifically highlighted this psychological aspect of knowing how long one will survive was conducted by Levy and collaborators (2002). They used data from a sample of more than 600 individuals aged 50 and older who participated the Ohio Longitudinal Study of Aging and Retirement. Based on a survival analysis, they showed that older adults with more positive self-perceptions of aging in fact survived longer, on average more than 7 years, than those with less positive self-perceptions. The finding remained even after controlling covariates age, gender, socioeconomic status, loneliness, and functional health. Interestingly, the effect was partially mediated by the will to live.

Kotter et al. (2009) examined whether, and how, self-perceptions of aging change with age and whether such change is associated with distance from death. Using data from the Berlin Aging Study, they found that it seemed to be experiences of more favorable change patterns, not only better overall satisfaction with aging and subjective age that contributes to lower mortality hazards.

The effect of subjective aging, or how individuals perceive their own aging in relation to longevity, was analyzed in a meta-analysis by Westerhof and colleagues (2014). Based on a systematic literature search, they identified longitudinal studies reporting effects of subjective aging on health, health behaviors, and longevity. Their meta-analysis resulted in an overall significant effect of subjective aging. The associations were stronger in studies with a shorter follow-up, for health compared with actual survival, and in studies of younger participants. The average age in the studies varied between 57 and 85 years, with a median age of 63 years. Notably, the effects were stronger in studies based in a context where welfare systems and state provisions were minimal. The authors concluded that subjective aging has a small but significant effect on health, health behaviors, and survival.

Offspring's optimism about longevity was found to correlate with parental longevity in two community-dwelling cohorts (Rius-Ottenheim et al. 2012), suggesting that optimism in forecasting may be partly determined by ideas of genetic influences on longevity. Interestingly, such an effect should be evaluated against evidence for heritability estimates of longevity, which have been found to be as low as about 25% (Finch and Tanzi 1997).

Hill and Turino (2014) found beneficial effects on survival among individuals who claimed that they had a purposeful perspective on their life. Using data from the longitudinal Midlife in the United States (MIDUS) study, they showed that purposeful individuals, independent of age, lived longer than their counterparts during a 14-year observation period after the baseline assessment, even after controlling for other markers of psychological and affective well-being. The authors concluded that a purpose in life might buffer against mortality risk across the adult years.

*In sum, significant information about the likelihood for survival can be drawn from self-perceptions of aging and subjective life expectancy, which in turn provides evidence for our ability to forecast longevity. In addition, feeling a purpose in life can increase survival.*

## Well-Being and Longevity

Subjective well-being (SWB) refers to how individuals evaluate their own life, including the emotional experiences of pleasure and what is considered to be a good life. SWB is commonly measured as positive affect which refers to experiences of pleasant emotion and mood, such as happiness and excitement, and low negative affect including the experiences of unpleasant distressing emotions and moods, such as sadness and anger. The balance between positive and negative affect has been used as an overall measure of SWB. In addition, life satisfaction is a construct closely connected to the affective dimensions of SWB, although it relates more to the cognitive evaluation of one's own life at present and how it has unfolded over previous years in terms of an overall satisfaction (i.e., "in most ways my life is close to my ideal and I am satisfied with my life").

Although we tend to strive for well-being over the entire life span, the socioemotional selectivity theory proposed by Carstensen (2006) assumes that the types of emotional states that are viewed as the most positive and preferable tend to change with age and the accompanying sense of a more restricted future time horizon. To feel satisfied with one's life becomes more of a priority than other goals that might have been viewed as important earlier in life. According to the theory, motivational shifts also influence cognitive processing in that older adults tend to show a preference for positive over negative information. This positivity effect may also be reflected in the preference for present emotion-related states over knowledge-related goals.

The sparse knowledge of the relative importance of cognitive and emotional facets of SWB for mortality led Wiest and collaborators (2011) to analyze the differential effects of life satisfaction, positive affect, and negative affect on mortality using data from more than 3000 German adults aged 40–85 years. Using Cox proportional hazards models, they found that no SWB indicator predicted mortality in middle-aged individuals when controlling for covariates. Life satisfaction and positive affect were, however, associated with lower mortality rates in adults older than 65, though self-rated health and physical activity attenuated the effect.

Another longitudinal study that examined components of subjective well-being was reported by Xu and Roberts (2010). They analyzed the relative role of the four well-being components suggested by Diener (2000), that is, global life satisfaction, satisfaction with important life domains, positive and negative affect, in data over 28 years drawn from a sample of nearly 7000 participants in the Alameda County Study. The outcome measure was longevity, evaluated by risks of all-cause, natural-cause, and unnatural-cause mortality. They found that higher well-being predicted a lower risk of all-cause and natural-cause mortality even after an initial control for age, gender, marital status, social contacts and affiliations, baseline health variables in terms of self-reports of chronic medical conditions and functional disabilities, and subjective health. With the exception of negative affect, they concluded that all other variables for subjective well-being significantly predicted longevity.

Lyrra and colleagues (2006) studied the relationship between scores on the Life Satisfaction Index Z scale and subsequent mortality among individuals aged 80 and older. Those in the lowest quartile of satisfaction with present life had an almost twofold risk of mortality compared with those in the highest quartile, even after adjusting for multiple confounders. Satisfaction with past life, however, showed no association with mortality, while current life satisfaction was highly related to survival over the next 10-year period.

Using data from the Longitudinal Study of Aging Danish Twins (LSADT), Sadler et al. (2011) confirmed that SWB predicted longevity in a study sample of 3966 twins aged 70 or older, followed for a median time period of 9 years. Notably, the effects were also revealed in within-pair analyses among 400 fraternal and 274 identical twin pairs which demonstrate that subjective well-being is associated with increased longevity independent of genetic and shared environmental influences.

*In sum, positive dimensions of well-being are significantly associated with better survival. Life satisfaction and positive affect are not only markers of happy life, but also important predictors of longevity.*

## Subjective Health and Longevity

Subjective health, how we perceive our own health status, is likely to also affect how we define our subjective age. However, they are two different factors that both have a relationship to longevity. According to Jyhlä (2009), subjective health, or self-rated health, lies at the crossroads of culture and biology, requiring collaborative and multidisciplinary efforts between several disciplines. She proposed a model of self-rated health, which represents the global statement about multiple aspects of health and in which both subjective and objective dimensions need to be considered.

Several studies have demonstrated that a global self-rating of health is indicative of subsequent survival (Idler and Benyamini 1997; Jyhlä 2009). As suggested by several researchers, self-rated health is a more inclusive measure than most other health indicators typically employed in studies of unselected samples. Jyhlä (2009) emphasizes that even if self-rated health is a significant predictor of mortality, it cannot be given a role as a determinant for the underlying biological devitalization that precedes death. Experienced overall health may only be a condensed evaluation of bodily conditions involved in vital biological processes. Hence, the predictive power of self-rated health becomes weaker in studies controlling for objectively measured health especially among individuals more knowledgeable and better informed about their own health status (Jyhlä 2009).

There is also an association between self-rated health and other dimensions of well-being. In a sample of individuals aged 80 and older, Berg et al. (2006) showed that there is a significant association with life satisfaction. In a follow-up study, she examined the association with 25 common medical diagnoses in old age and found that only stroke, sleep problems, and incontinence were significantly associated with life satisfaction.

The associations between self-rated health, various objective measures of health, and longevity are far from perfect. In a study by Benyamini et al. (2011), they specifically addressed the question: For whom does poor self-rated health not

predict mortality? Using data from a study of individuals aged 75 and older in Israel, they found that engagement in meaningful activities was an indicator of better health and longer survival even among those with poor self-rated health.

Feng et al. (2014) compared self-rated health and interview-rated health in the Chinese Longitudinal Health Longevity Survey and found that disability, cognitive function, chronic disease conditions, psychological well-being, and health behaviors influenced both self-rated health and interview-rated health. In addition to a focus on hard measures of health such as diagnoses, blood pressure, and BMI, it is also important to ask the question: "How would you rate your own overall health?"

*In sum, self-rated health is a statistical predictor and an indicator of a self-evaluation of overall health and vitality and findings underscore a significant association between self-rated health and longevity.*

## Social Connectedness and Longevity

The ability to establish and maintain a social network is partly a reflection of an individual's psychological competency as connectedness, and social embeddedness means that we are mutually attractive for social relationships.

In a meta-analysis, based on more than 90 reports with data on about 400,000 people, Shor and Roelfs (2015) specifically examined the relationship between social contact frequencies and longevity. Although they found a significant overall effect on mortality, subgroup analyses revealed no association among men or for the magnitude of interactions among family members. They concluded that contact frequency seems to be less beneficial than previously assumed for health and survival and that the quality of the social contact should be considered. In the Longitudinal Aging Study Amsterdam (LASA), Ellwardt and collaborators (2015) also examined the mortality risk in participants aged 54–85 at baseline, in relation to functional and structural characteristics of the personal network,

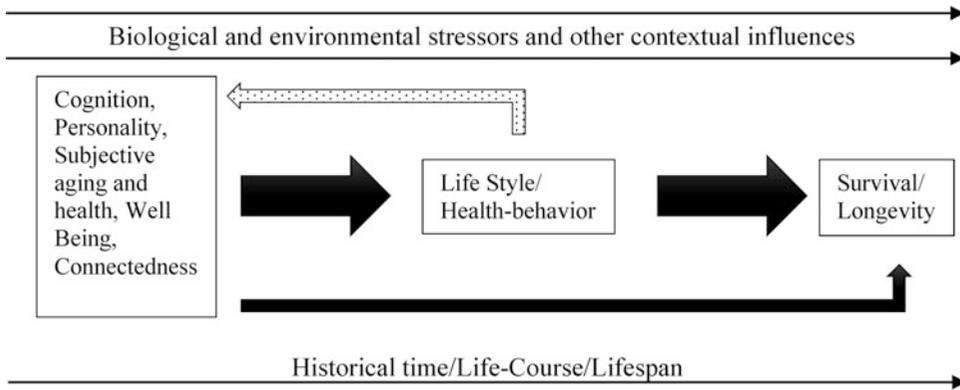
adjusting for mental, cognitive, and physical health. Almost 3000 individuals were followed for mortality over a 20-year time span. The four functional characteristics were emotional loneliness, social loneliness, emotional support, and instrumental support, whereas the structural characteristics were living arrangement, frequency and number of contacts, and various social roles. The lowest mortality risk was observed among those embedded in large and diverse networks.

Another extensive meta-analysis by Holt-Lunstad and colleagues (2010) examined the evidence of social relationships in relation to mortality in 148 studies with more than 300,000 participants. They reviewed the literature more specifically for the specific aspects of social relationships that seem to be most predictive for later survival. Individual characteristics were examined, including cause of mortality, initial health status, and health history. The time period for follow-up and specific rating of social relationships were also taken into account. The main outcome of the analysis was that of a 50% increased likelihood of survival among participants with stronger social relationships. Notably, the results were consistent across age, sex, initial health status, cause of death, and follow-up period. The analysis also revealed that the associations were stronger for more complex measures of social integration and lower for binary indicators like living alone versus with others. The authors emphasize that the observed effects are comparable with nonsmoking versus smoking and even exceed many other well-known risk factors.

*In sum, social connectedness is related to longevity, but the association is stronger for closer and more emotionally rewarding social relationship, compared with contact frequencies.*

## Psychological Dimensions of Longevity: From Empirical Observations to Theoretical Synthesis

The human life span is ultimately determined by biological criteria for survival. A unique feature of humankind, however, is the capability to redesign



**Psychology of Longevity, Fig. 1** Overview model of psychological factors contributing to longevity via lifestyle and health behavior

the environment and to adapt one’s own behavior to reduce risks for morbidity, disability, and mortality, thereby increasing longevity. The outcome of such efforts is seen in the dramatically reduced infant mortality and among adults in the rectangularization of the survival curve. An extended life expectancy also in older ages demonstrates that the boundaries for life are not entirely fixed and deterministic. Longevity differs considerably between nations and reflects the overall living conditions in various regions of the world. In a review by Christensen et al. (2009), it was estimated that the majority of babies born in the year 2000, in countries with already long life expectancies, are likely to celebrate their 100th birthday.

Compared with earlier birth cohorts, later cohorts tend to show better overall health and cognition at the same chronological age. A possible explanation to this is influences from an extended education and lifelong intellectual stimulation that have made us better adapted to cope with challenges and environmental change. In the everyday context, general knowledge and specific cognitive abilities are crucial for adjustment and engagement with life in the broadest sense, as well as for specific health-related behaviors. Personality dimensions and the way we perceive ourselves as aging individuals are also important driving forces for the adjustment. Stochastic variables, however, tend to become more important with age in determining subsequent

longevity, independent of psychological characteristics and functioning. Studies of very old survivors therefore tend to find it difficult to identify clustered psychological characteristics that may have contributed to longevity. To better understand the prerequisites for longevity, we therefore need to adopt a life-course or life-span developmental perspective.

In this chapter, we have highlighted empirical studies demonstrating an essential role of psychological characteristics in human longevity. Cognitive health and cognitive ability, conscientiousness, well-being and positive emotions, subjective aging and health, the forecasting of purpose and meaning of remaining life, and social connectedness are all found to be associated with longevity (Fig. 1).

Although psychological variables are associated with differences in average survival, certain interaction patterns among these variables are likely. In various constellations, they are likely to affect lifestyle and various health-related behaviors which in turn affect the likelihood for maintenance of vitality, health, and thereby survival and longevity. This complexity is nicely illustrated in a longitudinal study by Wilson and collaborators (2015) which suggests that conscientiousness has a neuroprotective effect. They show that higher conscientiousness was related to a slower terminal decline trajectory, even after an adjustment for neuropathological burden.

According to our proposed model, there might be more direct relationships between individual psychological characteristics and longevity, but the model emphasizes that lifestyle and health-related behavior mediate these influences. A better understanding of the prerequisites for longevity therefore requires that we adopt a general life-course and life-span developmental perspective. We also need to localize the life-span development in the historical and environmental context. The general framework is not only important for a better understanding of observed outcomes but also important for public health interventions aimed at a longer and healthier life span.

To ensure healthy longevity in future generations, we need to consider interactions among multiple factors related to birth cohort and generation, living and socioeconomic conditions, and the interplay between genetic and environmental influences which in concert foster psychological functioning and characteristics as well as certain lifestyles and health-related behaviors. Future research needs to examine the direct and interactive relationships among dimensions of cognition, personality, and psychological well-being but especially the role of lifestyles and health-related behaviors as mediators determining longevity. To contextualize how we feel, think, and act within a broad biopsychosocial paradigm is therefore essential for a better understanding of observed gradients of late life survival and the psychology of longevity.

## Cross-References

- ▶ [Age and Time in Geropsychology](#)
- ▶ [Aging and Psychological Well-Being](#)
- ▶ [Aging and Quality of Life](#)
- ▶ [Distance-to-Death Research in Geropsychology](#)
- ▶ [End of Life Care](#)
- ▶ [Environmental Influences on Aging and Behavior, Theories of](#)
- ▶ [Late Life Transitions](#)
- ▶ [Psychological Theories of Successful Aging](#)
- ▶ [Psychological Theories on Health and Aging](#)
- ▶ [Suicide in Late Life](#)

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## Psychology of Wisdom

Judith Glück

Department of Psychology, Alpen-Adria-Universität Klagenfurt, Klagenfurt, Austria

### Synonyms

Life experience; Prudence; Sagacity

### Definitions of Wisdom

As the number of wisdom researchers grows, so does the number of definitions and operationalizations of wisdom. While some issues are still under debate, researchers agree on the following aspects concerning the definition of wisdom (cf. Jeste et al. 2010): Wisdom is a highly desirable but rare quality; it is unlikely that an “ideally wise” person exists at all. Wisdom concerns the existential issues of human life – such as our awareness of our own mortality, fundamental ethical questions, or the balance of autonomy versus intimacy in relationships. Wisdom is a complex construct that combines cognitive components, such as broad and deep knowledge, and noncognitive components such as emotion regulation competencies and openness to new ideas and experiences. Wisdom involves critical self-reflection and awareness of the inherent uncertainty and unpredictability of the human existence – wise people are aware of how much they do not, and cannot, know. Wisdom is acquired through life experience, but it does not necessarily come with age. Wisdom involves good intentions – for others as well as for oneself. Therefore, it often manifests itself in guidance provided to others, though not necessarily in direct advice giving.

The most important point of current controversy concerns the degree to which wisdom is a quality that involves the whole self of an individual and immanently linked to his or her personal development. Some researchers focus more on the cognitive aspects of wisdom and define it more as

a quality of a person’s thinking about problems, including problems of fictitious individuals and larger societal entities. Other researchers argue that true wisdom goes far beyond thinking and is based on an extraordinary development of the self through the reflection and integration of life experiences. These two perspectives on wisdom have been labeled “general wisdom” and “personal wisdom” (e.g., Staudinger and Glück 2011). It is not yet clear, however, whether personal and general wisdom are really two empirically distinct constructs or if they should be considered as different methodological approaches to essentially the same construct. The most prominent definitions of general and personal wisdom are the following.

### The Berlin Wisdom Model

The most classical psychological conception of wisdom is the Berlin Wisdom Model, developed by Paul Baltes and colleagues from the 1980s on (overview in Baltes and Staudinger 2000). It defines wisdom as expertise in the fundamental pragmatics of life. This kind of expertise manifests itself as wisdom-related knowledge, which is characterized by five criteria: Factual knowledge concerns the nature and variability of personalities, developmental pathways, and interpersonal relationships. Procedural knowledge concerns strategies and heuristics for dealing with difficult life problems. Life-span contextualism is awareness and consideration of the fact that situational and developmental contexts have strong influences on people’s thinking and behavior. Value relativism is acceptance and tolerance of individual and cultural differences in value orientations. Recognition and management of uncertainty mean that wise individuals are aware of and able to deal with the inherent unpredictability of human life.

### Wisdom as Self-Distanced Reasoning

In a more recent approach to investigating general wisdom, Igor Grossmann and colleagues define wise reasoning as “the use of certain types of pragmatic reasoning to navigate important challenges of social life” (Grossmann et al. 2010, p. 7246). The relevant types of pragmatic

reasoning are based on dialectical thinking and intellectual humility. They manifest themselves in the ability to take different viewpoints, recognize the limitations of knowledge and the likelihood of change, make flexible predictions, and search for conflict resolution and compromise.

### **The Balance Theory of Wisdom**

Robert J. Sternberg (1998) conceptualizes (general) wisdom as the application of tacit knowledge to life problems that involve conflicts between individuals and life domains. Tacit knowledge, according to Sternberg, is procedural, domain-specific knowledge about how to reach a goal within a system. With wisdom-requiring problems, the goal is to achieve a common good, i.e., to optimize the outcome across the different interests involved; ethical values play an important role in achieving this goal. A wise solution is balanced in that it considers and balances conflicting intrapersonal, interpersonal, and extrapersonal interests as well as short-term and long-term perspectives into account. It is also balanced in how it deals with the situational context: individuals may either adapt to the context, actively change it, or select a different context.

### **The Three-Dimensional Wisdom Theory**

The best-known conception of personal wisdom is probably Monika Ardelt's three-dimensional wisdom theory (Ardelt 2003), which defines wisdom as a personality characteristic that entails three dimensions. The cognitive dimension develops through the motivation and ability to understand the human condition, which leads the individual to acquire rich and deep factual and procedural knowledge. The reflective dimension is based on a general willingness to look at phenomena from different sides and take multiple perspectives. Wise individuals also try to look at themselves from different perspectives, which leads to self-insight and self-growth. The affective dimension is an empathetic, caring attitude toward others that extends beyond friends and family to include humankind and the world at large.

### **Wisdom as Self-Transcendence**

Michael R. Levenson et al. (2005) argues that the most central aspect of wisdom is self-transcendence. As self-transcendent individuals do not depend on external self-definitions, self-enhancement, or self-confirmation, they are able to perceive people and things as they really are. Based on philosophical work on culturally universal characteristics of wisdom, Levenson has proposed three stages through which self-transcendence develops. Self-knowledge is a clear awareness of the internal and external sources of one's self. Detachment is awareness of the transient nature of external sources of self. Integration is the acceptance and integration of all aspects of the self, overcoming self-illusions and accepting one's weaknesses. Individuals who are able to integrate all sides of their self will be independent of external self-enhancement and able to develop self-transcendent, and thus truly caring, relations to others and the world.

The different conceptions presented above may seem to some readers like the proverbial blind men "investigating" an elephant: they focus on quite different aspects – expertise, balancing, and self-transcendence do not immediately fit together. But they may all be facets of a certain way of dealing with life and the challenges that it entails, which is characterized by being reflective of one's own experiences, open to the perspectives of others, and motivated to understand, learn, and grow toward living a life that is good for oneself and others.

## **Psychological Wisdom Research**

### **Lay Conceptions of Wisdom**

In the first phase of psychological wisdom research, several studies looked at laypeople's conceptions of wisdom to get a first understanding of this somewhat elusive construct (overview in Bluck and Glück 2005). Lay conceptions were also labeled "implicit theories" of wisdom (Sternberg 1985) although they are usually assessed by rather explicit methods such as ratings of how central certain characteristics are for wisdom. The core components of wisdom that

were identified in studies of lay conceptions have clearly also shaped psychologists' theories. For example, a seminal lay-conception study by Clayton and Birren (1980) identified cognitive, reflective, and affective components of wisdom, which became an important basis for psychological wisdom theories (Ardelt 2003).

Later, lay-conception research focused more on individual differences in wisdom conceptions, e.g., between cultures and age groups. Cross-cultural research shows that "Western" conceptions tend to emphasize cognitive aspects of wisdom, while "Eastern" conceptions give equal weight to noncognitive aspects such as humility, empathy, and emotion regulation (Takahashi and Overton 2005) – a distinction that somehow parallels that of general and personal wisdom. In addition to differences between cultures, however, there are marked individual differences within cultures. For example, the perceived centrality of affective aspects of wisdom increases with age, suggesting that life experience may make people more conscious of the importance of caring about others.

### Measuring Wisdom

With complex constructs like wisdom, measurement is a nontrivial issue. As explained earlier, wisdom combines certain attitudes, such as a motivation to question the obvious, personality components such as openness to new ideas and experiences, and competencies such as factual and procedural knowledge about life problems or emotion regulation skills. As discussed earlier, some researchers have focused more on the personality-type components of wisdom, while others have focused on the competencies. Accordingly, two general classes of measures of wisdom have been developed – self-report scales and performance tasks.

While attitudes and personality components are usually measured by self-report, assessing competencies by self-report has obvious limitations because people are not particularly good at judging their own abilities. Even with respect to attitudes and personality, however, people do not always describe themselves veridically in self-report measures, either because they want to

present themselves or because they actually perceive themselves in an unrealistic way. This is an issue with all self-report measures, but it is particularly problematic with a construct like wisdom that entails critical self-reflection: in fact, truly wise individuals are likely to view themselves less positively than people with strong self-illusions. Thus, the validity of self-report measures of wisdom may be somewhat limited especially when the items refer to characteristics that are clearly positive. Authors of self-report wisdom scales have used different approaches to avoid this problem, such as the use of reverse-coded items.

Competencies, on the other hand, are generally measured by means of performance tasks, often, e.g., in the case of intelligence, using closed-response tasks where the participant selects the correct response from a set of alternatives. Wisdom is almost impossible to measure with such closed-response tasks, however, because most people are very well able to recognize a wise response to a problem even if they would be completely unable to actively produce a response nearly as wise. Therefore, most competence measures of wisdom consist of open-ended tasks in which participants produce spoken or written responses that are then evaluated according to predefined criteria. Obviously, these approaches require much more time and effort than the administration of a self-report scale. Also, people who are highly intelligent, but not particularly wise, may well be able to produce highly convincing responses to open-ended wisdom tasks. If they were faced with the same problem in real life, however, their lack of the noncognitive qualities of wisdom might render them unable to utilize their wisdom-related knowledge. Currently, several researchers are working on new measures of wisdom, some of which are intended to increase participants' personal involvement.

Several self-report scales and performance measures of wisdom have been developed and validated. As each measure is based on a specific conception of wisdom, researchers who want to use a particular measure should always consider whether its theoretical background is consistent with their research question.

### Self-Report Scales

The most prominent self-report wisdom scales include the 39-item Three-Dimensional Wisdom Scale (3D-WS; Ardel [2003](#)), which measures Ardel's cognitive, reflective, and affective dimensions. The Self-Assessed Wisdom Scale (SAWS; Webster [2007](#)) consists of 40 items measuring openness, emotional regulation, humor, critical life experience, and reminiscence and reflectiveness. The Adult Self-Transcendence Inventory (ASTI; Levenson et al. [2005](#)) measures wisdom as self-transcendence. The most recent version consists of 34 items, 10 measuring alienation and 24 measuring self-transcendence. The 20-item Brief Wisdom Screening Scale (Glück et al. [2013](#)) was empirically derived by selecting those items from the 3D-WS, ASTI, and SAWS that had the highest loadings on a common factor.

### Performance Measures

The "classical" performance measure of general wisdom is the Berlin Wisdom Paradigm (BWP; overview in Baltes and Staudinger [2000](#)). Participants are asked to think aloud about brief descriptions of difficult life problems. Responses are transcribed and rated with respect to five criteria: factual knowledge, procedural knowledge, life-span contextualism, value relativism, and recognition and management of uncertainty. Mickler and Staudinger ([2008](#)) built on the Berlin wisdom paradigm to develop a parallel measure of personal wisdom. Their Bremen Wisdom Paradigm measures participants' wisdom with respect to their own self and life experiences. Participants are asked to think aloud about questions concerning themselves as a friend. Responses are transcribed and rated with respect to five personal-wisdom criteria: rich self-knowledge, heuristics of growth and self-regulation, interrelation of the self, self-relativism, and tolerance of ambiguity.

Grossmann et al. ([2010](#)) developed a new paradigm for measuring wise reasoning. Participants are presented with stories about conflicts between social groups in foreign countries, such as ethnic tensions or the assimilation of immigrants. They are interviewed about what they think will happen in those countries and why. Response transcripts

are coded for perspective shifting to take different viewpoints, recognition of the likelihood of change, flexibility of predictions, recognition of uncertainty and the limits of knowledge, search for conflict resolution, and search for compromise.

### Correlates of Wisdom

Wisdom is conceptually and empirically related to at least six groups of psychological variables: intelligence, personality, affect and well-being, identity development, value orientations and moral development, and religiosity and spirituality.

Correlations between wisdom and **intelligence** are relatively low. Correlations with intelligence tests are between zero and 0.20 for self-report measures and somewhat higher, in the 0.20–0.30 range, for performance measures of wisdom. As wisdom is often considered as a kind of expertise, one would expect to find positive correlations with crystallized intelligence and zero or even negative correlations with fluid intelligence, but empirical findings show no consistent picture. While the SAWS and Grossmann's measure of wise reasoning show the expected pattern of correlations, the 3D-WS is positively related to fluid intelligence, and the BWP and BrWP are positively related to both fluid and crystallized intelligence. Linear correlations may not be the optimal indicator for the relations of wisdom to other variables, however. For example, wisdom might require a certain minimum level of intelligence, but beyond that level, there might be essentially a zero relationship.

The **personality** dimension that is most consistently related to wisdom is openness to experience. In fact, Webster ([2007](#)) considers openness a component of wisdom. People high in openness are more likely to learn and grow from new ideas, experiences, and contexts throughout their life. Apart from openness, self-report measures of wisdom tend to be correlated to other personality dimensions (e.g., agreeableness, extraversion, and negatively related to neuroticism) as well, whereas performance measures are mostly uncorrelated to personality. This is probably partly due to shared method variance among

self-report scales and partly due to the fact that most self-report measures are based on conceptions of wisdom that include personality aspects.

The relationship between wisdom and **well-being** is still under debate. Some authors are convinced that wisdom causes higher levels of life satisfaction and positive affect, but others believe that wisdom entails an awareness of the negative sides of the human existence that may prohibit high levels of happiness. Conceptually and empirically, wisdom is clearly more closely related to eudaimonic well-being, the awareness of meaning in one's own life, than to hedonic well-being, the simple enjoyment of a pleasurable life.

With respect to **identity development**, the evidence consistently suggests low positive correlations across different wisdom measures. Wisdom goes along with higher levels of ego development, integrity, and generativity and an orientation toward personal growth and learning from life. Correlations between wisdom and life experiences per se, on the other hand, tend to be low to insignificant. These findings are consistent with the idea that wisdom does not develop through any particular experiences but through the way individuals deal with and reflect upon them.

There is surprisingly little research on the question whether wisdom is related to **ethical and moral constructs** such as value orientations or levels of moral development. Definitions of wisdom as well as empirical findings suggest that wisdom is positively related to universalistic, altruistic, and growth-oriented and negatively related to authoritarian and hedonistic value orientations. Independent of which values an individual endorses, wisdom-related knowledge is also related to an advanced level of moral reasoning in the Kohlbergian sense, i.e., moral judgment based on general ethical principles.

A growing body of research suggests relationships between wisdom and **spirituality** and intrinsic **religiosity** but not extrinsic (i.e., externally motivated) religiousness. Spirituality may be particularly related to the self-transcendent aspects of wisdom. Both wisdom and religiosity could play important roles in helping individuals deal with existential challenges.

## Wisdom and Age

Wisdom does not necessarily come with age. While the individuals that laypeople nominate as particularly wise are usually at least in their sixties, laypeople do not endorse the idea that every older person is wise. Research also suggests that most older people live largely satisfactory, happy lives but few have developed high levels of wisdom. Empirically, relations to age differ between measures of wisdom, with zero correlations for the Berlin wisdom paradigm and the adult self-transcendence inventory, a positive relation for Grossmann's measure of wise reasoning, negative relations for the Bremen personal-wisdom paradigm and the three-dimensional wisdom scale, and even an inverse U-shaped relation for the self-assessed wisdom scale (as nonlinear patterns have not been explored for the other measures, more complex relationships might actually be more frequent). This diversity is probably due to the fact that different measures emphasize different aspects of wisdom. Some aspects, such as accumulated life experience, relativistic thinking, or emotion regulation competencies, may increase with age, while others, such as self-concept complexity or fluid intelligence, decrease. However, highly wise individuals may be able to maintain high levels of functioning even in aspects that generally decrease with age because of their lifelong accumulation of expertise: someone who has been thinking and advising others about difficult life situations for many years may be able to grasp the essentials of a complex situation more fully at age 80 than someone else does at age 40 by using acquired strategies and heuristics that can overcome the cognitive limitations of old age.

In addition to individual developmental processes, there are several reasons to assume that the experience of old age itself can be conducive to wisdom. Aging may change the way people think about life, as it introduces new perspectives about control and remaining lifetime. Relatively typical experiences of old age, such as health-related events and loss of professional roles, may shift the focus from active problem-solving toward an increasing awareness of the limitations of personal control. Awareness of one's limited

remaining lifetime can foster adaptive emotion regulation and self-transcendence. Similarly, Erik Erikson (1959) has argued that integrity, the positive resolution of the last crisis of identity development, involves the acceptance of one's life as it was lived. Thus, experiences that are relatively typical of old age may be conducive to growth in wisdom – at least in those people who have sufficient psychological and psychosocial resources to deal with them constructively.

### The Development of Wisdom

Why do a few people become very wise in the course of their lives, while so many others go through similar experiences but do not seem to learn or grow from them? The uncommonness of high levels of wisdom suggests that wisdom requires extraordinary constellations of resources and experiences to develop. In the context of the Berlin Wisdom Model, Baltes and Staudinger (2000) suggested that there are many different paths to wisdom, but they all involve characteristics of the individual such as intelligence, creativity, openness, expertise-relevant factors such as the presence of mentors or a motivation to learn and grow, and relevant experiential contexts such as parenthood, certain professional roles, or old age.

The MORE Life Experience Model (Glück and Bluck 2013) proposes that wisdom develops through an interaction of psychological resources with challenging life experiences. The four central resources – as sense of mastery, openness, reflectivity, and emotion regulation/empathy – influence which life challenges people encounter, how they appraise them and deal with them, and how they integrate past challenges in their life story. Individuals with higher levels of the resources are more easily able to deal with life-changing experiences in ways that foster learning and growth toward wisdom.

### Fostering Wisdom

The question whether it is possible to teach or train wisdom has obvious societal relevance. Indeed, experimental research by the Berlin wisdom group and by Igor Grossmann's lab has identified short-term interventions that had significant positive effects on general wisdom. All these

interventions have in common that they somehow prompted participants to transcend their own viewpoints: by imagining to discuss a wisdom task with a close other person, by reflecting about the variability of life contexts and values, or by taking a distanced, as opposed to self-immersed, perspective. An instruction to “try to give a wise response,” however, increased levels of wisdom-related knowledge only in participants who already were quite wise. No experimental intervention research has yet been published with respect to personal wisdom.

Longer-term interventions for fostering wisdom have mostly been discussed with respect to education: could schools or universities teach wisdom or at least wisdom-relevant knowledge and skills? Little empirical research has been published as yet, but it seems likely that some aspects of wisdom, especially cognitive facets such as relativistic thinking or critical self-reflection, can (and should) be trained in educational settings.

### Applied Wisdom Research: Wisdom and Leadership

Wisdom and leadership seem to be strongly associated in the minds of most people. When laypersons are asked to nominate wise figures, they often come up with societal leaders such as Mahatma Gandhi, Jesus Christ, Martin Luther King, or Nelson Mandela (Paulhus et al. 2002), who inspired millions of followers and fundamentally improved the lives of many. Currently, leadership research seems to be more and more interested in going beyond conceptions of leadership as mostly strategic, technocratic, and unconcerned with ethical issues and in integrating aspects such as wisdom. In a seminal paper, McKenna et al. (2009) built on the psychological wisdom literature as well as on Aristotle's writings on practical wisdom to derive five propositions about wise leadership: (1) Wise leaders use careful observation and logical reasoning to establish facts and to derive explanations and conclusions. (2) They are also aware of the relevance of nonrational and subjective aspects in decision-making. (3) Wise leaders value tolerance and humane and virtuous outcomes. (4) While their actions may be based on more general

considerations, they are always practical and real life oriented. (5) Wise leaders are aware of the personal and social rewards of contributing to the good lives of themselves and others. Along similar lines, Yang (2008) proposed three components of wise leadership: integration (of perspectives, interests, or ways of thinking), embodiment of ideas through concrete actions, and positive effects for the self as well as for others.

While wisdom research clearly has promising implications for leadership in many fields, such as politics, law, education, or medicine, it is also important to mention that structural constraints may often stand against the manifestation of wisdom in such contexts. In politics, for example, voters may tend to prefer leaders who strongly advocate simple, convincing visions to wiser individuals who are aware of the whole complexity of a situation and the diversity of values and perspectives. Also, temporal, organizational, and administrative constraints may make it very difficult and exhausting for a wise leader to try to attain major changes. For these reasons, wise individuals may not feel particularly attracted to fields that would require high levels of wisdom such as politics. In addition to calling for wise leaders, it may seem worthwhile to think about how societal structures could be changed to allow for more wisdom in their decision-making machineries.

### Current Developments and Open Questions

The field of psychological wisdom research is growing fast; researchers are both developing new approaches to studying wisdom and applying concepts and measures of wisdom in new areas. New, more ecologically valid and less laborious methods for measuring wisdom are being developed, short-term and long-term wisdom interventions are being studied, and new methods of data analysis are being applied. A large number of important questions are still open. A long time ago, creativity research profited enormously from the suggestion to investigate at least four “Ps”: not just creative persons but also creative products, creative processes, and external presses. For example, what distinguishes presidential addresses that laypeople consider wise from those they consider less wise? Through which

cognitive and noncognitive processes do some people arrive at wiser solutions to difficult real-life problems? How do situational constraints in professional contexts limit people’s ability to make wise decisions? Another important issue concerns the fact that the large majority of current wisdom studies have been carried out in modern Western individualistic societies – to what extent are our conceptions of wisdom universal rather than shaped by our cultural, historical, and societal context? Our world is faced with many, and more and more global, challenges. Wisdom research will hopefully contribute to the identification and implementation of wise solutions.

### Cross-References

- ▶ [Adaptive Resources of the Aging Self, Assimilative and Accommodative Modes of Coping](#)
- ▶ [Altruism and Prosocial Behavior](#)
- ▶ [Crystallized Intelligence](#)
- ▶ [Emotional Development in Old Age](#)
- ▶ [Expertise and Ageing](#)
- ▶ [Leadership and Aging](#)
- ▶ [Memory, Autobiographical](#)
- ▶ [Psychosocial Well-Being](#)
- ▶ [Resilience and Aging](#)
- ▶ [Socioemotional Selectivity Theory](#)
- ▶ [Spirituality and Religious Participation in Later Life](#)
- ▶ [Stage Theories of Personality](#)
- ▶ [Stress and Coping Theory in Geropsychology](#)

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## Psychosocial Well-Being

Richard A. Burns

Centre for Research on Ageing Health and Wellbeing, Research School of Population Health, The Australian National University, Canberra, ACT, Australia

## Synonyms

Eudaimonia; Hedonia; Psychological well-being; Subjective wellbeing

## Definition

Psychological well-being refers to inter- and intraindividual levels of positive functioning that can include one's relatedness with others and self-referent attitudes that include one's sense of mastery and personal growth. Subjective well-being reflects dimensions of affect judgments of life satisfaction.

## Introduction

The concept of well-being has received considerable interest in recent years, both in the scientific and lay literature. As such, well-being is frequently cited as a national priority for government policy around the world (Beddington et al. 2008). However, depending upon one's professional and personal perspective, the notion of well-being can have quite different connotations. For instance, economists may interpret well-being in terms of economic capacity and prosperity, the growth in both individual and national economic wealth. Population health researchers may focus on issues of health promotion and disease eradication. Social policy advocates may phrase issues of well-being in terms of health-care provision, education access, and issues of justice and equality. For behavioral scientists, the notion of well-being is most frequently framed in terms of individuals'

own level of experience, reflecting their personal, experiential, and phenomenological sense of happiness and engagement with their families, work, and community.

Consequently, different well-being definitions may lead to quite different understandings of how well-being is related to age and aging processes. Even within the behavioral sciences, where the operationalization of concepts is integral to model development and applied research, a lack of rigor in operational definition has made understanding the disparate findings related to well-being and developmental trajectories in late life difficult to reconcile. The psychosocial well-being literature is awash with various terms and models; the same term can reflect different concepts for different researchers, while different terms can mean the same thing for others. Over recent decades, considerable effort has been made to reconcile these different approaches. Most frequently, within the behavioral sciences, well-being research is described as reflecting two broad approaches or traditions. The first approach is frequently referred to as the hedonic or subjective well-being (SWB) tradition. With roots in the third and fourth century BC, the philosophy of Aristippus and Epicurus and by the work of fellow *Cyrenaics* – one of the earliest Socratic schools – SWB is based on hedonic principles in which pleasure and happiness are of primary concern to the individual, irrespective of the virtuous nature of that pleasure fulfillment. Such principles were echoed centuries later by Priestley and Bentham’s “greatest happiness principle” that a good society is built on individuals’ attempts to maximize pleasure and self-interest. The term *hedonia* itself is derived from the Greek word for “pleasure.” The second approach is the eudaemonic or psychological well-being (PWB) tradition. Similar to *hedonia*, *eudaimonia* has its foundations in antiquity, most notably reflected in Aristotle’s treatise *Nicomachean Ethics* which was one of the first secular texts to expound on what it is to live a good life. As with *hedonia*, the term *eudaimonia* derives from the Ancient Greek *eu* for goodness or well-being and *daimon* for spirit. Hence, *eudaimonia* can be interpreted as the focus on living the good life or with a good

spirit. Numerous reviews have sought to summarize and collate different well-being models within these broader contexts (Ryan and Deci 2001; Huppert et al. 2004, 2009).

### **Hedonia: Subjective Well-being**

SWB research emerged during the 1960/1970s as an attempt to measure quality of life and to monitor the impact of social policy on social change. These initial SWB studies emphasized the importance of life satisfaction and happiness as indicators of well-being and life quality. As a hedonic approach, SWB models typically relate well-being to subjective happiness and relate to the attainment of goals or valued outcomes with a focus on “what makes experiences and life pleasant and unpleasant” (Kahnemann et al. 1999). SWB therefore represents individuals’ subjective evaluations about different aspects of their lives, incorporating an assessment of the range of emotions they are experiencing. These evaluations comprise cognitive and affective interpretations and, unlike objective measures of psychological and physical health, reflect an individual’s personal assessment of their own life. SWB is commonly defined by three components: life satisfaction, the presence of positive mood, and the absence of negative mood (Kahnemann et al. 1999; Diener et al. 1999). Accordingly, by clearly defining well-being in terms of satisfaction and positive and negative valence, research into the area has been able to clearly differentiate between constructs and has led to a voluminous amount of research into the causes and consequences of SWB. In addition, renewed attention in the “positive” psychology field at the turn of the century has strengthened the well-being literature base, arguing that for too long, well-being research was driven by clinical definitions of mental health and by the notion that the absence of mental ill-health is too narrow and constricting a definition to be useful as an indicator of wellness. However, even a focus on SWB, and in particular on notions of happiness and positive affective states, overlooks other important constructs of well-being such as personal growth and

development that are said to reflect a *eudaemonic* approach to well-being. Finally, it is important to note that while much of the SWB literature is focused on a positive and negative affect dichotomy, Russell and colleagues (Posner et al. 2005) have proposed a circumplex model of affect, for which there is an increasing evidence base, which highlights the need to discriminate between low- and high-arousal positive and negative affect. For instance, feeling sad (low negative arousal) contrasts with feeling nervous (high negative arousal).

**Eudaimonia: Psychological Well-being**

PWB has its foundations on *eudaemonic* assumptions that suggest that well-being is related to whether individuals live their lives according to their true nature or spirit (*daimon*), reflected in earlier psychological theories such as Maslow’s theory of self-actualization. However, unlike SWB concepts which have been clearly defined, much of the PWB literature has struggled to develop well-validated models of PWB. This is in part due to the vagueness of PWB operationalizations of wellness and what it means to be living the good life, unlike SWB constructs.

There are two widely cited measurement models of PWB. The first is that encapsulated by Carol Ryff’s model of PWB, from which the psychological well-being scales were derived (Ryff 1989a, b; Ryff and Keyes 1995). Ryff’s PWB scales drew from gerontological and life-span research and reflect one construct-oriented approach to PWB. Their theoretical underpinnings stemmed from a wide range of influences including Allport’s concept of the mature personality, Rogers’ fully functioning individual, and Maslow’s notion of self-actualization. Through interviews with young, middle-aged, and older members of the general population, Ryff argued that six key dimensions were consistently identified as indicative of the good life and well-being (Table 1). The PWB scales therefore reflect a multidimensional approach to the measurement of PWB that tap six distinct areas and include autonomy, personal growth, self-acceptance, purpose in life, environmental mastery, and positive

**Psychosocial Well-Being, Table 1** Summary of PWB variables and their definitions

PWB variable	Definition
Environmental mastery	Feelings of competence and capacity to manage and meet the responsibilities of everyday life
Personal growth	Capacity for continued development, potential, and openness to experience
Purpose in life	Feelings of purpose and having a sense of life direction and that past and present experiences are meaningful
Self-acceptance	The capacity for accepting and acknowledging one’s strengths and virtues as well as recognizing one’s weaknesses
Positive relations with others	The sense that one has warm, satisfying, and trusting relationships and are socially concerned
Autonomy	The extent to which one views oneself as self-determining and independent, resisting pressure to meet social expectations

relatedness with others. *Self-acceptance* is a significant construct within theories that define self-actualization and fully functioning individuals and emphasizes an ability to develop warm trusting *relationships with others* and being empathetic and affectionate toward others. However, these individuals remain *autonomous*, resisting societal expectations to change and conform. *Environmental mastery* reflects an ability of self to manipulate and function within constraints, while *purpose in life* reflects the capacity for goal selection and developing a sense of life direction which contribute to meaning in one’s life. *Personal growth* reflects individuals’ capacity to grow and realize one’s own inner potential. Following Ryff’s theory, these PWB concepts are all fundamental to the individuals’ capacity to actualize and maintain a fully functioning self.

While the conceptual model has intuitive appeal, support for the PWB scales themselves has been mixed (Ryff and Keyes 1995; Abbott et al. 2006; Burns and Machin 2009; Clarke et al. 2001). It has been noted (Burns and Machin 2009) that a number of validation studies (1) utilized a short or a very short form of the PWB



scales or (2) implemented questionable factor analytical methods for the data in question (e.g., principal component analysis with varimax rotation). Indeed, in addressing these issues, two independent studies, using multiple national samples (Abbott et al. 2006; Burns and Machin 2009), have consistently demonstrated that at least the environmental mastery, personal growth, purpose in life, and self-acceptance items are unable to discriminate between their parent factors. This should not be surprising; Clarke, Ryff, and colleagues reported themselves a high degree of correlation between these four PWB factors (Clarke et al. 2001). However, despite the weaknesses related to aspects of the scale's initial construction and the analytical limitations of some subsequent validation studies, considerable evidence does relate various PWB dimensions to a range of outcomes including biological health, successful transitions in later life, and better therapeutic outcomes (Huppert et al. 2004; Abbott et al. 2006; Fava and Ruini 2003).

Often described as a theoretical framework of motivational drives, a second widely cited model that has embraced the concept of eudaimonia as a central aspect of well-being is Ryan and Deci's self-determination theory (SDT) (Ryan and Deci 2000, 2001). SDT delineates between three basic psychological and social needs which include autonomy, competence, and relatedness. Much of the research within this framework focuses on identifying the mechanisms by which internal and external drivers of individual motivation realize these three needs. Burns has noted (Burns and Machin 2009) the commonality with autonomy and relatedness from the SDT and Ryff PWB models and further suggested that the SDT competence factor may be related to the superordinate PWB factor that reflected the scales (environmental mastery, personal growth, purpose in life, and self-acceptance) which Burns and Abbott separately identified (Abbott et al. 2006; Burns and Machin 2009). According to SDT, the fulfillment of these three needs is essential for psychological growth and psychological health. Much SDT research has focused on identifying and examining the pathways by which social and cultural factors facilitate or

inhibit the fulfillment of these needs. At its heart, SDT posits that individuals (1) are proactive agents in their lives, with the capacity to master their own drives and emotions; (2) are inherently growth oriented; and (3) need a nurturing social environment to strive for optimal development. Within a life-span perspective, the capacity to satisfy these needs will vary with other age-related declines such as with changes in social status (e.g., retired), relationships (e.g., widowed), physical health (development of age-related diseases like dementia), and proximity to death. Thus, the satisfaction of these needs is purported to vary in different degrees of importance as a consequence of different developmental periods. However, it is generally considered that failure to strive for these needs results in negative psychological consequences. While well validated and cited in other areas of the behavioral sciences, SDT has had only limited influence in the geropsychology sphere.

### **Reconciling Different Well-being Traditions**

PWB proponents have typically challenged SWB models as being limited in describing long-term positive functioning on the premise that SWB dimensions are often fallible indicators of healthy living given a focus on affective states and generalized evaluations of satisfaction, which generally change little over time, but which are highly reactive in shorter temporal contexts. However, PWB proponents do not dismiss the importance of satisfaction or emotion; simply, they place less emphasis on the promotion of positive emotions or for that matter reducing negative experiences. Rather, they are concerned more with the appropriateness of the emotional experience. For example, as a consequence of experiencing a negative life event, such as the death of a loved one, it is only natural for an individual to experience a degree of negative affect and/or lowered positive affect. Emotion, for researchers within the PWB perspective, is therefore contextual. The end goal of experiencing emotions is to contribute to the promotion of personal growth in the long term.

Despite their conceptual differences, PWB and SWB share a number of commonalities. While decades of research have related notions of positive mental and physical health with the absence of such adverse states as depression, anxiety, and physical illness, a number of researchers have proposed that well-being is not necessarily an antithesis to ill-being (Beddington et al. 2008; Ryan and Deci 2001; Huppert et al. 2004, 2009; Kahnemann et al. 1999; Diener et al. 1999; Ryff 1989a, b; Abbott et al. 2006; Burns et al. 2014a). There have also been attempts to reconcile SWB and PWB, and there is an increasing literature providing substantial evidence from factorial analysis studies for items to discriminate between SWB and PWB domains (Burns and Machin 2009; Gallagher et al. 2009). A recent collaboration of well-being researchers (Huppert et al. 2009) has sought to consolidate these different well-being traditions into a coherent measure of well-being that

...systematically assesses key wellbeing variables for representative samples, including positive and negative emotions, engagement, purpose and meaning, optimism and trust, and life satisfaction, as well as satisfaction with specific domains of life.

The European Social Survey (ESS) Well-being Module (Huppert et al. 2009) reflects a systematic attempt to reconcile both SWB and PWB approaches and also extends a focus on intrapersonal factors by incorporating dimensions of social and interpersonal well-being. The ESS Well-being Module (see Table 2) comprises two domains, the inter- and intrapersonal domains within which well-being can be conceptualized in terms of psychological feeling and functioning, reflecting the SWB and PWB traditions, respectively. Huppert et al. (2009) argue that the module’s development provides an

opportunity for a richly textured description of how the citizens of Europe experience their lives. It complements more objective data on economic, social and environmental influences on well-being, which can be derived from other items within the ESS and from other data sources. We believe that the Well-being Module will provide invaluable information for behavioural and social scientists, and contribute to the development of policies and practices for enhancing well-being across Europe.

**Psychosocial Well-Being, Table 2** Conceptual framework for the ESS well-being module and constructs assessed within the four domains (Huppert et al. 2009)

	Intrapersonal	Interpersonal
Feeling (SWB)	Satisfaction	Belonging
	Positive affect	Social support
	Negative affect	Social recognition
	Optimism	
	Vitality	
	Self-esteem	
Functioning (PWB)	Autonomy	Social engagement
	Competence	Caring
	Interest in learning	Altruism
	Goal orientation	
	Sense of purpose	
	Resilience	

It is clear that the model attempts to encapsulate leading well-being theories and models and importantly focuses on both the individual and their relatedness to their social contexts. There is a considerable literature base on the role of these different well-being dimensions on outcomes across the life-span and into older adulthood. Importantly, their utility in providing additional and complementary information to traditional clinical measures of psychological distress and mental health is clear. For example, Burns and colleagues have recently and consistently demonstrated the additional utility of well-being measures over and above measures of psychological distress in promoting health outcomes including falls likelihood, self-rated health, and mortality (Burns et al. 2012, 2014a, b, 2015) in older adults. Further, in trying to place well-being and mental health constructs within some theoretical context, Burns and colleagues (2011) explored the associations between measures of SWB or “feeling” (operationalized by positive and negative affect) and PWB or “functioning” (operationalized by mastery/competence and resilience), with measures of depression and anxiety. They identified strong support for a model whereby SWB mediated the effects of PWB on depression and anxiety. That is, perceptions of mastery and resilience

drove positive and negative affect which in turn predicted depression and anxiety outcomes. It is increasingly evident that well-being and mental health are related and that well-being outcomes are worthy of study as much as the clinical focus on dimensions of mental health.

### Relating Well-being and Age

In relation to changes in well-being with age, there has been a paradox of sorts. Despite consistent findings relating to decreased physiological and cognitive capacity in later life, older adults are generally satisfied with their lives. However, the capacity to describe and explain well-being trajectories across later adulthood is impacted by a number of factors. Issues of operational definition have previously been identified as factors that may moderate our understanding of well-being processes in late life. Other issues relate to study design and whether data are drawn from cross-sectional or longitudinal panel data. While some cross-sectional studies indicate few age-related differences in well-being, analyses of longitudinal studies often identify some individuals as reporting considerable well-being decline (Burns et al. 2015). This is compounded by current estimates that suggest over half of the variance in various well-being dimensions are within person. Hence, in order to appreciate the exact processes in which well-being may fluctuate in later life, it is important to understand the extent to which well-being varies within individuals and the drivers of this variation. However, even where designs and operational definitions are consistent, disparate findings can be found. For example, Clark and colleagues (2012) have suggested that the association between life satisfaction and age is best described as an inverted U shape whereby both young and older adults report the highest levels of well-being (compared to adults in mid-life). In contrast, Baird and colleagues (2010) reviewed over 20 years of longitudinal data from the German Socio-Economic Panel and British Household Panel Studies and found stable life satisfaction in the German population until age

70, while the British population reported increases in mid-life and with substantial declines in late life. In Australia, Headey and Warren (2008) identified life satisfaction as lowest in mid-life. These findings indicate the large differences in life satisfaction across seemingly similar countries and further highlight that although some differences between studies can be attributed to differences in operational definition, even where constructs are comparable, it may be that a particular construct, such as with life satisfaction in this case, is not necessarily a valid or sensitive indicator of age-related changes.

A further issue that may influence our understanding of well-being in later life relates to increasing evidence that changes in well-being are less a context of aging, but rather exposure to other confounding factors that may in turn drive well-being changes. These include changes in physical health and mortality. For example, Gerstorf and colleagues (2008, 2010) have demonstrated that changes in well-being are more strongly related to mortality and time to death than increasing age per se, providing evidence for both a terminal decline (a gradual decline) and terminal drop (a gradual decline prior to a precipitous drop in the years preceding death) in well-being. Extending Gerstorf et al.'s findings, Burns and colleagues (2014a) replicated the terminal decline but importantly were able to demonstrate how within-person change in physical health attenuated these terminal declines in well-being. Similarly, within a mixture modeling analysis framework, Burns and colleagues (2015) identified that despite an overall population-level terminal decline in well-being, mixture analysis revealed several classes for whom most reported stable well-being trajectories, with only 10–20% of the population actually reporting decline. Analysis indicated that participants in these classes comprised individuals with the worst and/or worsening health status. Other evidences for the confounding role of physical health have been reported. Windsor et al. (2013) extended focus on positive and affective dimensions of SWB to incorporate the role of arousal states and the role physical health plays in moderating age

differences. In line with other findings (Kessler and Staudinger 2009), Windsor et al. (2013) identified older adults as reporting higher levels of low-arousal positive affect and lower levels of high arousal, but that age-related declines in physical functioning were significant drivers of the lower levels of high arousal.

## Improving Well-being Outcomes

There is a growing body of evidence for the efficacy of psychological interventions to elicit changes in well-being in both clinical and community populations (Fava and Ruini 2003; Lyubomirsky et al. 2011; Sin and Lyubomirsky 2009). Within a clinical context, Fava and colleagues have utilized well-being therapy (WBT), in conjunction with cognitive behavioral therapy (CBT), that focuses on building dimensions of psychological functioning (e.g., mastery, purpose, self-acceptance). Their clinical findings indicate substantial reduction in relapse rates in the WBT group (relapse rate = 40%) in comparison with the CBT-only group (relapse rate = 90%). Their methods have been utilized as part of health and social development classes in schools with great impact in reducing psychological distress and improving a sense of well-being in students. A recent meta-analysis (Sin and Lyubomirsky 2009) identified medium effect sizes for the efficacy of positive psychology programs for increasing well-being ( $r = 0.29$ , 95%; CI: 0.21, 0.37) and for decreasing depression symptoms ( $r = 0.31$ , 95%; CI: 0.17, 0.43). Engagement in these activities elicited both positive functioning and feeling in adults, the benefits of which included improved health outcomes, community engagement, and increased workforce participation.

## Conclusion

Well-being is an important concept across a wide variety of scientific and health domains and is increasingly impacting on government policy. Within the behavioral sciences, approaches to

well-being can be described as ascribing to one of two broad traditions, hedonia (SWB) and eudaimonia (PWB). While SWB proponents focus on hedonic factors that include judgments of satisfaction and affect, PWB researchers seek to identify those characteristics that may describe how well individuals are living their lives and relate to perceptions of personal growth, a sense of life purpose, and self-acceptance. There is considerable conceptual and statistical evidence to support the delineation of these two related yet separate traditions. However, failures to recognize different operational definitions and to disentangle age effects between cross-sectional and longitudinal studies have highlighted limitations in our capacity to accurately describe well-being changes in later adulthood. It is increasingly recognized that much of the well-being literature has failed to identify the extent to which well-being variation is a consequence of true age-related differences as opposed to natural daily variation and changing individual contexts such as decline in physical health or cognitive capacities. Overall, there is increasing evidence for the utility in examining well-being in late life in concert with clinical measures of psychological health and distress, with evidence to suggest that well-being is a sensitive indicator of lives being lived well within the context of age-related physical, health, social, and economic declines.

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## PTSD and Trauma

Steven R. Thorp, Lisa H. Glassman and  
Stephanie Y. Wells

VA San Diego Healthcare System, San Diego,  
CA, USA

University of California, San Diego, San Diego,  
CA, USA

### Synonyms

Assault; Combat; Posttraumatic stress disorder;  
Threat; Traumatic event; Violence

### Definition

The newest version of the *Diagnostic and Statistical Manual of Mental Disorders* classifies posttraumatic stress disorder (PTSD) as a cluster of symptoms that develop after a traumatic experience (American Psychiatric Association 2013). The stressor may include direct exposure to actual or threatened death, serious injury or sexual violence, witnessing such an event, or repeated exposure to aversive details of an event. Learning that a close relative or friend has experienced a trauma, such as finding out a parent or child has died suddenly of accidental or violent causes, can also qualify as a trauma. As a result of experiencing one of these stressors, the individual must respond with intrusion symptoms such as intrusive memories, nightmares, or flashbacks; avoidance of trauma reminders and/or thoughts and feelings associated with the event; changes in cognitions and mood such as persistent feelings of guilt or anger; and increased arousal that often takes the form of irritability, aggression, or sleep disturbances. Symptoms must result in functional impairment and last for at least 1 month.

### Introduction

Given that the number of older adults within the US population is growing more quickly than other

age-groups (US Census Bureau 2010), examining PTSD and its treatment within the older adult population is a critical endeavor. PTSD, and trauma more broadly, can have a significant impact on older adults (Hyer and Sohnle 2001). This entry will cover the epidemiology, course, risk factors, assessment, and treatment of PTSD in older adults. Much of the current PTSD literature in older adults is based on research examining the impact of the Holocaust, military experiences such as combat and prisoner-of-war status, or large-scale disasters (e.g., natural disasters). Little is known about the effects of other types of trauma, such as interpersonal trauma or the effects of traumatization during older adulthood (Cook and Niederehe 2007; Thorp et al. 2011). Furthermore, research on this topic is complicated by the fact that “older adult” has been defined in various ways in the literature, sometimes including subjects as young as 55. While future research in these neglected areas is critical to our understanding of PTSD in older adults, the current state of the literature allows some conclusions regarding how PTSD and its assessment and treatment may differ in older populations.

### Epidemiology

There are a few studies that have examined the prevalence of PTSD in older adults – most epidemiological studies either do not include older adults or do not incorporate enough older adults to draw any reliable conclusions (Cook and Niederehe 2007; Thorp et al. 2011). Additionally, longitudinal research in this area has been limited, partially due to the fact that PTSD was not included in the DSM until 1980 (DSM-III) and changes to PTSD diagnostic criteria have occurred with every successive DSM since that time. Estimates of the lifetime prevalence of any traumatic event range from 70% to 90% in the older population compared to about 55% in the general population (Thorp et al. 2011). However, studies have found that the lifetime prevalence of full PTSD in older adults is approximately 2.5–3.5%, compared to approximately 7% in the general population. Nonetheless, prevalence rates

for PTSD over 50% have been reported among older adults who were combat veterans, former prisoners of war, or Holocaust survivors (Averill and Beck 2000; Thorp et al. 2011). It has also been suggested that older adults who do not meet criteria for the full PTSD diagnosis may still be suffering substantially from PTSD symptoms. Prevalence estimates of subsyndromal or partial PTSD, when an individual is only one or two symptoms short of the diagnosis, have been estimated at 13.5% for older adults (Averill and Beck 2000). This wide range of prevalence estimates can be explained by differences in diagnostic criteria, populations studied, diagnostic criteria used, and assessment format (e.g., clinical interview vs. self-report questionnaire).

## Course

Studies that examine the long-term effects of early and midlife trauma into older adulthood have found that PTSD that is chronic (lasting at least 3 months) typically persists when left untreated and that individuals can continue to exhibit symptoms or meet criteria for PTSD several decades following the initial trauma (Cook and Niederehe 2007). Some research indicates that older adults who have been traumatized at a younger age are more likely to have longer courses (Averill and Beck 2000). It has been hypothesized that symptoms surge immediately following the trauma, dissipate for a period of time later on, and resurge later in an ongoing cyclic fashion, though there are few empirical longitudinal studies (Cook and Niederehe 2007). Some authors posit that decreased cognitive functioning, social isolation, and health issues in older adults may be related to relative increases in PTSD symptoms later in life (Averill and Beck 2000; Cook and Niederehe 2007).

When an individual first develops PTSD at least 6 months after the traumatic event, they are classified as having delayed-onset PTSD. There have been case study evaluations of delayed-onset PTSD in older adults, specifically in Vietnam combat veterans (Averill and Beck 2000). In some cases, full PTSD did not emerge until

many years after the traumatic event. There are many hypothesized theories regarding the emergence of full PTSD in later life, including reduced psychological resilience and resources to cope with the changes associated with aging, increased chance of experiencing an event that resembles the initial trauma over time, and more time available to reflect on past life events due to retirement and other major changes (Averill and Beck 2000). Some authors suggest that, instead of a late-life emergence, symptoms most likely remained unnoticed until later in life or intensified once the distractions of work and family declined (Andrews et al. 2008; Thorp et al. 2011). It is important to note that delayed-onset PTSD is relatively uncommon, and thus little is known about how delayed-onset PTSD may differ from standard PTSD (onset within 6 months of the traumatic event).

## Comorbidities

Many individuals with PTSD have comorbid psychiatric conditions (Fields 1996), and older adults with PTSD are more likely to have major depression, anxiety disorders, somatic disorders, cognitive difficulties, or substance or alcohol use disorders than individuals without PTSD (Averill and Beck 2000). Individuals with PTSD are also more likely to have comorbid physical problems when compared to those without PTSD, including gastrointestinal, arterial, dermatological, and musculoskeletal diagnoses (Cook and Niederehe 2007; Rodgers et al. 2005). Of note, the vast majority of this research has been done with male combat veterans; little is known about comorbid conditions in females, minorities, and individuals with noncombat trauma histories. Furthermore, among older adults, it is typically not reported whether these comorbid conditions predate the trauma or if they form later in life. Many traumatic events reported by older adults occurred early in life (e.g., late teens or early 20s), so it is possible that the PTSD preceded the other physical and mental health problems.

There are a variety of potential risk factors for PTSD, including history of psychiatric illness,

child abuse, and family adversity, though these have not been examined in a population of older adults separate from other populations. There is also some evidence that individuals who have several significant life stressors, a substance use disorder, or an exaggerated physiological response to the trauma itself are more likely to have poorer PTSD outcomes (Thorp et al. 2011). There is some evidence that individuals may be vulnerable to PTSD in older adulthood given the transitions and negative life events that are associated with advanced age, such as widowhood, loss of identity, loss of income, or decreased mobility (Cook and Niederehe 2007). Additionally, individuals' previously successful avoidance strategies, which can include activities like working long hours or avoidance of family and friends, may no longer be possible in older adulthood. Thus, vulnerability to PTSD and the course of the disorder would be affected by the unique circumstances that can occur in late life (Averill and Beck 2000; Thorp et al. 2011).

## Assessment

The comprehensive assessment of PTSD is a critical part of determining an individual's unique needs and how to best address them. As with all populations, it is important to assess a variety of domains including medical, psychiatric, and substance use history. However, there are some unique factors that should be considered when working with older populations. For example, self-report items may be easier to read when printed in large, bold fonts with high contrast, and providers should sit facing patients who have hearing difficulties to enhance communication (Cook and Niederehe 2007). Clinicians should also consider obtaining collateral information from family members, friends, and caregivers. Utilizing a combination of observational methodologies, self-report, and interviews is optimal (Thorp et al. 2011). Utilizing more than one method of assessment often provides a more comprehensive understanding of the patient's experiences and current symptoms.

Although there are limited data on the assessment of PTSD in older adults in comparison to other age-groups, clinicians may consider adjusting their standard procedures when working with older adults (Thorp et al. 2011). Providers sometimes address immediate concerns with appetite, sleep, mood, or anxiety without assessing for past traumatic history. Optimally, clinicians will comprehensively assess a patient's history to examine different periods of that individual's life as well as to adequately cover the various types of trauma that could occur. Clinicians can invite discussion by specifically asking about experiences of sexual assault, combat, childhood sexual trauma, accidents, and other potential traumas. Assessors should carefully document age of onset, duration, and course of symptoms across psychiatric conditions. There are often time constraints during assessments, but the clinician should be careful not to rush the historical portion of the interview with older adults. This history may uncover critical past traumas, treatment experiences, or treatment expectations. The information can help a clinician educate the patient and normalize responses. It may be helpful to consider creating a visual timeline of all traumas, symptoms, treatments, medication, and medical and psychiatric conditions to share with the individual, to ensure that the assessor, treatment team, and patient (and patient's family if patient is willing) are all in agreement regarding the historical pattern of symptoms (Thorp et al. 2011).

There are other considerations that should be taken into account when assessing PTSD in older adults. For example, older adults may experience hyperarousal and anxiety symptoms differently than younger populations, differentially express symptoms of a foreshortened future, or have medical comorbidities and medications that change the expression of symptoms and complicate the assessment process (Thorp et al. 2011). Further, older adults grew up in a generation when mental health issues were discussed less openly; therefore, older adults may have increased stigma around mental health symptoms. They may be less likely to report psychological distress compared to physical health complaints.

## Assessment Instruments

Several PTSD and trauma-related assessment tools have been validated in older adult populations or are commonly used in these populations.

*Clinician-Administered PTSD Scale (CAPS).* The CAPS is a 45-min, 30-item clinician-administered interview that assesses PTSD severity and can aid in diagnostic decision-making. The CAPS is one of the most commonly used PTSD assessment tools across populations, but clinicians must be trained in utilizing the measure to ensure accuracy (Foa et al. 2009; Keane et al. 2007). The CAPS-4 has been validated in older adults and has been shown to have high validity and internal consistency in this population (Cook and O'Donnell 2005; Thorp et al. 2011). The CAPS-5 has been updated to reflect DSM-5 diagnostic criteria, but norms specifically for older adults are not yet published.

*PTSD Checklist (PCL).* The PCL is a 20-item self-report questionnaire that assesses a variety of PTSD symptoms. Scores range from 0 to 80, with higher scores indicating greater levels of symptomology. Although an interview should confirm the presence of a qualifying traumatic event, the PCL can be a critical component of a PTSD assessment (Foa et al. 2009; Keane et al. 2007). The PCL has been validated in older adult populations (Cook and O'Donnell 2005; Thorp et al. 2011). The PCL has been updated for DSM-5 (PCL-5), but norms specifically for older adults are not yet published.

*PTSD Symptom Scale – Interview (PSS-I).* The PSS-I is a 20-min, 17-item semistructured interview that assesses symptom severity and can aid in diagnostic decision-making (Foa et al. 2009; Keane et al. 2007). The PSS-I does not require any training but has not been validated specifically in older populations.

*PTSD Diagnostic Scale (PDS).* The PDS is a 49-item self-report measure that assesses PTSD symptom severity over the past month in regard to a patient-selected trauma. Unlike many other self-report measures, the PDS includes a section that asks the individual to describe their traumatic event in some detail (Foa et al. 2009).

The PDS has not been validated specifically in older adults.

*Impact of Event Scale, Revised Version (IES-R).* The IES-R is a 22-item self-report measure that asks individuals to pick a traumatic event and then rate the impact of several PTSD-related symptoms on his or her past week. The revised IES has three subscales – intrusion symptoms, avoidance symptoms, and hyperarousal symptoms – but is not considered a diagnostic measure (Keane et al. 2007). The IES-R has been validated in older populations (Cook and O'Donnell 2005; Thorp et al. 2011), but there are no norms for DSM-5 published specifically for older adults.

*Mississippi Scale for Combat-Related PTSD (M-PTSD).* The M-PTSD is a 35-item self-report scale that was specifically designed to assess combat-related PTSD. Items were adapted from the DSM-III (Keane et al. 2007; Thorp et al. 2011). The M-PTSD has been validated in older populations (Cook and O'Donnell 2005; Thorp et al. 2011).

*Minnesota Multiphasic Personality Inventory (MMPI).* The MMPI is a lengthy self-report questionnaire that contains over 500 true/false questions in total and can take up to 2 h to complete. Despite its length, the simple true/false response format can facilitate administration with older adults. The MMPI contains a PTSD scale that can provide helpful information regarding potential trauma-related symptoms but is not diagnostic. Although the MMPI can be time consuming, it provides several other scales that cover personality characteristics, depression, anxiety, and schizophrenia and can give information regarding validity including over-reporting or downplaying of symptoms. The MMPI has been validated in several populations, including older adults (Cook and O'Donnell 2005; Thorp et al. 2011).

*Posttraumatic Cognitions Inventory (PTCI).* The PTCI is a 36-item self-report measure (only 33 items are scored) that was developed to assess trauma-related cognitions that may contribute to the development of PTSD or maintenance of PTSD symptoms in an individual. Although this

is not a diagnostic measure, it can be very helpful in guiding treatment or providing motivation to obtain treatment (Orsillo 2001). The PTCI has been used across several demographic groups, but the psychometric properties have not been specifically examined in the older adult population.

*SCL 90-Revised (SCL-90-R)*. The SCL-90-R is a 90-item self-report scale that takes about 15 min to complete. Like the MMPI, the SCL-90-R provides information regarding other psychiatric symptoms via additional subscales that include somatization, interpersonal sensitivity, depression, hostility, and paranoid ideation scales. This measure has been validated in older adults (Cook and O'Donnell 2005; Thorp et al. 2011).

## Treatment

There are some important considerations that should be taken into account during the psychological or pharmacological treatment of PTSD in older adults. In regard to pharmacotherapy, older adults may be more prone to side effects, reduced metabolic capabilities, cognitive changes, medical conditions, age-related pharmacokinetic and pharmacodynamic changes, and polypharmacy (Thorp et al. 2011). When working with older adults, prescribers often choose to start with a low dose of medication and to titrate as necessary (“start low and go slow”) (Cook and Niederehe 2007). Additionally, because older adults are often prescribed several medications at once, prescribers should consider possible interactions between medications. They should also be careful to closely monitor both common and uncommon adverse reactions to each medication.

Data on the efficacy of pharmacotherapy in older adults with PTSD are limited (Cook and Niederehe 2007). However, prazosin and quetiapine have been shown to reduce PTSD symptom severity (Thorp et al. 2011). Selective serotonin reuptake inhibitors (SSRIs) are often prescribed as the first-line treatment for PTSD across age-groups. There is substantial evidence that SSRIs reduce hyperarousal, avoidance, and

re-experiencing symptoms in older adults, and they also have been shown to improve symptoms of anxiety and depression, which often accompany PTSD. Although the SSRIs have noteworthy side effects that may include sexual dysfunction, insomnia, or gastrointestinal problems, they are typically better tolerated than other classes of psychotropic medications. While some prescribers choose to use tricyclic antidepressants (TCAs) and monoamine oxidase inhibitors (MAOIs), there is some evidence that these classes of medications only reduce re-experiencing symptoms and they carry greater risks of side effects (Thorp et al. 2011). Therefore, they are often considered a second line of treatment to SSRIs.

Although many types of psychotherapy have been applied to PTSD, few have been tested empirically with older adults. It is recommended that providers use existing evidence-based treatments for PTSD in the general population, such as prolonged exposure (PE), cognitive processing therapy (CPT), and eye movement desensitization and reprocessing (EMDR) when treating older adults (Foa et al. 2009).

PE is a type of cognitive behavioral therapy that has been specifically designed to treat PTSD. PE's core components are psychoeducation, breathing retraining, imaginal exposure, and in vivo exposure. PE has been shown to be highly efficacious in the treatment of a variety of traumas. In vivo exposure involves repeatedly engaging in previously avoided behaviors, and imaginal exposure requires a repeated, detailed oral narrative of the trauma memory. Going to a crowded grocery store, visiting a part of town that reminds you of the traumatic event, or calling an avoided friend or family member are just some examples of possible in vivo exposures. Sessions last approximately 90 min, and treatment can take 12–15 sessions (Foa et al. 2009). Originally developed for survivors of sexual trauma, PE has been repeatedly shown to be effective for sexual trauma, childhood sexual trauma, military-related trauma, physical assault, accidents, and mixed traumas (Foa et al. 2009). There have been no published randomized controlled trials (RCTs)

that examine the efficacy of PE specifically in an older adult population. However, there are two studies that have compared exposure to other conditions, and these studies and case studies have indicated the efficacy of exposure in the older population.

CPT is a type of cognitive behavioral therapy that was developed for individuals with PTSD. CPT focuses on identifying how an individual's thoughts and beliefs about themselves, others, and the world have been impacted by the trauma. Many individuals with PTSD report thinking that the world is more dangerous than he/she used to believe, that he/she is incompetent, or that people are not to be trusted. Next, the clinician helps the patient challenge their maladaptive thoughts and modify those thoughts and beliefs in accordance with information obtained via Socratic questioning (Resick and Schnicke 1993). In the full protocol of CPT, patients are asked to write a trauma narrative that describes the traumatic event in detail. However, research has also shown that CPT-C (CPT without the trauma narrative) is also efficacious for the treatment of PTSD. Therefore, research is mixed regarding whether the trauma account is a necessary part of treatment or whether some individuals may benefit more from CPT or CPT-C. The clinician and patient discuss themes of safety, trust, esteem, intimacy, power, and control. CPT can be delivered in both group and individual formats and is typically done in 12 weekly 60-min sessions (Resick and Schnicke 1993). There have been no RCTs to date examining the efficacy of CPT specifically in older adults.

EMDR was developed with the goal of helping an individual process their trauma while engaging in bilateral eye movements. The patient is asked to focus on the trauma for brief periods of time while performing these eye movements. While there is significant evidence that the eye-movement portion of EMDR does not add efficacy to the exposure portions of the treatment, research indicates that EMDR is an effective treatment for PTSD (Cook and O'Donnell 2005). There have been no RCTs examining EMDR specifically in older adults, though some case studies have shown

efficacy in this population (Cook and O'Donnell 2005; Thorp et al. 2011).

Some researchers have proposed that exposure therapies may be contraindicated for older adults because of increased autonomic arousal that may exacerbate physical conditions. Further, some individuals have suggested that older adults with cognitive impairments may struggle with cognitive behavioral therapies because they are learning based (Thorp et al. 2011). However, there are no empirical data to suggest that older adults do not respond well to exposure-based or cognitive therapies. Although there are no published randomized controlled trials (RCTs) of PTSD therapy in older adults, RCTs across other age-groups support the efficacy of PE, CPT, and EMDR for the treatment of PTSD (Foa et al. 2009; Thorp et al. 2011). There have been three trials and case studies supporting the use of general exposure therapies with older adults with PTSD and case studies suggesting that EMDR can be helpful with this population.

Most of the information available regarding the treatment of PTSD in older adults comes from single case studies or severely underpowered, uncontrolled, nonrandomized studies. More research is needed to determine (a) whether current gold standard treatments are effective in older populations and (b) whether any modifications are needed to improve treatment outcomes in older populations. Clinicians should take reasonable steps to ensure that treatments are enhanced for each patient based on their individual needs. Potential modifications may include involving caregivers for a patient who cannot care for himself or herself or printing in bigger fonts for individuals who have vision difficulties.

There is little research available on whether it is necessary to modify psychotherapy for PTSD in older adult populations and if so, how treatment should be modified (Koder 2007; Thorp et al. 2011). However, some considerations have been suggested, including increasing the structure of treatment and each individual session (e.g., overview of course of treatment, agendas for each meeting); progressing more slowly; simplifying material; adding modules that address loss,

dependency, and survivor guilt; addressing the individual using proper titles (e.g., “Mr. Smith”); discussing physical ailments; utilizing memory aids; and incorporating family members and/or caregivers (Koder 2007). It is important to note that research has not indicated that any of these modifications are necessary to enhance the efficacy of current evidence-based treatments for PTSD in older populations, but clinicians may choose to include some of these approaches.

## Summary

PTSD is a major mental health concern among all populations. Given that PTSD can become a chronic problem if left untreated and affects a large number of older adults, more research is needed regarding the phenomenology, course, assessment, and treatment of trauma-related symptoms in this population. Furthermore, specific research is needed on older women, minorities, and older survivors of noncombat traumas, including sexual assault, other crime victimization, and car accidents. As the proportion of older adults continues to climb over the next several decades, developing a better understanding of the proper assessment and treatment of PTSD in this group will shift from an important area for future research to an imperative health issue.

## Cross-References

- ▶ [Cognitive Behavioural Therapy](#)
- ▶ [Elder Abuse and Neglect](#)
- ▶ [Family Therapy](#)
- ▶ [Interpersonal Psychotherapy](#)
- ▶ [Mental Health and Aging](#)
- ▶ [Problem-Solving Therapy](#)
- ▶ [Psychodynamic and Humanistic Approaches](#)

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## Purpose, Meaning, and Work in Later Life

Patrick L. Hill<sup>1</sup> and M. Teresa Cardador<sup>2</sup>

<sup>1</sup>Department of Psychology, Carleton University, Ottawa, ON, Canada

<sup>2</sup>School of Labor and Employment Relations, University of Illinois, Urbana-Champaign, IL, USA

### Synonyms

Meaning in life; Psychological well-being; Purpose in life; Well-being in retirement

### Definition

The workplace often provides a prominent context in which one derives a sense of purpose or meaning to life. Research has begun to consider the role of aging and retirement on constructs like purpose and meaning, though clear directions remain for future research.

### Introduction

When considering the prominent changes that occur during the adult years, many of those that immediately come to mind likely occur with respect to one's work and career. Across adulthood, not only do individuals typically experience multiple changes in their specific occupations and workplaces, but also the functions that work serves tend to differ over time. For instance, the key normative tasks that confront individuals differ in the workplace during young, middle, and older adulthood (Hutteman et al. 2014). Broadly speaking, the early adult years are typically spent "getting started," with respect to obtaining occupational qualifications and building a foundation for future success within one's domain of interest. Middle adulthood brings an opportunity to build toward higher levels of job success (promotion,

recognition, etc.), while still focusing on maintenance in terms of consistent job responsibilities. Finally, a primary task confronting older adults is navigating the transition out of one's job responsibilities into retirement.

As the workplace often provides a primary context for individuals' daily lives, one would expect that the normative changes in work roles would provide developmental "presses" that shape individual dispositions and personal characteristics. Indeed, research looking at personality change during young adulthood consistently has shown that individuals tend to increase on those traits seemingly important for occupational success, such as being conscientious, emotionally stable, and agreeable (Roberts et al. 2006). Furthermore, meta-analytic work suggests that commitment and success in the workplace is positively linked to these dispositional characteristics (Lodi-Smith and Roberts 2007). These dispositional effects have been found to be lasting, such that people do not appear to decline on these characteristics once they lose their work status through retirement (Roberts et al. 2006). While broad personality dimensions may remain largely intact, other individual difference variables may be more influenced by the work transitions later in life. The goal of the current entry is to discuss how constructs such as sense of purpose and meaning may be influenced during older adulthood and retirement.

Given that the personal significance or intrinsic value of work may change throughout the life span, it is valuable to consider whether work transitions influence the extent to which individuals perceive a sense of purpose or meaning to their lives. Prior to investigating such claims, the current entry first considers some important definitional issues, given that several labels are used in the literature for similar though not synonymous constructs. One consideration of central importance to the current entry is the potential for distinguishing purpose (and purposefulness) from meaning (or meaningfulness). In addition, it is worth understanding how researchers have assessed and couched these constructs specifically within the context of the workplace.

## Purpose and Meaning in Life and Work

A sense of purpose refers to the perception that one has life goals in place that serve to organize one's sense of self, direct daily activities, and thus chart a direction to take in life (McKnight and Kashdan 2009; Ryff 1989). Alternatively, researchers note that the process of finding meaning in life typically is more retrospective in nature and involves establishing a sense of connectedness and coherence that provides personal significance (Steger et al. 2006). Though it is theorized that engagement in purposeful activity can increase one's sense of meaning, researchers suggest that following one's purpose is but one of four avenues toward a sense of meaning, with other promoters of meaning including having set values and justification, a belief in one's self-efficacy and self-worth, and the sense that one is perceived by others as a worthwhile individual (Crescioni and Baumeister 2013). Therefore, while purpose and meaning are interrelated constructs, they are distinctive in ways that can prove valuable for understanding the potential for differing trajectories for levels of purpose and meaning during older adulthood.

To help elucidate the potential distinction between these constructs, it is valuable to consider how the terms "purposefulness" and "meaningfulness" are used within the psychology and organizational behavior literature. Purposefulness has previously been conceived as a personality trait reflecting a lower-order component of conscientiousness (Hofstee et al. 1992), and thus the phrase "purposeful activity" tends to reflect premeditated, goal-directed action, from which it is difficult to distract the actor. Meaningfulness though tends to come from the realization that something or someone has significance in one's life, and thus is a particularly positive experience. In this respect, one can determine that something has a meaning or definition, and yet not view that event or action as meaningful (see, e.g., Rosso et al. 2010; Wrzesniewski 2003). As an example, one can determine that the meaning of going to work is to accrue wealth, but still not define this activity as *meaningful* in nature. Despite the potential value

of distinguishing purpose from purposefulness, and meaning from meaningfulness, researchers more commonly employ these terms interchangeably. Throughout, this entry employs the same terminology as the original researchers used when describing their findings, though these labels may not fully reflect the distinction between purposefulness and meaningfulness described here.

That said, work from the industrial-organizational psychology and organizational behavior literature typically has focused more on how individuals derive meaningfulness rather than levels of felt meaning in work. Two frequently examined and related constructs on this front are meaningful work and a sense of calling. Meaningful work refers to the amount and type of purpose and significance work holds for an individual (Rosso et al. 2010). Sense of calling is conceptualized as an approach to work that aligns with a sense of personal meaning, is motivated by prosocial values, and arises in response to a transcendent summons (Dik and Duffy 2009). For example, a teacher may feel called by societal need to use her personal talents to improve the lives of underserved youth. Callings are considered unique to each individual – something people believe they must do to fulfill their unique purpose in life or to be living in line with their deepest self. While sense of calling has been linked to meaningful work (Wrzesniewski 2003), one need not have a sense of calling to experience work as meaningful. Meaningful work has also been linked to specific job characteristics, such as the individual's identification with the task, sense of autonomy, and perceived task significance (Fried and Ferris 1987). Meaningful work also has been linked to a sense of belonging, whether one perceives alignment or coherence between one's behavior and the "true" self (i.e., authenticity), and a belief in one's ability and power to produce an intended effect or make a difference (i.e., self-efficacy [see Rosso et al. 2010 for a review]). Thus, like purpose and meaning in life, sense of calling and meaningful work are interrelated, yet distinct, constructs that provide unique insights into how people attach purpose and significance to their work.

## Considering Change in Levels of Purpose and Meaning in Life as Related to Work

With these definitions in place, one can consider how and why the work transitions facing older adults may influence their levels of purpose and meaning in life. Given that purpose is defined with respect to having long-term goals that organize one's daily activities, purposeful activities often may involve engagement in one's work and vocation. Choosing a career path is clearly a prominent method by which individuals can organize and define their daily activities to be in line with their ultimate long-term goals. For instance, most individuals likely have experienced how engaging in work-related activities allows one to feel more purposeful and driven; similarly, reflection upon task completion may provide one a sense of personal significance or meaningfulness.

In line with this belief, multiple studies have now pointed to the close link between a sense of purpose in life and occupational activities and aims. For instance, when asked to identify life goals most personally important, adults commonly endorse goals related to occupational success and achievement (Hill et al. 2010a; Roberts et al. 2004). Moreover, one study found that individuals who reported increasing importance of occupational goals during the transition to adulthood tended also to report higher levels of purpose in life in middle adulthood (Hill et al. 2011). The belief that work is a central arena in which purposeful activities occur is likely instilled even before individuals begin initial engagement within the workplace. For instance, when adolescents (a group either yet to begin or just beginning to take part in work) are asked to define what it means to have a purpose, one study found that around one-quarter of participants explicitly mentioned themes of occupational or financial success (Hill et al. 2010b).

Given the strong connection between purpose and work, retirement may portend negative consequences in the form of reducing a sense of purpose, because individuals have lost a prominent context for purposeful activity. Indeed, meta-analytic work confirms the predicted relationships between levels of purpose in life and both age and

work status (Pinquart 2002). Older and retired adults do tend to score lower on a sense of purpose than their counterparts. Researchers have suggested a curvilinear trend for sense of purpose in life during adulthood, insofar that participants tend to report higher levels on the construct from young to middle adulthood, with declines thereafter (Ryff and Keyes 1995). Though these effect sizes are modest in nature, this age trend conforms to the age-graded work tasks described above. Middle adulthood is a period primarily of maintenance and successive achievement in the workplace, which – if work commitment and progress does play a role in purpose – should allow one to feel more purposeful in this stage than during initial efforts to find a job or during later efforts to deal with the loss of occupation through retirement.

An interesting question then is whether these trajectories also hold for levels of meaning in life. Though living a purposeful life is one route to meaningfulness, one could predict an attenuated decline among older adults, in part because meaningfulness can be derived from other sources as well (e.g., relationships, community, self- and social worth [see for a review, Crescioni and Baumeister 2013; Rosso et al. 2010]). There even are reasons to predict that a sense of meaning could *increase* during older adulthood, given that a primary goal during this developmental period is a focus on being generative toward future cohorts and having a sense of integrity (Erikson 1959). Retirement could provide an opportunity to reflect upon past achievements in the workplace for deriving greater self-worth and a sense that one's life has significance, as well as provide greater opportunities for generative activities. Cross-sectional research appears to support this later prediction (Steger et al. 2009). Specifically, participants aged 65 and older reported a greater presence of meaning in their lives than their young and middle adult counterparts.

In addition to considering the role of retirement as a predictor of purpose and meaning levels, it is worth considering whether and how purpose and meaning predict retirement. The cross-sectional findings above also can be interpreted as evidence that individuals who report a greater sense of

purpose in life may be less likely to retire. Indeed, the perception that one's work is meaningful could provide one reason why older adults continue to work well after the age necessary for financial stability after retirement (e.g., Smyer and Pitt-Catsouphes 2007). As such, there likely exists a bidirectional relationship, to an extent, between the decision to retire and levels of purpose and meaning in life, which merits further consideration in future research.

With regard to meaningful work and calling, it is logical to predict that both may experience declines following retirement, given their conceptual coupling within the workplace. However, there is evidence that a sense of calling and meaningful work may continue past retirement. Research has demonstrated that individuals are quite adept at choosing leisure, volunteer, and community activities that align with their perceived calling in life (Berg et al. 2010). Additionally, retirees with a strong sense of purpose may begin "encore careers" – purpose-driven postretirement careers that make a difference in personal and communal well-being (Freedman 2007). These postretirement careers, which vary in their degree of formality, often are motivated by personal values and goals, and align career goals with work and leisure activities in retirement. In turn, there is ample reason to expect that older adults should be better able to maintain a sense of purpose and meaningfulness post retirement when they are able to organize their daily lives and activities in ways that conform to their sense of calling and/or provide new avenues for work meaningfulness. In line with this prediction, the next section will identify potential avenues for promoting greater purposefulness and meaningfulness in old age.

### **Promoting Purposefulness and Meaningfulness in Old Age**

Two strategies that may help to promote purposefulness and meaningfulness in old age are role engagement and activity engagement. Role engagement may prove a valuable pathway for mitigating the general declines in purposefulness

and meaningfulness in older adulthood and post retirement. For example, helping retired individuals find roles and responsibilities that promote their sense of self-efficacy, personal worth, connection, and contribution may allow individuals to experience a sense of purpose, as well as maintain continuity with some of the sources of meaningfulness provided in a work context (Froidevaux and Hirschi 2015). This should be particularly true when such roles and responsibilities are similar to what individuals experienced in the workplace (e.g., a retired professor providing workshops to fellow retirement community members; a retired mechanical engineer with a passion for fishing designing and making fishing reels to give to friends and sell online). In line with continuity theory (Wang and Shultz 2010), which suggests that retirees are likely to benefit from maintaining activities comparable to those they experienced prior to retirement, one method for helping older adults maintain their levels of purposefulness and meaningfulness may be through providing them clearly prescribed roles within their communities (or retirement communities). This could involve connecting them with volunteer, community, religious, or leisure pursuits that allow them to experience continuity with some of the sources of meaningfulness provided in a work context (Froidevaux and Hirschi 2015). These pursuits can help individuals apply their talents to activities that are interesting and challenging, making a contribution that goes beyond the self, and acting in accordance with their values and beliefs.

In addition to the benefits of more circumscribed role engagement, multiple studies have demonstrated the benefits of promoting activity engagement for healthy aging later in life. Several of these studies have focused on cognitive activity engagement, given the susceptibility for older adults to decline on their levels of cognitive functioning. Interestingly, experimental work suggests that regular engagement in cognitive activities may motivate individuals toward seemingly adaptive personality changes, such as greater openness to experience (Jackson et al. 2012). This type of activity engagement could prove particularly valuable given the strong

relationship between openness to experience and sense of purpose among older adults (Hill et al. 2015). When work no longer provides a context in which to experience new events and situations, older adults may be more vulnerable to declines in purposefulness if they do not possess a natural disposition toward seeking out new activities. As such, interventions to promote openness may encourage older adults toward greater activity engagement and personal agency, both of which are conceptual and empirical hallmarks of having a purpose in life.

### Future Directions for Research

Future research is needed to foster a better understanding of how to reduce the vulnerability of older (and retired) adults to feeling less purposeful, as well as potentially losing their sense of meaningfulness and/or calling. Several areas of research could help accomplish this aim. First, research is needed to develop measures that better distinguish and couch the constructs of purpose and meaning in life, meaningful work, and calling within the context of older adulthood. Most measures of these constructs are intentionally agnostic with respect to developmental stage, in order to facilitate comparisons across age-groups. However, such a measurement approach may fail to account for how older adults in particular would define what it means to be purposeful or have a meaningful life, as well as consider how meaningful work can occur outside of the “traditional” workplace.

Second, more research on these topics is needed that employs older adult and retired samples. For good reason, existing research on a sense of calling and meaningful work typically samples individuals currently involved in the workplace, often focusing on young or middle adult samples. One limitation of this work, however, is that it complicates the ability to make strong conclusions with respect to whether older and retired adults do report significantly lower levels on these constructs, or if older adults naturally reinterpret the items with respect to their current

activities outside of work, a point with clear measurement ramifications. Accordingly, research is needed to examine whether existing inventories allow older adults to reliably report their levels of meaningful work and calling when retired or in more reduced work roles, such as bridge employment or encore careers.

Third, longitudinal research is needed in order to better investigate mean- and individual-level trajectories for sense of purpose, meaningful life, meaningful work, and calling across adulthood. Only recently has purpose in life inventories been included in prominent large-scale studies of adult development (e.g., the Health and Retirement Study of U.S. Adults), and fewer still are long-term studies that include measures of the other constructs mentioned herein. As such, most developmental research with these constructs has relied on cross-sectional studies that sample broad age ranges. While useful, this approach does not allow researchers to consider individual-level fluctuations in purpose, meaningfulness and sense of calling, or which variables may predict such fluctuations over time. Understanding such relationships is particularly valuable to inform the development of interventions that target those older adults potentially at greater risk for declines in purposefulness and meaningfulness with old age and retirement. Moreover, longitudinal research would be valuable for verifying the cross-sectional finding that a sense of meaning in life increases in older adulthood (Steger et al. 2009), in order to gauge the relative need for purpose-focused relative than meaning-focused interventions with older adults.

### Conclusion

Given that the significance and function of paid work changes throughout the life span, and evidence that purpose and meaningfulness are tied to work, it is important to consider how and why one’s sense of purpose and meaningfulness may be affected by retirement, as well as how these can be maintained in old age. This chapter has outlined the characteristics of purpose and

meaningfulness in work and life, and considered how purpose and meaningfulness might change in relationship a transition from work. Moreover, this chapter has suggested strategies for promoting purposefulness and meaningfulness in old age, and outlined potentially fruitful areas for future research in this area.

## Cross-References

- ▶ [Aging and Psychological Well-Being](#)
- ▶ [Life Span Developmental Psychology](#)
- ▶ [Selection, Optimization, and Compensation at Work in Relation to Age](#)
- ▶ [Work to Retirement](#)

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## Quality of Life in Older People

Robert A. Cummins  
Deakin University, Melbourne, VIC, Australia

### Synonyms

Aged; Happiness; Old age; Subjective life quality;  
Subjective wellbeing

### Definitions

Both of the terms in this chapter title require definition. A simple and comprehensive definition of “quality of life” (QOL) comes from the Australian Centre on Quality of Life, as: “Quality of life is both objective and subjective. Each of these two axes comprise several domains which, together, define the total construct. Objective domains are measured through culturally relevant indices of objective wellbeing. Subjective domains are measured through questions of satisfaction.”

While this definition will be elaborated as the chapter unfolds, two points can be noted. First, the objective and subjective dimensions must be measured separately. Second, the subjective dimension is commonly referred to as subjective wellbeing (SWB).

“Older people” are defined in agreement with the general literature and with the convention

adopted for this volume, as referring to people 65 years of age and older.

### Overview

The life quality of older people has always been in jeopardy. As people age beyond their capacity to offer effective instrumental support, their very survival has been traditionally dependent on family generosity. This chancy proposition has continued into in recent times, at least in terms of social dependence, as extended families have given way to nuclear families, often requiring the older person to be housed separately. In response to this transition, charitable institutions have offered some support and some governments offer basic forms of assistance. In general, however, older people have become increasingly at risk of disconnection from their familiar support networks, at a time when increasing infirmity is making them more vulnerable. Even more alarming, the proportion of such people in the population is increasing.

Recognition of aging populations as a serious issue for public policy began during the 1950s. Of special concern at that time was the belief that occupational retirement results in frustration, bitterness, isolation, and general psychological malaise. Indeed, some writers, such as Dorfman (1954), even asserted that retired workers would create such a seed-bed of discontent that they might alter the basic structure of the society.

The disconfirmation of this myth required the creation of theory and appropriate social statistics, both of which were slow to develop. In the meantime, the life quality of aging populations was inferred through traditional objective statistics concerning such variables as wealth, health, and social structures.

Of special interest to developed countries has been quality of life issues associated with aging and health. This is because the provision of optimal medical care to older people has the potential to bankrupt most governments. So, some form of health-care rationing is necessary, and underpinning all such schemes is a consideration of life quality. So, measuring life quality in medicine has been an important scientific responsibility.

Before the 1990s, objective indices were used for this purpose. Health was measured as physical health and high life quality was inferred through longevity. While this changed with the subsequent development of Health Related Quality Of Life scales, such measures over-emphasize the life domain of health in estimating overall life quality (Cummins et al. 2004). A more balanced view of subjective quality of life has gradually emerged from within the social sciences.

The earliest efforts to measure the subjective side of life quality go back to the 1940s, with various pioneers devising scales of “morale” and “happiness.” Progress in developing and applying such measures over the next three decades was very slow, with both researchers and administrators expressing concern that such data were unreliable. Then, in the mid 1970s, two extraordinary publications (Andrews and Withey 1976; Campbell et al. 1976) changed the way quality of life is understood.

At the heart of this new understanding is the appreciation, previously mentioned, that the quality of life construct comprises two very different universes of measurement. The traditional measures of objective life quality are matched by new measures comprising subjective perceptions of life quality: how satisfied people feel with their health, with their financial situation, and so on. Crucial for understanding is that these two kinds of measurement, objective and subjective life quality, are so different that they cannot be

substituted for one another. Just because an older person is physically frail and widowed does not mean that they feel bad about themselves; they probably feel just fine. So in order to get a full picture of someone’s life quality, both dimensions need to be measured and separately considered.

The remainder of this article concerns the subjective side of life quality, especially as it has evolved within the social sciences. A prerequisite to such discussion, however, is to clarify the vexed issue of terminology.

### Issues of Nomenclature

The science concerning subjective wellbeing (SWB) is plagued by ill-defined and confusing terminology. For example, while researchers contributing to this literature often refer to “happiness,” this term has two quite different meanings. In common language, happiness is a feeling generated by a nice event. It is transitory and what psychologists refer to as an emotional state. However, there is another kind of happiness that is not an emotion. This different form of happiness is not generated in reaction to something that has happened, but rather it is a mood, in the form of a trait. Mood happiness is genetically driven, unchanging, and normally forms a constant background to our thoughts. It is a gentle, mildly activated form of positive affect and its role is to make us feel good about ourselves.

Mood happiness is the major component of SWB measured by scales such as the Personal Wellbeing Index (PWI: International Wellbeing Group 2013). However, in the early days of research into the subjective life quality of older people, no such understanding was available, and one of the earliest forms of measurement was termed “morale.” Several different kinds of items would be used to create morale scales including satisfaction with life and other positive feelings, together with depression and other forms of negative feelings. The latter would be reverse-scored and the numbers combined to provide an average level of morale. While these measures lacked the sophistication of contemporary instruments, they tend to produce rather similar results.

For this reason, these various measures will be considered together as representing SWB.

## Issues of Theory

Once researchers started to apply SWB measures to population samples, it became evident that contrary to earlier fears, the data were surprisingly reliable. So these measures started to be employed to measure the chronic life quality of individuals and groups. These psychologically “positive” measures were seen as representing a desirable side of subjective life. So the combination of reliability and desirability started to attract researchers to investigate the relationship between SWB and other variables. These included both objective variables such as age and income, as well as subjective variables, such as perceived adjustment and depression.

Of special interest to the early 1960s researchers was the SWB of older people. This group was getting the attention of demographers, as has been described, and it was assumed they would exhibit low SWB. After all, they commonly had reduced financial resources, were in poor physical health, and feeling uncertain of their role following the departure of the children or retirement. It was therefore a great surprise to find that empirical measures indicated no universal decrement in morale after 65 years. So theory was needed to account for this unexpected finding. The first of these was “activity theory.”

## Activity Theory and Disengagement Theory

Some of the first scientific observations concerning the life quality of older people were their reduced scope of activities. This was assumed to have implications for their life quality, since relationship interaction is such a crucial human need.

The first effort to account for this phenomenon was proposed almost 70 years ago by the sociologist Ruth Cavan and colleagues (Cavan et al. 1949) in the form of activity theory. Then,

about a decade later, a far more elaborate account of social withdrawal was proposed in the form of disengagement theory (Cumming and Henry 1961).

Both theories generated much interest among researchers at that time, and both theories failed to survive the welter of critique that was heaped upon them. Nevertheless, it is instructive to consider what they both proposed and why they were discredited.

While each theory assumes a decrease in “activity” beyond 65 years of age, they differ in the form of activity under consideration. For activity theory, it was measured using the Chicago Inventory of Activity and Attitudes (Cavan et al. 1949). This activity scale comprises a set of very broad measures, which include leisure-time activities, religious activities, intimate social activities, economic activities, and health. Items vary from estimates of social interaction to reading the Bible. In other words, an “activity” is regarded as almost anything that the person does physically. For disengagement theory, the dependent variable is “engagement” measured through the number of social roles, the variation of those roles, and the frequency of interaction.

The first observation relating to both theories is that the supposed phenomenon of a universal reduction in “activity” after 65 years of age has not been empirically supported. This is true of both general activity (e.g., Palmore 1968) and social engagement (e.g., Zborowski 1962). However, older people do show substantial heterogeneity in both the level and type of maintained activities. So this opens the question of whether more refined measures of activity might reveal connections to SWB.

Activity theory makes no such refinement. It simply asserts that reduced activity equates to low SWB. The benchmark for judging “reduced” is the average activity levels of middle-age people. It is then assumed that these levels are also needed in old age because the basic psychological and social needs of such people remain unchanged. Thus, the way to maintain SWB in old age is to remain active.

The proposal from disengagement theory is quite different. It asserts a process of

disengagement exists as a natural and inevitable outcome of old age. In this context, the maintenance of SWB depends on the person matching their levels of engagement to the levels dictated by this developmental imperative. If the reduction in activity exceeds the level that is developmentally appropriate, then SWB will decrease.

Neither of these propositions has withstood scrutiny. First, the definition of “activity” is so broad, covering virtually any form of human activity, that it cannot be effectively measured in normally functioning people. Second, the developmental imperative to reduced engagement, coupled with the requirement to match this by actual behavior, is both unlikely and without empirical support. It also fails to adequately consider the differences between different forms of social contact. For example, Lowenthal and Haven (1968) found that among community-dwelling older people, the probability of depression depends on the absence of a confidant, not on the level of social interaction.

With the advantage of hindsight, these pioneer theories did a good job with the information available at that time. But they were trying to solve a problem for which the available tools and concepts were inadequate. Importantly, both relied on objective measures of activity, whereas the key link to SWB comes from subjective measures of engagement and interaction. So neither theory was able to account for the mixture of results that were reported. This caused confusion, even among the theories’ authors. For example, Cumming and Henry (1961) report that their measure of morale “is somewhat higher among women whose children have left home, as indeed it is among older men who have retired” (p. 100). Yet they also report that their measure of disengagement is not related to morale (p. 91). Other authors add to the confusion using various angles of reasoning, which include psychological processes that support denial of the claimed losses, denial that SWB is maintained, and the power of Zen transcendence. However, none of these can adequately explain how SWB can remain at normal levels into old age even after evident reduction in key objective variables such as money,

health, and relationships. A contemporary explanation comes from homeostasis theory.

### Subjective Wellbeing Homeostasis

Using the seven-item Personal Wellbeing Index (International Wellbeing Group 2013) we have been monitoring the subjective wellbeing (SWB) of the Australian population over the past 15 years. Respondents use a 0–10, end-defined response scale, anchored by “no satisfaction” and “complete satisfaction.” The data are converted to a standard 0–100 point format, as described in the manual. When the mean scores from our 30 independent surveys are used as data, the grand mean is 75.3 percentage points and the standard deviation 0.72. This yields a normative range of 73.8–76.7 points. In other words, the mean score of a random survey of people in Australia can be predicted, with 95% certainty, to lie within a 2.9% point range.

A reason for this extraordinary level of stability is provided by the theory of SWB homeostasis. This proposes that, in a manner analogous to the homeostatic maintenance of body temperature, the essence of SWB is actively controlled and maintained by a set of psychological devices (for an extended description, see Cummins 2013a). The purpose of this homeostatic system is to protect the central positive and activated trait mood called homeostatically protected mood (HPMood).

HPMood normally perfuses all items forming the Personal Wellbeing Index, as well as other semiabstract thoughts about the self (Lai and Cummins 2013). This includes responses to the classic single question to measure SWB “How satisfied are you with your life as a whole?” Given the extraordinary generality of this question and the impossibility of answering through cognition, the response that people give reflects their level of HPMood. That is, respondents are using mood as information (see, Schwarz and Clore 1996).

The stability of population mean scores comes about because each person has a genetically determined set-point for their own level of HPMood. These set-points form a normal distribution between 70 and 90 percentage points (Cummins

et al. 2014) and around each set-point is a range of 8–9 percentage points, within which homeostasis normally maintains the affective experience of each person.

Contrary to views expressed by some authors (Headey et al. 2014), set-point theory does not carry an assumption of immutability in the measured variable. There are three reasons. First, returning to the example of body temperature, a thermometer does not measure the temperature set-point. It measures whatever temperature the body happened to be at the time of measurement. This principle also applies to measures of SWB and HPMood. Second, as explained by Cannon (1932), the measured variable can move within its set-point-range. Third, homeostasis can be defeated and, when this occurs, the measured variable moves outside its set-point-range as it comes under the control of the challenging agent. Thus, prolonged exposure to a sufficiently persistent hot or cold thermal challenge will cause measured body temperature to rise or fall. This does not represent a change in set-point. It is a defeat of homeostasis and a change in the *measured* variable. Once the source of thermal challenge is removed, core body temperature will normally revert to its set-point under the influence of homeostasis.

The measurement of HPMood (or its proxy, SWB) shows analogous properties. While its level normally lies within 8–9% points of its set-point, the experience of strong emotion causes homeostasis to fail. When this occurs, attention switches to the emotion generated by the challenging agent and away from HPMood. This emotion then influences responses to all semiabstract questions regarding the felt-level of SWB. However, over time, external and internal resources will be directed to the restoration of homeostasis. These will normally reduce the perceived challenge to a level allowing homeostatic control to be restored, and then reported SWB returns to lie within its set-point range.

#### Homeostatic Resources

The first line of homeostatic defense is formed by the three primary “external resources” of money, relationships, and meaningful activity. Money is

the most flexible resource. It can be used not only to purchase positive experience but also to avoid negative experience, such as by paying someone to clean the house. Relationships, when positive and intimate, allow much of daily life experience to occur within known contexts of positive interaction. Achieving something personally important each day enhances positive feelings and a sense of purpose, while also building financial or social capital.

Interestingly, more of each resource is not necessarily better. The positive influence of money on SWB, as an Australian average, rises up to a gross household income of around AU\$150,000, and then its influence plateaus. The reason for this ceiling is that all reasonable purchasable defensive resources have been deployed. In a similar vein, more than one intimate relationship is not normally a better defensive resource than one and may indeed be worse due to a diffusion or responsibility. Finally, too much attention to a single aspect of personal achievement, such as making money, will detract from developing other important life areas.

#### Recovering Homeostatic Control

No matter how well developed are the combined external resources, strong emotional episodes will still be experienced from time to time. When this occurs, homeostasis is defeated, SWB moves below (or above) its set-point-range, and the imperative on such occasions is homeostatic recovery.

When the challenge is negative, brief and not too strong, we recover homeostatic control fast. This is achieved through a number of automatic psychological processes: (a) Behavior: we disengage from the source of the challenge; (b) Habituation: decreasing responsiveness to a repeated stimulus; (c) Adaptation: people judge the strength of their current positive or negative experience against a level of “affective neutrality,” which can be raised or lowered by past experience. This concerns the processes of allostasis (McEwen 1998).

When the challenge is negative, prolonged, and strong, recovering homeostatic control is a slower process. This is achieved through the use

of both the external resources that have been described, together with a different set of internal resources. These are collectively called secondary control (Rothbaum et al. 1982) and have the aim of changing the self to accommodate an uncontrollable new situation. For example, people can find meaning in the event “God is testing me.” The purpose of secondary control is to minimize the impact of the negative event by introducing the prospect of a positive future outcome.

If the combined power of the external and internal resources fails to return homeostatic control, then the consequence is a period of sadness and negative self-reflection. If the condition of homeostatic failure persists, the probability of depression is much enhanced (Cummins 2010).

### Depression and Resilience

The specter of depression is the worst outcome of homeostatic failure. It represents the collective failure of all the resources described above, so the strength of these resources together may be conceptualized as constituting the strength of homeostatic resilience. The normal maintenance of SWB is, thus, a balance between the strength of homeostatic resilience versus the strength of emotional challenge.

A substantial focus of applied research in QOL has been to identify general population subgroups where the resilience of homeostasis is overwhelmed by the strength of emotional challenge people experience each day. Some such groups have been well described and are more commonly found among the older generation. They include people recently divorced or separated, retrenched from their job, or having become widowed. Some groups, however, are not so obvious, and one of the most poignant are informal carers; family members caring for a relative with a disability at home.

In 2014, Hammond et al. (2014) reported a study of over 4,000 informal carers, conducted in collaboration with Carers Australia. Using the Personal Wellbeing Index, the group as a whole had the lowest mean level of SWB we have recorded (58 points, as against a normal range for the population of 73–76 points). As confirmation of the link between low SWB and depression,

the median SWB of the carers corresponded to being moderately depressed, using the depression, anxiety and stress scale (Lovibond and Lovibond 1995). The reason for this dreadful situation is straight forward. Despite a strong social security system in Australia, these families typically have a low household income. Additionally, the primary carer commonly has no employment due to the demands of their caring role, parents are often separated, their friends have evaporated, and for those caring for their child with a disability, their role as carer is likely to continue throughout the remainder of their lifetime. In short, SWB homeostasis has failed due to inadequate support from money, relationships, personal achievement, and an overwhelmed system of secondary control.

### Summary

The failure of activity theory can be understood when considered in terms of homeostatic resources. The crucial issue for maintained levels of SWB is not the level of “activity” but the strength of homeostatic resilience. This understanding is important at all ages, but especially in old age since the level of homeostatic challenges is likely rising, thereby requiring more defensive resources to be deployed. Supportive evidence comes from (Lowenthal and Boler 1965) who followed-up a sample aged 60+ years over 3 years. While they found no overall evidence of voluntary social withdrawal (contrary to disengagement theory), they did find that when social withdrawal occurred, the potentially negative effects on SWB could be offset by calling on the resources of money or intimate relationships. Thus, to a reasonable extent, the three primary external resources can substitute for one another.

### The Application of Homeostasis Theory to Old Age

In considering the application of the homeostasis theory that has been described, there are three broad issues to be kept in mind. The first is that old age is not simply a time of resource loss. Not only can resource advantages be identified in key

areas, such as accumulated wealth, but also the defensive power of secondary control is likely at its highest level in old age. Second is the crucial understanding, absent from activity theory, that objective and subjective variables form two different kinds of measurement, and that measures of one cannot be used to infer levels of the other. Third is that the various forms of external resource can reasonably substitute for one another.

Thus, if an older person is living alone, with no family contact, and in poor medical health, this does not mean they have low SWB. They may have an intimate, noncohabiting partner, adequate income, and engagement in a solitary activity such as painting. These issues will now be examined in the context of the specific key external resources. The source of the cited results and tables, unless otherwise specified, is based on the accumulated data from 30 surveys using the Australian Unity Wellbeing Index. Detailed results are available from Cummins et al. (2013).

### Income

The power of income as a defensive resource can be demonstrated in two ways. The most obvious is that when the population is separated into income groupings, there is a consistent rise in SWB with each income increment, up to a threshold. The reason for this threshold has been stated, as representing an income, which allows the purchase of most reasonable forms of homeostatic defense. In Australia, this corresponds to a gross, before tax, household income of around \$150,000 per annum. The second demonstration comes from regressing the seven domains of the Personal Wellbeing Index (PWI) against the single global item of General Life Satisfaction (“life as a whole”). This regression shows that, of the 51% of variance accounted for, over half (58%) is shared variance, caused by HPMood. This leaves the 42% unique variance contributed by individual PWI domains (Cummins et al. 2013, Table A2.17.1). Within this unique variance, the three highest contributing domains are: standard of living (18%), achieving in life (13%), and relationships (8%). Thus, in general population samples, which mainly comprise people younger than 65 years of age, income

is the single most important influence on SWB in Australia.

Interestingly, this strong connection between SWB and income is much reduced in old age. From the lowest income (<\$15,000pa) to one of the highest (\$251,000–500,000pa), the SWB of young adults aged 25–36 years of age moves from 64.2 points to 78.4 points, an increase of 14.2 points. For the group aged 76 and older, the shift is from 76.9 to 79.4, an increase of just 2.5 points (Cummins et al. 2013, Table A3.10). Clearly, the connection between money and SWB is much weaker in old age. This may be due to a host of factors, some of which may not generalize to other nations. Australia’s social security system ensures that people living on an old-age pension have a level of income sufficient for simple living and, importantly, that this income is secure. They also receive subsidized medical care and can access numerous forms of support to assist living in their home, including subsidized meal delivery, home cleaning, and nursing care. Thus, their need for money is reduced.

### Relationships

Unbeknown to the early researchers on aging, the power of human interaction is only weakly measured by quantity. They had assumed that the more social contacts someone has, and the more diverse these contacts are, the more likely is the person to have high morale. However, as has been stated, reliance on objective data to infer SWB is invalid. One strong, intimate, reciprocal relationship is a more powerful homeostatic defense than a thousand Facebook friends. It is the subjective side of reciprocal relationships that is such a powerful resource for SWB.

The defensive power of a confidant continues into old age, and this understanding allows a many of the early results to be better understood. For example, the literature is consistent in showing that divorce, separation, and widowhood are a severe threat to SWB maintenance at all ages, but especially among older people. The most likely active element causing such results is the loss of an intimate relationship, rather than simply decreased social contact. This has strong implications for remediation. If someone in a broken

relationship has an intimate other partner, their SWB may well be fine. However, again, money provides a caveat. If relationship loss means the survivor is without income then, of course, the negative effect on their SWB is severe. Notably, however, even with a modest income, widows in Australia aged 66 years and over have normal-range SWB (Cummins et al. 2013, Fig. 5.12).

### A Role in Life

Having the sense of something important to do each day is assessed by the PWI domain “How satisfied are you with what you are achieving in life?” Purpose in life is the third corner of the triumvirate “Golden Triangle” of external resources supporting homeostasis, and it is a risk area for many people as they retire or after the children leave home. The central construct describing this life domain is perceived control (Rothbaum et al. 1982). If people feel they are in control, either because they can control some relevant aspect of their environment or control their own feelings about the things that change, they are likely to be homeostatically intact. If, however, they lose this capacity and enter a state of learned helplessness, depression is a likely outcome. Cumming and Henry (1961) asked their older sample “What are the worst things about the age you are now?” The first was “health,” the second was “not being listened to,” indicative of a sense of role loss.

Again, however, there are counterbalancing positives in old age. Cumming and Henry (1961) also asked their older cohort “What are the best things about the age you are now?” They report that nearly a quarter of the older men and nearly a third of the women felt freedom from their instrumental roles to be a great advantage. In truth, many paid jobs are hard and unrewarding, while many women experience relief when their children become independent. Moreover, in contemporary society, a valued role as a volunteer is generally available to anyone who seeks life purpose through such position. Confirmation that a strong sense of life purpose is generally retained into old age comes from a national sample of over 60,000 respondents in Australia (Cummins et al. 2013). These data show that satisfaction

with achieving in life falls significantly from 18–25 years of age to 46–55 years of age, then starts to rise again. At 76 years and over, it is at its highest level of any age (Cummins et al. 2013, Table A 5.11.4), an actual increase in the sense of life purpose from younger ages.

### Health

As people age, their bodies accumulate structural damage and metabolic dysfunction. Moreover, as in the example above from Cumming and Henry (1961), health is usually a front-of-mind topic for people who are old. So, as expected, satisfaction with health shows a regular decrease with increasing age. So why does SWB go against this trend and generally increase after 65 years of age or so? There are two reasons. The first is that the relationship between SWB and physical health is generally weak due to:

1. Homeostasis causing a disjunction between objective health and SWB. For example, people normally adapt to reduced levels of physical mobility and, when they do, there is little or no relationship between measures of physical capacity and SWB.
2. A whole raft of conditional factors which include the following:
  - 2.1 Whether the medical condition has an associated psychological discomfort that is consciously perceived. If the person perceives severe pain, then this may well result in homeostatic failure. If, however, a severe medical condition such as high blood pressure is properly treated, the person will be generally unaware of their condition and it will weakly impact SWB.
  - 2.2 Whether the medical condition is chronic or acute. If the condition has a slow onset and development, then it is likely the person will adapt to the imposed circumstances and maintain homeostatic control of SWB. If, however, the onset is sudden, such as with injury, adaptation requires the passage of sufficient time to become maximally effective.
  - 2.3 Whether surgery or prostheses can ameliorate the disability.

- 2.4 Whether the person has the support that they need. There are two separate categories to consider. One is instrumental support and the other is social and intimacy support.
- 2.5 Personal resilience. This can be conceptualized in homeostatic terms as command over resources and a review is available (Cummins and Wooden 2014). As has been described, the resources may be either external or internal through cognitive devices such as secondary control.

The second reason for the general increase in SWB in older age is that, of the 7 PWI domains, health is the only domain to decrease beyond 65 years of age. Of the others, safety shows no reliable change, while all of the other five domains increase. Thus, when the seven domains are combined to yield SWB, they present as an increased level in older-age (Cummins et al. 2013, Tables A5.11.2 to A5.11.8).

From the above it is evident that only way to determine whether a medical condition is associated with subjective life quality is to measure SWB directly.

## Conclusions and Outlook

The theory of subjective wellbeing homeostasis provides a coherent description of the relationship between subjective wellbeing (SWB) and the various sources of challenge that people face in old age. As far as is known, the results of published studies are consistent with predictions made by this theory. However, of course, whether it will accommodate future findings is unknown. More certain is that the theory is set for further development, most particularly in terms of understanding differences in homeostatic resilience between people, especially people from economically undeveloped countries. Most of the results that form the empirical support for homeostatic theory come from either North America or Australia. Much greater challenges are experienced by older people in developing countries. Whether the predictions of homeostasis hold fast under

conditions of different resource availability remains uncertain.

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## Cross-References

- ▶ [Activity Theory, Disengagement Theory, and Successful Aging](#)
- ▶ [Aging and Psychological Well-Being](#)
- ▶ [Aging and Quality of Life](#)
- ▶ [Psychological Theories of Successful Aging](#)
- ▶ [Resilience and Aging](#)
- ▶ [Well-Being in Centenarians](#)

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## Recruitment and Selection of Older Workers

Catherine Earl, Philip Taylor and  
Christopher McLoughlin  
Federation Business School, Federation  
University Australia, Churchill, VIC, Australia

### Synonyms

Baby boomers; Hiring; Labor demand; Mature aged workers; Workers aged over 50

### Definition

Recruitment refers to seeking, selecting, and hiring people for employment.

Older workers are people aged over 50 years who participate in the labor market.

### Introduction

In recent decades there has been a shift in labor market public policy from a culture of early retirement to one centered on hiring older workers, i.e., those aged over 50. The culture of early exit flourished in most major industrialized economies until the 1990s. Previously, older workers who left the workforce prematurely were regarded to be early retirees rather than unemployed. Their joblessness ended not with their reentering the

workforce but transferring to pensions (Casey and Laczko 1989). Subsequently, there has been a policy shift towards prolonging working lives that has been generated by population aging in general as well as the aging of workforces in specific industry sectors, such as nursing and teaching.

Despite there being a business case for retaining older workers and legislation protecting them from discrimination, age-related biases continue to limit opportunities for those nearing retirement. However, there is some limited evidence that employer's attitudes and behaviors may be shifting in response to workforce aging (Taylor et al. 2013). Notably, biases in selection processes restrict an older worker's mobility within the labor market.

Age barriers in the labor market refer to discriminatory practices based on age-related characteristics and beliefs that are exercised by employers and recruiters, managers, and coworkers. Such judgments rely on age without taking into account an individual's actual knowledge, skills, and abilities. This can result in unlawful age discrimination (Posthuma et al. 2012). This entry explores age barriers experienced by older workers and considers these in the context of recruitment.

### Age-Related Bias in Recruitment Practices

Attitudes to older workers have shifted to become more positive at the public policy level, but the question arises as to whether and how attitudes

may have also shifted at the employer level. It is long established that age-related norms are important in recruitment. Recruitment practices, such as short listing and interviewing, may discriminate against older workers, particularly when education, qualification, and experience are specified (Taylor and Walker 1994). While age-related biases and unlawful discrimination are evident in recruitment practices, they are far less obvious than in workforce exit (Anderson et al. 2013). This subtlety stems from a combination of factors including a manager's priorities, personnel shortages, and other organizational factors as well as the applicant's age and other attributes upon which the hiring of older workers depends (Karpinska et al. 2011).

Research indicates that the significance of age norms in recruitment should not be underestimated, although individuals who violate age norms do not automatically receive negative evaluations. One of the most interesting and elegant studies to consider these issues found that recruiters rated candidates lower when they were considered older than the normative age for their career level whereas the opposite was the case when the candidate was younger. Candidates who were younger than the normative age for their career level were seen as on the "fast track," whereas older workers were seen as being behind schedule (Perry et al. 1996). The implications of these findings are that a younger person who applies for the kind of job typically reserved for an older person might be considered incongruent but this would be offset by the positive perception that the individual is aspirational. Older and younger workers who applied for jobs considered age normative would be considered congruent.

Moreover, while age is not indicative of personal work-related traits, research in simulated hiring situations demonstrates that it is a significant factor in shaping recruiter perceptions and expectations about the probable or possible duration of an older applicant's remaining working life (Craft et al. 1979). Another study found recruiters who evaluated hypothetical job applicants preferred mid-age candidates. While both the oldest and youngest jobseekers were less likely to be selected, applicants aged over 54 years were the least likely to be offered a job (Richardson

et al. 2013). It does appear that stereotypical assumptions underpin the types of jobs that might be considered suitable for older workers.

### **Labor Shortages Make Hiring Older Workers Attractive**

Economic imperatives may induce employers to seek new sources of labor. Employers who face labor shortages seek to engage workers who have not traditionally formed the core of their organizations' workforces. Such workers include primarily women and migrant workers but also older workers (Henkens et al. 2008). Research indicates that the selection of older workers forms part of a multifaceted strategy to respond to labor shortages and workforce aging. Experiences of recruitment difficulties, such as being unable to fill vacant positions quickly, attracting insufficient candidates for selection, and inadequate quality of candidates, may also contribute to employers hiring older workers, even if they hold negative stereotype-based attitudes about them (Taylor et al. 2013). However, recruiting older workers may be a secondary or less preferred option to other sources of labor supply (Loretto and White 2006).

Hiring probabilities decline with age. The older an older worker is, the more difficult they find it to secure work. This may be due in part to the uncertainty employers may perceive about the level of productivity of older jobseekers compared to younger ones. Nevertheless, older managers and managers of older workforces more readily hire older workers, which increases the hiring probability of older jobseekers in an aging population (Heyma et al. 2014). Even in an aging workforce, older workers are more likely to be selected when employers face a constrained choice of recruits and they are able to demonstrate that their skills are up to date. Moreover, older workers who strategically reskill or upskill themselves are more successful as they are able to find employment in industries experiencing labor shortages (Patrickson and Ranzijn 2003).

While older workers may be valued in meeting labor shortages in aging populations, age barriers still exist and they may restrict career development

as well as take a toll on mental health and emotional well-being. It is important to recognize that not all employment offers have a positive effect on an older worker's well-being. Permanent work that overcomes financial hardship or uncertainty experienced during a period of unemployment has a much more positive influence on well-being than temporary work and self-employment (Strandh 2000).

### **Employer Attitudes to Hiring Older Workers**

Recruiters assess an applicant's potentiality for performance. Older workers with years of accrued experience may be viewed by employers as lacking an appropriate "fit" in an organizational context of rapid change and dynamism where portability and flexibility are highly valued (Sennett 2006, 2008). However, expert performance seems to be unaffected by one's age. On most tasks, the benefits older employees have accrued through practice are much greater, in both absolute and relative terms, than the losses that their increasing ages may have bought about. Nevertheless, during the selection process, there is evidence that employers not only make use of actual information concerning applicants but also draw on their perceptions gleaned from biases related to age or other factors (Perry et al. 1996).

Research indicates that employers view older workers' potentiality and organizational fit in stereotypical terms as being reliable, resistant to change, and difficult to reskill, particularly as a contrast to highly desired attributes, such as flexibility, creativity, and innovation, which they are perceived to lack. Older workers are likely to experience diminishing prospects when their accumulated experience is regarded unfavorably to indicate a lack of potentiality (Taylor et al. 2010). Older jobseekers report being offered low-skilled and poorly remunerated jobs that are not in line with their experience nor their skills (Riach and Loretto 2009).

It also seems that recruiters are likely to consider older job applicants to have a fairly stable set of attributes that would be unresponsive to remedial actions, such as training or work redesign.

There is further evidence from simulated hiring situations that when recruiters were presented with a scenario under which they were facing high levels of cost pressure, they reverted to age-related biases about capacity to learn and consequently were less likely to recommend training when the hypothetical employee was older than when they were younger (Erber and Danker 1995). Recruiters were also found to be more likely to attribute poor performance by hypothetical older subordinates to stable, permanent, factors than was the case for younger subordinates. Additionally, job simplification rather than training was felt to be more appropriate for older workers (Dedrick and Dobbins 1991). Employer uncertainty about the knowledge and skill performance of older workers may be compounded by their perceptions of an older worker's potentiality in terms of injury risk. Employer attitudes vary; some may consign aging employees to less productive roles, and others may redesign the workplace to accommodate older workers within productive roles (Brooke et al. 2013). Recruiters would not be as likely to make such an assumption about younger applicants.

Studies of simulated hiring situations have consistently found that individuals playing the role of recruiter express bias against older workers in applicant evaluations. Such biases may center on the perceived "fit" of an older worker in an organization. In one study it was found that employers were more likely to hire an older worker when their workforce had a high age norm coupled with a labor shortage and the applicants met their expectations about physical appearance and relevant experience (Karpinska et al. 2013). Additional research concludes that issues of gender and race further complicate hiring conditions for older workers. Age discrimination is reported to be as pervasive as other forms of discrimination in recruitment (Lahey 2008).

### **Judging the Perceived Value of Older Workers**

Stereotyping plays a role in employer and recruiter attitudes to employees of all ages. Older workers are valued for a set of perceived attributes

identified by employers and recruiters. These attributes are often evaluated in contrast to the perceived attributes of younger workers. Common stereotypes about older workers suggest they are less employable than younger workers, which places them in a precarious situation regarding the risk of job loss and future opportunities for reemployment (Klehe et al. 2012). Yet, it is possible that there are no performance differences between older and younger workers and that older workers may indeed outperform young workers. In this case, the negative attitudes that have been evident among employers must be understood to stem from unconscious bias and hidden workplace agism (Malinen and Johnston 2013).

Age stereotyping has been found to be influential in shaping employer attitudes about older workers even when they are targeted in recruitment. Advocates have promoted an approach that replaces negative stereotyping with more positive alternatives to minimize biases against older workers, which although benevolent does not challenge a reliance on universalizing characteristics and narrow modes of behavior (Riach 2007). Moving beyond common stereotypes provides a more positive and more differentiated understanding of older workers (Kunze et al. 2013).

However, it is not only employer attitudes that influence how older workers are treated in the workforce. It is also important to consider the attitudes of other workers towards older employees. Research indicates that attitudes to older workers in the workforce are largely positive, with older workers' attitudes being more positive than those of younger workers. Older workers do not feel more discriminated against than their younger colleagues, although they perceive some human resource practices preference younger workers (Kluge and Krings 2008).

### **Combating Age Discrimination in Hiring**

A decision to target older workers for recruitment is more likely in organizations with a high age profile and an organizational climate oriented towards

diversity (Goldberg et al. 2013). Once an organization decides to target older workers, employers need to consider which recruitment sources, recruiter characteristics, and impression management tactics are most effective for attracting older jobseekers (Lievens et al. 2012). But, as older workers are not all alike, to view them as an equity group in their own right is highly problematical and potentially lends itself to age stereotyping rather than evaluation of individual capabilities. To be effective, employer policies need to be not simply directed at older workers but should adopt an "age-aware" rather than "age-free" approach (Brooke and Taylor 2005).

Equal opportunity legislation proscribing age discrimination in the labor market is a feature of most developed economies. However, there is very little evidence that stronger age discrimination protections help older workers cope with labor market disruption and workforce stresses relative to younger workers. Stronger age discrimination protections may in fact deter hiring of older workers during times of uncertainty (Neumark and Button 2014).

Another common approach has been wage subsidies to encourage employers to hire older workers. Job creation programs in Europe throughout the 1970s and 1980s relied on policies of full or partial wage subsidies, particularly for older and younger unemployed workers (Bekemans 1985). Their use has persisted, despite mixed evidence concerning their efficacy. Some evaluations conclude that such policies are successful by improving the employability of older workers and by enabling unemployed older workers to reenter the workforce, while their negative side effects of deadweight loss, crowding out, creaming, and displacement effects seem to be limited (Conen 2013). Other evaluations, however, while being positive in their overall assessment, report results that may give cause to doubt the effectiveness of wage subsidies and also stress the need for careful design of such schemes (Jaenichen and Stephan 2011). Added to this are possible stigmatizing effects. Such measures are, by their very nature, agist and may further erode self-confidence by categorizing people as "difficult to employ." The signal that might be received by employers is that older workers have such work-limiting issues that only government compensation could make them

attractive, with the risk of deepening age prejudice and institutionalizing age discrimination.

An alternative approach has been awareness-raising campaigns among employers. These have been tried in a number of industrialized countries, although their impact appears to have been limited. For instance, following consultation the British Government's Code of Practice on Age Diversity in Employment was launched in 1999 with an accompanying media campaign. An important part of government policy on age and employment, it was disseminated widely (Education and Employment Committee 2001a, b). Although it set out principles of nonage-biased employment practices and provided examples of best practice, research indicated that the Code had a limited impact (Goldstone and Jones 2001). Over three waves of an evaluation survey, awareness of it increased from 23% to 37% of employers. However, a very small number – 9% at wave 3 – had seen a copy. More representatives of larger organizations had seen a copy – 1 in 5 larger compared to 1 in 12 smaller organizations. A very small number of employers – 2% at wave 3 – stated that they had changed policies as a result of the Code. Thus, it may be difficult to persuade employers of the merits of implementing age-aware human resource management policies.

On the other hand, pressures on labor supply may change employer behavior without the need for substantial government intervention. Concerns about workforce aging and its influences and about labor shortages appear to be influencing the adoption of measures favoring older workers, with the implication that they may persist even in the situation of an economic downturn (Taylor et al. 2013).

## Future Directions

The mechanisms underlying recruiter bias towards older workers appear to be well understood, although much of the research has been based on hypothetical scenarios. More “real-world” research is needed to confirm this understanding that older jobseekers are evaluated unfairly on the basis of age-related biases about their potentiality as well as from actual

information about their workforce experience in a way that younger workers may not be.

While internationally public policy is being aimed at the prolongation of working lives, there is mixed evidence concerning the efficacy of current practical approaches to influencing recruiter behavior regarding older workers. These have emerged rapidly in recent years, but systematic research into their utility is lacking. Comparative research considering the extent of their impact and value for money would be valuable.

In considering employer hiring strategies, there is also a need to consider what jobs older workers are being selected for and on what terms. While employers may become more favorably disposed to older labor, if it is relegated to roles on the periphery of organizations without opportunities for advancement and growth, this may not be conducive to the worker's well-being and, consequently, to a successful transition from work to retirement.

In this regard, flexible working is much promoted as a strategy for retaining older workers. However, it must be stressed that flexibility, if this means part-time work, may not be a solution. Not every older worker desires to work part-time. Taking an approach that offers one strategy for all older workers is neither equitable nor realistic. For those who do seek flexible working options, flexibility and job quality need to go hand in hand.

Amid labor shortages generated by workforce aging and other industry-specific factors, recruiters will need to design recruitment strategies so that they can deal with greater workforce diversity. Otherwise, they will face persistent skill and labor shortages and also risk losing valuable knowledge and experience, and concomitantly, competitive advantage.

## Cross-References

- ▶ [Age Discrimination](#)
- ▶ [Age Stereotypes in the Workplace](#)
- ▶ [Age Stereotyping and Discrimination](#)
- ▶ [Age Stereotyping and Views of Aging, Theories of](#)
- ▶ [Early and Unplanned Retirement](#)
- ▶ [Human Resource Management and Aging](#)

- ▶ [Job Attitudes and Age](#)
- ▶ [Late Life Transitions](#)
- ▶ [Timing of Retirement](#)
- ▶ [Training at Work and Aging](#)
- ▶ [Women and Retirement](#)
- ▶ [Work Design and Aging](#)
- ▶ [Work Motivation and Aging](#)

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## Reminiscence Interventions in Elderly People

Rosa Marina Afonso<sup>1,2</sup>, Juan Pedro Serrano Selva<sup>3</sup> and José Miguel Latorre Postigo<sup>3</sup>

<sup>1</sup>Department of Psychology and Education, University of Beira Interior, Covilhã, Portugal  
<sup>2</sup>UNIFAI-ICBAS and CINTESIS, University of Porto, Porto, Portugal

<sup>3</sup>Department of Psychology, Faculty of Medicine, University of Castilla-La Mancha, Albacete, Spain

## Synonyms

Autobiographical memories; Episodic memory; life review

## Definition

Reminiscence is the intentional or spontaneous process of retrieving episodes personally lived in the past. This retrieval of autobiographical memories may or may not have a logic or sequence in terms of the topics recalled. Understanding and evaluation are not an integral part of reminiscence, which tends to be highly spontaneous and mostly unstructured. On one hand, reminiscence can be regarded as a spontaneous phenomenon emerging in different settings, which forms part of many social and family events, providing people with the opportunity to relate episodes and/or tell their life history. On the other hand, especially in older adults, reminiscence can be used as a therapeutic intervention strategy in different fields, such as a prevention strategy for mental disorders or a way to promote mental health. Reminiscing past events can help a person feel more confident and self-assured when dealing with the changes related to old age. It can also have positive effects in different psychological and psychiatric pathologies.

## Reminiscence and Autobiographical Memory in Aging

As people age, the tendency to remember the past and reinterpret it positively increases naturally. Individuals remember positive events that made them happy more frequently than negative ones. However, this does not mean that negative events are forgotten; these are often reinterpreted and/or changed in their affective valence or perhaps make change in order to provide more positive feelings.

Autobiographical memory (AM) is a memory system consisting of specific episodes recollected from a person's life. It emerges as a re-living of actions, events, and situations remembered by an individual. This memory generally contains information on places, actions, persons, objects, thoughts, and affections and plays a central role in the construction of identity or of the self, in emotional experience, and in all the attributes that define a person. Reminiscence (RM) is the way

individuals access such information for its use. It is the voluntary or involuntary action of recollecting memories from one's past. This recollection can reinforce the memory itself and reinterpret it, giving it meaning and emotion according to affective state. Specifically, the socioemotional selectivity theory (Carstensen et al. 2003) argues that as a person ages, they focus on stimuli of positive emotional valence. These cognitive strategies can have considerable advantages since they help to regulate emotion, maximize coping efforts, and increase subjective satisfaction with the present and the past. However, not all memories are linked to positive emotions. The past generates emotions ranging from resignation, serenity, pride, and satisfaction to complete bitterness and vengeful anger, emotions determined by thoughts of the past (Latorre et al. 2008).

Although there is still little experimental and clinical research on autobiographical memory and aging, deficits in episodic memory (and more specifically in details of the context) are a major problem in old age. Some authors consider this lack of the capacity to recall information related to context could be a result of a deficit in the ability to control sources, in other words, the ability to remember the source or origin of thoughts and memories. There are numerous studies in this regard, which confirm that the memory of episodic contextual details deteriorates in older adults (Berna et al. 2012; Friedman and Johnson 2014; Latorre et al. 2012). Older adults tend to choose personally significant memories maintained by frequent repetition. Since these memories have been repeated many times, they are highly accessible and retain their realism and original details. Although in younger people a strong emotion generated by a dramatic or stressful event is enough to produce long-lasting, vivid memories, in older people the retention of detailed memories depends almost exclusively on repetition.

In order to understand the decline in AM's specificity in older adults, one theory can be enunciated – that proposed by Conway and

Pleydell-Pearce (2000) regarding how AM functions and how it is organized. In summary, the theory holds that AM is highly organized and comprises three levels of hierarchically organized autobiographical knowledge: (1) The highest level of the hierarchy corresponds to *lifetime periods*, categorized as segments of life measured in years or decades. (2) The middle level includes *general events*, episodes which by virtue of having occurred on more than one occasion are classified as general memories. They are events which last days, weeks, or months. (3) The lowest level corresponds to *specific events*. These are concrete, individual events, which are measured in seconds, minutes, or hours. When people tell life stories, these three elements tend to be intertwined, yet in terms of access to memory, they are ordered hierarchically. This structure helps to explain the differences in latency time in the access to each memory type; the more specific the memory, the greater the latency time. Life periods help to locate knowledge of general and specific events. They provide the skeleton framework for autobiographical memories. General events appear to be the natural points of access to our autobiographical memories, and, arguably, they hold this privileged position due to the benefits of repetition. Furthermore, they retain a large part of the distinctive flavor of a person's past and are easily accessible because they have been reinforced through repetition.

In the last decade, a large number of studies have focused on analyzing differences in access to autobiographical memories between control groups and groups with different pathologies. These studies show that when a cue word is presented (e.g., *happy* or *sad*), depressed persons retrieve fewer specific and more general memories than nondepressed persons. This phenomenon is known as overgeneral autobiographical memory (OGM) (Williams et al. 2007). Research on OGM shows that older adults generate fewer specific memories than younger adults (Ros et al. 2010). The OGM effect is also found in older adults with depression (Serrano et al. 2007). However, the effect size (the magnitude,

or size, of an effect) is smaller than in samples of younger adults. In contrast to the case of younger adults, in samples of older adults, the effect size is larger for positive cue words than for negative ones (Latorre et al. 2012). Furthermore, younger adults are able to generate a larger number of specific memories in response to a series of cue words. This is possibly explained by the decrease in executive capacity of working memory in old age (Ros et al. 2010).

### Taxonomy and Functions of Reminiscence Styles

The different taxonomies and functions of reminiscence emerge from the fact that it is a multidimensional, multidisciplinary, and multi-generational process. On some occasions this process is intrapersonal, encouraging introspection and self-reflection, and on others it is interpersonal, promoting sociability and connections with others.

Several authors have attempted to classify the types and functions of reminiscence using qualitative coding of narratives and quantitative analysis of data collected from questionnaires. Here we present some of these taxonomies, in order, mainly, to illustrate what function is associated with the process of reminiscence and how this process can be directed in the search for well-being in the aging process. According to Coleman (1974), there are two types of reminiscence: simple reminiscence and informative reminiscence. Simple reminiscence is the spontaneous retrieval of past events; the event is viewed as a significant element of a person's life and can be a resource for the balance of the self. Informative reminiscence is the application of past experiences to the present as a way to teach others. LoGerfo (1981), on the other hand, describes three types of reminiscence: informative, evaluative, and obsessive. Informative reminiscence entails a pleasurable recollection of past events, which can lead to mood enhancement. Evaluative reminiscence involves attempts to reconcile with past conflicts

and failures. Obsessive reminiscence describes the persistent and unproductive recollection of remorseful memories.

Merriam (1980) identifies three types of reminiscence: therapeutic, informative, and enjoyment. Therapeutic reminiscence describes reminiscence as a mechanism to cope with life's problems and to understand oneself. It also refers to life review as a form of acceptance and integration of the self. Informative reminiscence entails the storytelling function of reminiscence, the transmission of cultural and educational values and teachings from the past: it involves the pleasure of entertaining and retelling personal achievements to others. The third type refers to the enjoyment produced by reminiscence and entails passing the time and the pleasure that telling stories from the past generates. Finally, Kovach (1990) considers that reminiscing often entails explicit or implicit interpretation of past events. This author identifies two types of reminiscence: *validating* and *lamenting*. Validating themes include joys, past to present comparisons, and self-appraisals. Lamenting themes include difficulties, regrets, and lacking choice.

In an effort to make a qualitative leap forward, Watt and Wong (1991) proposed one of the most commonly cited taxonomy in the field of reminiscence research. The authors identify six types of reminiscence: *integrative*, *instrumental*, *transmissive*, *narrative*, *escapist*, and *obsessive*, stressing that only the first two are related to measures of successful aging. *Integrative reminiscence* is a process involving acceptance of the self and others, conflict solving and reconciliation, a sense and meaning of personal value, and integration of the past and present. The functions of *instrumental reminiscence* are recollecting past plans and the attainment of goals, drawing from past experiences to solve present problems, and remembering past attempts to overcome difficulties. *Transmissive reminiscence* resembles storytelling in that it attempts to teach and entertain listeners. This type of reminiscence involves an audience, generally comprising younger people who can benefit from the experiences transmitted.

Moral instruction is usually included. *Escapist reminiscence* is generally considered to be defensive. It tends to glorify the past and deprecate the present. It expresses a wish to return to the past. This type of reminiscence can help protect one's self and self-esteem as it gives pleasure and provides relief from present stress. However, this type of reminiscence can be damaging if it interferes with present functioning. The key characteristic of *obsessive reminiscence* is persistent rumination on negative past events. This type of reminiscence is evidenced by feelings of guilt, shame, resentment, and despair. It reflects a failure to integrate problematic past experiences in positive aspects of life. Obsessive reminiscence is often associated with mental health disorders. However, for two reasons, it can also have an adaptive function: it highlights an unresolved conflict and can lead to its solution, and it can serve as preparation for problem solving. *Narrative reminiscing* is descriptive rather than interpretive or evaluative. It is a nonevaluative narrative of a life episode.

### The Reminiscence Function Scale (RFS)

The taxonomy presented by Webster (1993) is currently one of the most widely accepted. Webster's reminiscence function scale (RFS) is a 43-item questionnaire in which, using a 6-point Likert-type scale, participants are required to quantify the extent to which they use reminiscence for one of the given functions. It permits a quantitative approach and facilitates research through the use of a test, which has proven to be psychometrically consistent in terms of reliability, validity, and factorial structure. The RFS identifies eight functions or uses for reminiscence: (i) *boredom reduction*, which emerges in non-stimulating environments as a way to pass the time, when memories are used to fill a void of stimulation or interest; (ii) *death preparation*, where memories are used to help review life, to deal with thoughts of life coming to an end, and to find tranquility when death is close; (iii) *identity*, that makes use of personal memories in the search for coherence, worth, and meaning in

one's life and to consolidate a sense of self; (iv) *problem solving*, where reminiscence is used as a way to recover techniques used in the past to solve problems and apply them to current challenges or situations; (v) *conversation* that includes the recollection of past events as a duty and form of social engagement; (vi) *intimacy maintenance*, which consists of retrieving memories of intimate social relations that are no longer part of one's life; (vii) *bitterness revival*, characterized by the rehashing and ruminating on memories of difficult life circumstances, misfortunes, and lost opportunities; and (viii) *teach/inform*, where reminiscing is a way to transmit life lessons or share personal ideologies.

The access to AM through RM serves a wide range of functions varying in importance across individuals and the life cycle. These can be divided structurally into three main functions (Webster et al. 2010). Interpersonal functions emerge when memory occurs in a social setting. These include *social interaction* (AM is used as material for conversation; exchanging experiences serves to maintain interest and allows individuals to take part in a group), *self-disclosure* (sharing AM as a way to establish relations and develop intimacy and friendship), and *empathy* (AM provides a basis to interpret behavior, infer emotions and opinions, and guide answers). Intrapersonal functions emerge when memory forms part of private reminiscence. These include *mood regulation* (used to regulate mood state) and *formation of the self-concept* (used to construct, preserve, or modify the self-concept; it also provides a means to deal with unresolved conflicts or decrease discrepancies between the ideal and current self). Knowledge-based functions refer to semantic memory and include *general knowledge* (the accumulation of general knowledge occurs when general event knowledge representations are constructed by processes of abstraction or inductive inference from specific autobiographical memories) and *problem solving* (AM provides experiences of past problems that can offer possible solutions for current problems and guide plans for future actions). There is evidence that the

**Reminisce Interventions in Elderly People, Table 1** Types of intervention reminiscence based

Type of reminiscence intervention	Description
Simple reminiscence	An unstructured autobiographic narrative that emerges spontaneously in a social, relational setting. This type of intervention can be used in groups at residential centers or care homes for older people as a way to establish social relationships and improve social well-being in the short term. This intervention is supported by the socioemotional selectivity theory, which encompasses the positive effects of reminiscence on mental health, regarding emotion regulation and the processing of information oriented toward pleasurable stimuli
Structured reminiscence or life review	In contrast to simple reminiscence, life review reminiscence is much more structured, focusing on the integration of positive and negative life events. It can be classified as evaluative. This type of intervention is suitable for persons with mild psychological disorder, who need support to cope with their current situation or life events. This intervention is supported by Erikson’s psychosocial theory of development, which describes eight developmental stages. This intervention identifies continuity between the past and present and obtains a vision of how participants have developed across the life cycle and how they feel in the present moment (Butler, 1963). This type of intervention is commonly used in the prevention of mental health problems and is usually conducted individually
Life review therapy	This is an eminently therapeutic intervention. It needs to meet all the requirements of this type of intervention regarding the technical knowledge of the therapist and the consent and confidentiality of the therapeutic process. It is highly structured and is designed for use with persons with mental problems or pathologies such as depression, anxiety, schizophrenia, posttraumatic stress disorder, etc. Life review therapy can modify identity and create a new outlook on life, producing changes in identity and mood state. It is usually combined with cognitive and problem-solving therapy, narrative therapy, and cognitive training

relative importance of these three functions varies with age. In middle age, memory is mainly used for problem solving while in old age intrapersonal functions dominate. There is a rapid increase in life review as “death preparation.”

**Reminiscence Therapy**

The application of reminiscence as a therapeutic intervention strategy should be carefully planned and make use of validated assessment protocols from research results and scientific theory. Health professionals and therapists must be aware that reminiscence may, in some cases, have adverse effects such as depression or anxiety (Westerhof et al. 2010).

Different types of material have been used in reminiscence interventions to facilitate the retrieval of autobiographical memories. This

material takes various forms, such as stimuli for reminiscence stimuli, visual aids, personal artifacts or objects, personal photo albums, memorable events or tangible past memories, etc. Given the subjectivity and importance of this type of memories or personal material, the process must be conducted with the informed consent of the participant and respecting the confidentiality of the data and intervention. Table 1 presents three basic types of reminiscence intervention: simple or unstructured reminiscence, structured reminiscence or life review, and life review therapy (Westerhof et al. 2010).

**Reminiscence as an Intervention Strategy in Depression in Older Adults**

Reminiscence is a psychological intervention proven to reduce depressive symptoms in old



age. It has been the subject of various studies (Bohlmeijer et al. 2005). In overall, there are two trends in the application of reminiscence treatment in the symptoms of old age. On one hand, there are interventions based on the training of specific positive autobiographical memories. On the other hand, there are interventions based on promoting integrative and instrumental reminiscence styles. The effectiveness of reminiscence based on specific positive memories can be explained by its potential to counteract two tendencies in depressive persons: the tendency to remember negative events and the tendency of depressive older adults toward over-generality when recalling autobiographical events (Serrano et al. 2007). So, the stimulation and retrieval of specific positive autobiographical memories counteract tendencies associated with depressive symptoms, thus reducing these symptoms. Secondly, interventions promoting integrative and instrumental reminiscence of autobiographical memories include cognitive processes and content related to depression, such as self-appraisal, causal attributions, and evaluation of personal resources and selection of coping strategies. Instrumental reminiscence requires individuals to recall coping with situations, the strategies they developed to solve difficult situations, and situations in which they achieved highly evaluated aims or helped others to achieve theirs. This type of memories permits the identification and recognition of important coping resources that have been useful for adaptive coping in life. The recall of problematic situations successfully coped with promotes self-appraisal and can motivate the individual to apply the strategies identified to current problematic situations. The ultimate aim of integrative reminiscence is to find continuity between different events and to discover that life, as lived, is of value. Using this type of reminiscence, individuals attempt to accept events, resolve past conflicts, and resolve the possible discrepancy between the ideal and reality. This reminiscence style provides the opportunity to review causes and consequences of different autobiographical events, by reviewing attributions formed and contextualizing events.

### **Reminiscence-Based Interventions for Persons with Neurocognitive Disorders**

Reminiscence-based interventions for persons with neurocognitive disorders consist in stimulating a person to retrieve and speak about past events and experiences with a person or group. For persons with this clinical condition, it is common to use material such as photos, images, videos, objects, and/or recordings to trigger autobiographical memories. The use of reminiscence therapy seems to have an impact on cognition, mood state, social relations, identity, problematic behaviors, functionality, and relations with their carers. However, there is little robust evidence of this therapeutic intervention's effectiveness, and studies on the impact of this therapy tend not to be rigorous and are based on small-size samples (Woods et al. 2005).

### **Reminiscence as a Strategy to Promote Well-being in Old Age**

Reminiscence can be used to foster skills of self-understanding, conflict resolution, acceptance of life as lived, and the understanding that life is finite, which all together can promote well-being in old age. One of the reminiscence-based techniques used to achieve this is to construct an autobiography in which the participant builds his/her life story using the memory of autobiographical events. It is a planned activity, which, apart from reminiscing, involves a structure uniting the participant's main life events. It can also include evaluation of the events (Webster and Haight 1995). Analysis of the effects of building an autobiography suggests it stimulates AM, facilitates the sense of continuity of self, increases self-confidence and the capacity to adapt, and improves self-understanding as well as interpersonal relations (Birren and Deutchman 1991). Reminiscence can even be used as a strategy for intergenerational community development. Changes in visual memory functions and attention have been observed in older adults taking part in structured autobiographical writing workshops (de Medeiros et al. 2007).

## Conclusions and Future Research

Reminiscence is an important process in old age that promotes a sense of identity across the life cycle and allows a person to cope with change and loss. As an intervention strategy, it has great therapeutic potential for geropsychologists in the reduction of depressive symptoms and in the promotion of well-being in old age. Despite available evidence of its impact, more research is required on how and in whom these interventions work the best (Westerhof and Bohlmeijer 2014). Evidence in those individuals suffering from a neurocognitive disorder is not as clear as in the case of persons with depressive symptoms.

Presently there is an increasing interest in the impact of reminiscence interventions and there are signs of emerging conceptual clarification. More sophisticated designs with control groups and clinical trials are being applied which provide more robust results on the use of this technique with therapeutic goals. More advanced techniques such as confirmatory factor analysis are being used, and psychometric instruments are being perfected. The organization and characteristics of reminiscence interventions are highly heterogeneous. The use of multimedia technology as an aid to record the autobiographical events recalled constitutes a challenge for the development of new formats of reminiscence intervention.

## Cross-References

- ▶ [Depression in Later Life](#)
- ▶ [Memory, Autobiographical](#)

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interest in their environment (Keane and O’Toole 2003). The National Remotivation Therapy Organization (NRTO) defines remotivation therapy (RT) as a small-group therapeutic modality, designed to help clients by promoting self-esteem, awareness, and socialization (National Remotivation Therapy Organization 2003). As the concept itself suggests, remotivation relates to the creation of interest in life, i.e., in a person’s daily activities, talents, hobbies, and social relationships with family and friends.

Remotivation therapy is a form of intervention focused on the capabilities and potential of individuals. It aims at helping to value personal strengths and to recognize specific features, roles, and unique traits of the patient. Although not originally conceived for older people, it has been used with this population as a way of promoting interest in the world. This is accomplished through the process of discussing small things in life that are not related to their problems. This is done by helping participants to think and talk about real-world issues and by aiding them in relating and communicating with other group members (Herlihy-Chevalier 2005). RT contributes to the improvement or maintenance of cognitive and physical skills, promotion of self-esteem, and increased hope and courage (Vandevender 2005; Vickery and Allison 2005).

All of these RT goals are achieved through stimulating activities combined with meaningful discussions and supportive interactions. It integrates features of several other therapeutic intervention modalities: first, *reality orientation* by asking the individual questions about time and space, as well as information about himself/herself; second, *reminiscence* by asking them to share their life experiences, memories, and personal belongings; third, *validation* by the therapist through their receptivity, neutrality, and impartiality; and finally, *sensory stimulation* through visual aids, pictures, music, and songs.

This entry provides an overview of the RT from its emergence in the 1950s onward, emphasizing its evidence-based contribution in promoting elders’ social skills, self-esteem, hope, and meaning in life.

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## Remotivation Therapy

Lia Araújo<sup>1,2</sup> and Oscar Ribeiro<sup>1,3,4</sup>

<sup>1</sup>UNIFAI and CINTESIS, ICBAS – University of Porto, Porto, Portugal

<sup>2</sup>Portugal and Polytechnic Institute, ESEV and CI&DETS, Viseu, Portugal

<sup>3</sup>Higher Institute of Social Service (ISSSP), Porto, Portugal

<sup>4</sup>University of Aveiro, Aveiro, Portugal

## Synonyms

Group intervention; Non-pharmacological therapy

## Definition

Remotivation refers to a variety of group therapy techniques used with chronically mentally ill patients in inpatient settings to stimulate their communication, vocational, and social skills and

## Origin and Development of Remotivation Therapy

Dorothy H. Smith, a retired English teacher who was a volunteer at the Northampton, Massachusetts, Veterans Administration Hospital, started the practice of remotivation in 1950. She started to use poetry, specifically reading poems and asking questions about the poem, with a group of seven men, most of them catatonic and considered to be mute since they had not spoken in years (Meixsell 2005). The initiative was considered a success since several members of this group answered the questions that she asked about the poem and one had even asked for the poem to be read again (Meixsell 2005).

Following these initial findings, in 1956 Smith began to develop training classes at Philadelphia State Hospital, which was then considered the national training center for remotivation. This practice attracted the attention of the American Psychiatric Association (APA) that, along with Smith, Kline, and French laboratories, promulgated remotivation groups in several hospitals and long-term care facilities around the United States (Sullivan et al. 2001). Reports from 1965 refer to the existence of 241 remotivation programs in 45 US states and over 15,000 trained remotivators (Meixsell 2005). In 1971, the National Remotivation Therapy Organization was formed. This organization, still active, provides seminars, classes, and Web access training for professionals who wish to use remotivation techniques with their patients, aiming to provide the standards for RT and to promote its practice.

After 15 years of exponential success, a decline in RT dissemination and practice occurred. According to Meixsell (2005), RT became confined to only a few activities due to the deinstitutionalization movement of the 1970s. With the closing of many psychiatric facilities, remotivation programs didn't move into the new treatment settings, and so these practices became less popular. The same disinvestment of RT also happened within academic and research fields. Between 1971 and 1977, five doctoral dissertations on RT were completed providing useful empirical data in what regards this therapeutic

approach in several areas including the effects of intensive remotivation techniques on institutional geriatric mental patients in a state mental hospital (Bovey 1971), reactions of nursing home residents to a specific remotivation technique (Arje 1973), and the effects of remotivation technique on patients, staff attitudes, and staff care of the patient (Pruitt 1976). Others also examined the benefits of RT in the treatment with domiciled geriatric combat veterans (Vandevender 2005) and the effect of RT on activity level and life satisfaction with institutionalized elderly populations. After this first effort in researching and establishing the impact of RT, no further research about this intervention occurred. A systematic literature review in PubMed and ISI Web of Knowledge databases using the term "remotivation therapy" revealed only 13 articles (Table 1).

The articles were published between 1973 and 2011, but the majority ( $n = 8$ ) dates back to the 1970s. No abstract or full texts were available for six of the 13 identified manuscripts. Even so, when analyzing the titles and journals and, when available, the abstracts and manuscripts, it appears that the first publications were more broad and conceptual, presenting the definitions and procedures of RT. Some of the researches presented the benefits for specific target populations (e.g., Huntington's and schizophrenic diseases, Sullivan et al. 2001), but the majority discusses remotivation with older individuals, suggesting the interest of its use in this population. As for the scientific scope of journals where the research on RT was published, it encompasses several disciplines, including psychiatry (e.g., *Perspectives in Psychiatric Care*), geriatrics (*Journal of the American Geriatrics Society*), nursing (e.g., *Journal of Gerontological Nursing*), and health and social policy (e.g., *Journal of Health & Social Policy*).

Using "remotivation" as the keyword (title, keywords, and/or abstracts), in an electronic search in PubMed, expands the results to 63 relevant manuscripts. This includes articles in which remotivation techniques were used within other interventions, such as the 3R mental stimulation program that incorporates remotivation with

**Remotivation Therapy, Table 1** Summary of scientific papers on remotivation therapy (1973–present)

Year	Authors	Title	Journal
2011	Araújo, L., Gomez, V., Teixeira, C., Ribeiro, O.	Remotivation Therapy Program for institutionalized elders: pilot study	Rev. Enf. Ref.
2001	Sullivan, F., Bird, E., Alpay, M., Cha, J.	Remotivation therapy and Huntington's disease	J Neurosci Nurs. 33, 136–42
1994	Murphy, M., Conley, J., Hernandez, M.	Group remotivation therapy for the 90s	Perspect Psychiatr Care. 30, 9–12
1990	Husaini, B., Castor, R., Whitten-Stovall, R., Moore, S., Nesor, W., Linn, J., Griffin, D.	An evaluation of a therapeutic health program for the black elderly	J Health Soc Policy. 2, 67–85
1988	Janssen, J., Giberson, D.	Remotivation therapy	J Gerontol Nurs. 14, 31–34
1978	Anderson, H.	Remotivation therapy	Dimens Health Serv. 55, 18–19
1977	Don Beal B., Duckro, P., Elias, J., Hecht, E.	Graded group procedures for long term regressed schizophrenics	J Nerv Ment Dis. 164, 102–106
1976	Dennis, H.	Remotivation therapy for the elderly: a surprising outcome	J Gerontol Nurs. 2, 28–30
1975	Williams, I.	Remotivation-therapy: what is it?	Hosp Adm Can. 17, 68–69
1975	Williams, I.	Remotivation – therapy: the search for a spark of interest	Can J Psychiatr Nurs. 16, 11
1975	Miller, M.A.	Remotivation therapy: a way to reach the confused elderly patient	J Gerontol Nurs. 1, 28–31
1974	N.A.	Remotivation therapy offers modern approach to mental illness	Can J Psychiatr Nurs. 15, 10-1
1973	Birkett, D., Boltuch, B.	Remotivation therapy	J Am Geriatr Soc. 21, 368–371

reminiscence and reality orientation (Koh et al. 1994) and the use of remotivation assumptions in intergenerational programs (West and Hutchinson 1992).

### Practices of Remotivation Therapy

Remotivation therapy is usually developed as a group treatment but can also be conducted individually, at the bedside for those who are too ill to integrate group sessions or for those who show disruptive behaviors or are not able to participate in a group for other reasons. Group interventions usually embody twelve sessions, conducted once or twice a week, lasting from thirty minutes to an hour. Groups are comprised on average with six persons (Herlihy-Chevalier 2005). In order to promote attendance, trust, and goal's attainment, the sessions should be held consistently and by the

same therapist. The remotivation program must have a certified remotivation therapist, commonly entitled “remotivator.” To become a certified remotivator, a clinician must have the National Remotivation Therapy Organization's training, with class time followed by a practicum in which the professional must conduct a therapy session with clients (National Remotivation Therapy Organization 2003). Professionals who specialize in RT include psychologists, nurses, recreational therapists, social workers, occupational therapists, psychiatrists (Meixsell 2005), and other professionals, including gerontologists.

According to Meixsell (2005) remotivation programs can be developed considering different topics and following specific steps. There may be remotivation in (i) self-care groups, directed to several hygiene tasks that a person performs on a daily basis; (ii) exercise groups, in which a conversation about the benefits of exercise and some

**Remotivation Therapy, Table 2** ProTR – a program of remotivation therapy

Session	Topic	Discussion (examples)
1	Living in our city	How can we describe our city? What memories do you have about some places of our city?
2	Saint Valentine's day	What kind of values is associated to this day? How was dating when you were young?
3	Going outside	What are the most well-known places to visit in our country/town? How do you feel during a tour?
4	Cooking	What are the typical dishes of our region? What is your favorite dish, the one that you used to cook?
5	Professions	What professions are most valued nowadays? How was your profession like? What specific tasks did you perform?
6	Successful aging	What must a person have or do to be "successfully aged"? What are your strategies for having good aging experiences?
7	Songs	What style of music is that (while listening to music)? What is your favorite music and how do you feel when listening to it?
8	The happiest days of our lives	What is associated with happiness (while seeing images)? What was the happiest day of your life?
9	Family	What are the characteristics and main differences of families from the present and the past (e.g., composition, (co)habitation)?
10	Easter	What are the typical traditions and customs of Easter time? What memories (visual, auditory, and smell information) do you have about this celebration?

physical activities could be promoted; (iii) patient education groups, focusing on a specific medical diagnosis and its functional implications to participants that experience similar conditions; (iv) media and craft groups, used to teach how to perform leisure activities; and (v) instrumental activities of daily living groups, with discussions and tasks about activities such as money management and homemaking (Meixsell 2005).

Vickery and Allison (2005) propose that remotivation sessions could approach more basic and objective topics, namely *what I did for a living, memories of early school years, my home when I was a child*, or more advanced and subjective ones. The advanced remotivation assumes a more differentiated and deep level of intervention and could explore topics such as *attention* (being alert, discovering the world around), *compassion* (caring and being cared for), *forgiveness* (feeling the healing balm of being forgiven), or *hospitality* (allowing people into your heart) (Vickery and Allison 2005). In the program presented by Cummings (2003), themes for the ten weekly sessions include personal continuity, hidden strengths and talents, functional adaptation, emotional adaptation, coping mechanisms, social skills, dealing

with loss, and caring for self and others. Table 2 exemplifies an example of themes/topics and questions for debate to be considered in a group intervention (Araújo et al. 2011).

Independently of the theme/topic to be covered, each remotivation session must include five distinct steps (Herlihy-Chevalier 2005): climate of acceptance, bridge to the real world, appreciation for the work of the world, sharing the world we live in, and climate of appreciation. Each of the steps must be followed in this order. These steps establish a set of microlevel goals that the remotivator must accomplish. Planning and resource management are important to remotivation's success. The topics must be of interest to the group members, which could be confirmed through prior conversations with them but also with their families and staff members. The use of tools can compensate sensory losses and enhance attention. The use of texts from magazines and newspapers, music and songs, and pictures and photographs instead of poetry (as initially defined by Dorothy Smith) works best with participants with regressing mental abilities and lower education levels (Araújo et al. 2011). To give each person a hands-on

project relating to the subject, using props (e.g., flowers in a session about seasons, dolls and toys in a session about traditional games) is essential to promote participation and facilitate the understanding of the topics (Vandevender 2005). Here is a detailed description of the five steps essential to a remotivation:

**Step 1. *Climate of acceptance***

The remotivator introduces himself/herself and welcomes each person on his or her arrival in a warm, friendly manner and assists in finding a seat or wheelchair space in the circle. Acknowledging members by name and giving attention to any aspect of their uniqueness (such as the clothing or haircut) must be guaranteed. It could also allude to aspects related with the weather or other trivial but relevant subjects in order to establish contact with participants. These observations must be pleasant and objective and serve to create an atmosphere free of formality and tension.

**Step 2. *Bridge to the real world***

The remotivator introduces a general topic that would be relevant to the group. In the original technique, the linkages with reality were promoted through the lecture of poetry about objective themes, following the assumptions of bibliotherapy. Also texts from magazines and newspapers as well as citations can be used. The texts must be simple, rhythmic, and related to the topic under exploration. Along with reading and analyzing a text, visual aids, pictures, and other objects that are related to the topic can be used. It is important to ensure that all participants have contact with the materials.

**Step 3. *Appreciation for the work of the world***

The remotivator develops the topic through planned, open-ended, factual, and objective questions, promoting discussion and interaction between participants. In order to keep the debate alive and to avoid dispersion, questions must be successively placed. In line with the previous step, also at this one materials appealing to the group members should be used.

**Step 4. *Sharing the world we live in***

The remotivator must stimulate the group members to think about the topic in relation to themselves and their realities. Here, the questions must call for subjective aspects of the topic, such as the participants' past experiences and reminiscences, personal opinions, and points of view.

**Step 5. *Climate of appreciation***

The remotivator provides a brief summary of the session emphasizing the most important ideas exchanged between participants. It is also time to express appreciation for the participants' attendance and contributions. The remotivator ends with information on the following session, inviting the group members, and transmitting a sense of continuity.

During the sessions the remotivator must not assume the role of a lecturer. Instead, the remotivator must speak in a nonthreatening and nonjudgmental manner, regardless of the participants' response to the presented topic. An individual acknowledgement of each group member's contribution must take place (Sullivan et al. 2001). Along with the use of open-ended questions, the remotivator seeks active listening, verbalizing appropriately in discussions, attentiveness to the activity, ability to remain on task, responding to reality cues, accepting redirection, making an effort to communicate with other group members, and demonstrating or expressing positive feelings in group (Erwin 2013).

**Remotivation Therapy with Specific Groups and Its Outcomes**

What started out as a group therapy in a psychiatric setting has been expanded into a modality developed in geriatric settings, especially in nursing homes, day care, and social clubs and in home for deinstitutionalized persons. Remotivation can therefore be used as a tool to intervene with individuals of different ages (adults and older adults), with different characteristics and needs, from functionally independent individuals to those with dementia and high sensory, cognitive, and physical constraints.

The first studies about the effect of RT were with mentally ill persons. Long (1965) reported the first experimental studies that were published, in which he concluded that remotivation significantly contributed to improve patients' behaviors by increasing communication and interest in other activities. The author pointed out remotivation as a suitable technique for preparing patients for other activities and treatments since it increases their willingness to do so.

The effects of a remotivation program, held twice a week over 21 weeks, with nursing home residents were explored within the Project Share (Arje 1973). The results showed that the remotivation group's outputs were significantly higher than the controls in socialization, mental status, morale, interest, appreciation, and relations with other members of the group, suggesting that the remotivation program had a positive effect in several social and psychological features. More recently, a study on the benefits of a remotivation program for the institutionalized elderly (ProTR) in terms of depressive symptoms, morale, and participation revealed the potential of RT as an intervention with older adults with global emotional distress, which is very common in this type of settings (Araújo et al. 2011). The program used ten sessions, planned in accordance with the participant's needs, capacities, interests, and cultural background, in which several questions were explored with the patients (see Table 2). The results revealed that the experimental group has experienced a reduction in terms of depressive symptoms and an increase in morale after the intervention. Remotivation also showed to be effective in persons who were isolated and unmotivated, living in single-family homes and who were unwilling to travel or to visit others (Harris and Bodden 1978). After receiving one-on-one weekly remotivation sessions during a time of six weeks, these individuals showed a significant improvement in the levels of motivation, trust, extroversion, independence, and anxiety.

Case studies about the use of remotivation programs for patients with Huntington's and Alzheimer's diseases have also been reported. Sullivan and colleagues incorporated RT in a treatment program designed to provide an

enriched environment for institutionalized Huntington's disease patients (Sullivan et al. 2001). The results pointed to the benefits of remotivation on these patients: it promoted a positive exchange of experiences, interaction with other patients, increase of interest, better frustration tolerance, and improved attention, abilities that can be constrained in Huntington's disease. With Alzheimer's and other dementia-related disorders, the sessions should be shorter and more frequent (daily) in order to achieve the benefits of remotivation therapy (Farmer 2005). Since these patients have diminished attention and cognitive constraints, the session should be adapted through some techniques such as placing the patients around a table with the remotivator, using songs and music instead of poetry, giving each person a hands-on project (e.g., sorting of buttons, arranging flowers), and maintaining the same structure during all sessions (Farmer 2005). With these recommendations, remotivation could be appropriate for dementia since it does not require advanced group therapy skills and is not psychologically intrusive. Furthermore, it demands the use of the available cognitive skills and promotes patient's strengths, avoiding dwelling on negative and symptoms of deficits.

## Future Directions

The emergence of RT dates back to 1950, in a group setting, applied to help withdrawn patients in mental care facilities regain communication, vocational, or social skills, along with (re)discovering interest in their surroundings. It reached its peak in the 1970s with the National Remotivation Therapy Organization establishing remotivation as a new approach to group intervention. The 1980s and 1990s brought RT into new settings, including long-term care facilities for older adults. Since then, RT has faced several challenges relating to waning popularity resulting in few opportunities for training and networking among professionals. The scarcity of research is also a challenge with few empirical publications on the topic (Stotts 2005). Nevertheless, the benefits of RT include promoting restoration of self-worth,

rekindling social skills, increasing reality awareness, and improving communication and verbalization (Sullivan et al. 2001). These benefits highlight the need to reinvest in this treatment modality. Further research is needed to determine RT's efficacy as compared with other treatment options, particularly for cognitively impaired older adults in a long-term care setting who may have few options.

## Cross-References

- ▶ [Bibliotherapy and Other Self-Administered Treatment](#)
- ▶ [Interprofessional Care](#)

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## Resilience and Aging

Ursula M. Staudinger<sup>1</sup> and Werner Greve<sup>2</sup>

<sup>1</sup>Columbia Aging Center, Columbia University, New York, NY, USA

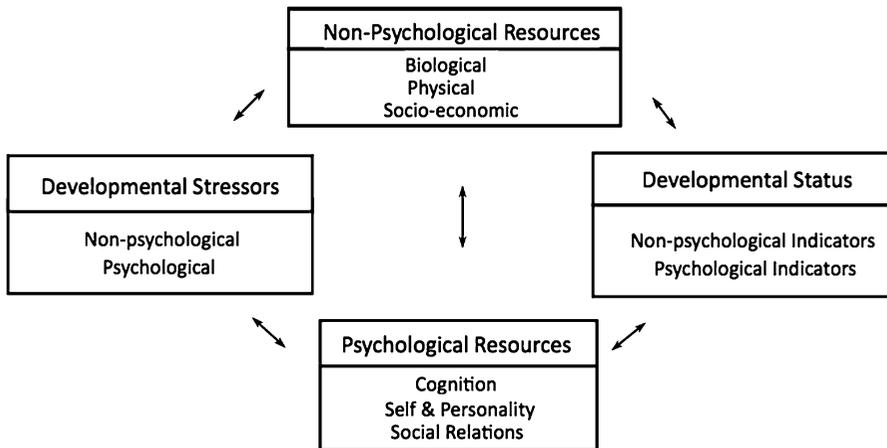
<sup>2</sup>Hildesheim University, Hildesheim, Germany

## Synonyms

Maintain well-being despite stressor; Reduced vulnerability for detrimental life constellations; Type of plasticity

## Definition

Resilience is a constellation of risk factors and resources that predict developmental outcomes. It aims to maintain or recover subjective



**Resilience and Aging, Fig. 1** Resilience as a constellation of psychological and nonpsychological resources

well-being and/or functioning in the face of developmental stressors.

### Origins and Challenges of the Concept

Resilience is most often used to convey the idea that individuals can avoid negative outcomes despite the presence of significant risk factors in their lives. It also includes the idea that individuals can regain normal levels of functioning after developmental setbacks, both with and without the help of external interventions (e.g., Garmezy 1991; Rutter 1985). When defining resilience more precisely, however, there is the challenge of not succumbing to a circular logic (Rutter 1985; Leipold and Greve 2009). Is resilience the outcome, the antecedent, or the process? Is it possible to assess resilience independently of risk and protector factors? Is it indeed a person characteristic, as notions of hardiness (Kobasa 1979), or ego resilience (Block and Block 1980) suggest?

We have proposed that it is useful to define resilience as a relational construct rather than a personality characteristic (Staudinger et al. 1995; Greve and Staudinger 2006), that is, a constellation of risk factors or stressors on the one hand and of available protective factors that are both of a psychological and nonpsychological nature, on

the other (see Fig. 1). This constellation then results in a developmental outcome such as (the maintenance of) subjective well-being or a given level of performance. According to this model of resilience, certain characteristics or mechanisms are not necessarily once and for all to be considered a resource. Rather, it may vary between individuals and even within one person across time what is a resource depending on the respective constellation at hand. Of course, it is crucial to define and assess each element of the constellation independently in order to avoid circularity.

Given this conceptualization, there is overlap between resilience and coping. Coping models provide a useful framing for one type of psychological resource in the sense of mediating mechanisms connecting risks on the one and developmental outcomes on the other side (Greve and Staudinger 2006).

### A LifeSpan Perspective on Resilience

It may come as a surprise, but it was not before the 1990s that the notion of “resilience” has been considered in the context of theorizing and research on aging (Staudinger et al. 1995; Ryff et al. 1998). There are at least three reasons for this: First, the concept of resilience was originally introduced for the study of child development

and, more precisely even, for the study of the psychopathology of child development rather than the investigation of normal development (e.g., Rutter 1985; Masten and Garmezy 1985; Luthar 2006). Second, the study of aging only gained in prominence in these years when longitudinal studies started to reach these higher ages. Thirdly, stereotypic conceptions of late life and the process of aging have tended to see late life as a time of uniformly negative changes and losses, in other words, a period of the life span not characterized by much resilience.

Managing threats and losses in late adulthood and age can be discussed from two angles. First, it is a question of specific events and conditions to be managed in old age. Decades of research have shown that adverse problem situations begin to accumulate in later adulthood. Physical and mental performance tend to decline, serious illness and disabilities occur with a higher probability than in younger years, the remaining years of life decrease, career goals disappear due to retirement, and important friends and relatives die (Baltes et al. 2006). The repeatedly replicated finding that indicators of well-being and psychological health do not decrease until very old age demonstrates, however, that older adults are able to cope with these adversities (e.g., Staudinger and Pasupathi 2000; Staudinger and Kessler 2009; Staudinger and Bowen 2010). The fact that problems associated with old age are characterized by a decreasing level of subjectively perceived control leads us to the second aspect: the means of coping in old age change. Adaptive reactions and processes that do not actively solve but “dissolve” the problem, i.e., reframe it, become increasingly promising and probable (Staudinger et al. 1995; Staudinger and Kessler 2009; Staudinger and Bowen 2010; Brandtstädter and Greve 1994).

From a lifespan perspective, the basic characteristic of human development and aging is its modifiability. This modifiability has been called the plasticity of human development, which is dependent on the risks and resources present in a person’s internal and external developmental contexts (Staudinger et al. 1995; Lerner 1984). The modifiability of human development is a neutral characteristic denoting the positive as well as the

negative deviation from typically observed developmental trajectories (Staudinger 2015). Resilience refers to those types of plasticity that concern the maintenance or recovery of functioning under conditions of stress. Whereas, when a typical developmental trajectory is exceeded (with or without the presence of stressors), this is called growth or thriving (Staudinger et al. 1995; Carver 1998). There is empirical evidence that resilience and growth are qualitatively different phenomena that ought to be studied separately (e.g., Staudinger and Kunzmann 2005). Two types of positive development have been distinguished to capture this difference: adjustment and growth. The former is linked with mastering the developmental tasks and challenges as they arise across the life span as well as the day-to-day hassles and maintaining one’s well-being. The latter is linked with pursuing the advancement of the greater good even if that implies jeopardizing one’s own well-being.

### **Empirical Evidence for Resilience in Later Adulthood and Old Age**

Resilience as the maintenance or recovery of prior levels of functioning after the occurrence of a stressor may be further differentiated as to whether it occurs as an *endogenous* (i.e., without external intervention) part of adult development and aging or whether it requires *exogenous* (i.e., intervention-based) conditions and support (Greve and Staudinger 2006; Staudinger and Greve 2001). In the following, we will present empirical examples for both types of resilience from two different areas of psychological functioning, that is, cognition and self and personality.

#### **Cognition**

Following Fig. 1, we first need to establish the stressor, which requires a resilience constellation to unfold. The stressor in this case is the age-related decline in brain functioning such as the number of neurons, their connectivity, and the brain physiology, which is reflected in decreased performance in indicators of the mechanics of the mind such as the speed of information processing

(e.g., Baltes et al. 2006). Surprisingly, under normal conditions, this decline, which starts already around age 25–30, does not play out negatively in everyday performance and when familiar circumstances are concerned. The decline only becomes visible under conditions of time pressure and in highly novel environments. How is that possible? Research has shown that this type of *endogenous* resilience of the cognitive system is based on the knowledge and experience that we accumulate as we move through life, be it in the context of work or life in general. For instance, Salthouse (1984) demonstrated in a classical study that expertise in typing compensates for age-related changes in performance. Due to years of typing experience, older expert typists read further ahead than their younger counterparts and thereby were able to compensate for the decline in the mechanics of the brain as they concern, for instance, the speed of eye-hand coordination. Or it was shown for the expertise in chess that older chess experts compensated for age-related decline in speed of information processing by forming larger chunks of information than younger chess experts and were thus able to maintain their chess performance (Charness and Bosman 1990).

Research on *exogenous resilience* of the cognitive system has demonstrated that it is possible to recover earlier levels of performance in the mechanics of the mind if certain types of training were provided. Decades of cognitive training research have shown that it is possible to regain earlier levels of intellectual functioning through massed practice (e.g., Consensus 2014; Hertzog et al. 2008). This work has also shown, however, that the increase in cognitive performance based on massed practice or explicit strategy training is achieved through strategy acquisition, that is, acquired knowledge (i.e., cognitive pragmatics) compensates for performance losses. No reactivation of brain areas and mechanisms that have undergone age-related decline are observed, and therefore, such performance increases generally do not generalize across different kinds of cognitive tasks (Nyberg et al. 2003). In recent years, long-term intervention studies (e.g., 12 months) that investigated the effect of aerobic exercise on cognition in old age found that

performance in the cognitive mechanics was improved across a wide range of tasks and that this improvement was associated with a reactivation of brain functioning in brain areas that previously had undergone pronounced age-related decline (e.g., Voelcker-Rehage et al. 2011). Thus, it seems that there is also cognitive resilience that is based on biological reactivation and not only based on knowledge-based compensation. Currently, there is work that examines how continuous cognitive challenges in everyday life such as at work or during leisure time may also help to stimulate exogenous resilience (e.g., Bowen et al. 2010). Of course, there are many more types of exogenous resilience to be mentioned and studied such as the compensatory distribution of cognitive tasks within a long-term couple or the use of external storage devices to support memory functioning to just mention two.

### Self and Personality

A number of studies indicate a high – and increasing – stability and predictability of self and personality across adulthood (Roberts and Caspi 2003). Though some approaches claim that this is indicative of the absence of personality development during adulthood (e.g., McCrae and Costa 1996), the lifespan perspective on human development argues that there is highly functional self-regulatory dynamics that supports such stability and resilience constellations (Greve and Staudinger 2006; Staudinger and Pasupathi 2000; Staudinger and Kessler 2009).

*Personality change.* The pattern of personality change during adulthood can be described as follows: emotional stability, conscientiousness, and agreeableness increase (Staudinger 2005). This pattern has been described as an increase in social mastery and adjustment and as such is an important component of the age-related increase in resilience in the face of developmental tasks. Similarly, using measures rooted in the personality change rather than stability literature, it has been demonstrated that environmental mastery, self-acceptance, and positive social relations increase, as we get older (Keyes and Ryff 1999). At the same time, openness to new experiences

and purpose in life and personal growth tend to decline with age in current cohorts, which is indicative of a decrease in personality growth (cf. Staudinger and Kessler 2009; Staudinger 2005). This latter finding is in line with the fact that wisdom-related insight and judgment as an indicator of psychological growth, in contrast to biological growth or maturation, does not automatically increase as we get older but resilience does (Staudinger and Glück 2011).

*Self-regulatory processes.* The tension between stability and change, just mentioned, extends to evaluative perspectives of (and on) the person. We tend to evaluate ourselves in an impressively stable manner (Staudinger and Pasupathi 2000); even though the balance of gains and losses tends to get worse in the second half of life and, we are indeed able to also perceive this decline quite clearly (e.g., Heckhausen et al. 1989). This pattern of results, at first glance almost “paradoxical” (Staudinger and Pasupathi 2000), highlights likewise the power of resilience constellations in reconciling stability and change in late adulthood and age.

Maintenance of one’s self can be achieved by strategic (planned) reactions as well as by automatic processes the person cannot control (as a rule, he or she is not even aware of them). Strategies of self-regulation (Brandtstädter 2006) include increased efforts of goal pursuit and attempts to receive social support. Such active forms of coping with life challenges are characterized by adherence to the standards and goal orientations under pressure. However, these problem-oriented reactions (“primary control”; Heckhausen et al. 2010) are only possible as long as appropriate problem-solving competence (e.g., social skills, physical resources) is available.

Once attempts to solve a given problem or to alleviate a stressor fail, self-regulatory adjustments can maintain or regain the individual’s sense of coherence and well-being. Adjustments of personal values and preferences, reinterpretations of stressful problem situations, changes in perspective, and deliberate (downward) comparisons are typical examples of processes that contribute to resolving the perceived problem, thereby reducing its adverse effect on well-being

and life satisfaction (Brandtstädter 2006). Although a person might be able to facilitate his or her detachment from a formerly important goal (by, say, a long journey that redirects one’s thoughts), the process of actually replacing a goal (degrading the old one, upgrading a new one) is certainly beyond the individual’s control (for instance, usually we have a hard time to let go of unreciprocated love). Nevertheless, the modification of one’s level of aspiration or the setting of a different goal altogether makes it possible to exercise control over such newly set goals, thus regaining a level of “primary” control which had been impossible before (Brandtstädter 2006; Baltes and Baltes 1990). For instance, when faced in old age with strong physical constraints, it may be highly adaptive to give up independence, that is, move into an assisted living facility or have permanent help move in. By choosing dependence in one domain, we may free up energy that we can use for keeping up independence in others such as maintaining friendships or for pursuing other interests (Staudinger et al. 1995). The reduction of aspiration levels can be interpreted in a similar fashion. Being irreversibly unable to fulfill a specific criterion of physical fitness due to aging – for example, climbing several flights of stairs with ease – may be alleviated by a more age-appropriate criterion such as climbing one flight. Such adjustments, however, presuppose that alternate evaluations and interpretations are available and require the cognitive flexibility to revise initially preferred interpretations and assessments (Brandtstädter 2006). The availability and integration of cumulated life experiences and adjustments in emotion regulation (i.e., mastery; Staudinger and Kessler 2009) seem to facilitate these adaptive processes, as increasing resilience has been observed across the life span.

In the past two and a half decades, several developmental theories of self-regulation have been developed to describe and explain this interplay of tenacious strategies and adjusting processes (Brandtstädter 2006; Heckhausen et al. 2010; Baltes and Baltes 1990; Freund et al. 1999). Whereas they differ, with respect to the scope of adaptive adjustment (from goal pursuit to

cognitive functioning) and with respect to the methodological approaches applied, they converge in the assumption that resilience emerges from the interplay of processes in a given constellation of stressors and resources (Staudinger et al. 1995).

Resilience constellations in old age do, of course, have their limits (Baltes and Smith 1999). Health problems of later life are often not curable and are not easily reframed. Not least in very old age, there is an increasing probability of deficits and losses that no longer appear “manageable.” Permanent eyesight restrictions or the loss of a long-term partner, for example, can only be compensated to a certain degree, and their emotional alleviation might prove difficult. And yet, constellations of resilience remain possible. For instance, focusing on reachable goals (e.g., being a valuable grandmother) and embracing transcendental values (e.g., prospect and hope of a reunion with the lost spouse in heaven) might contribute to a stabilization of one’s quality of life, one’s experience of meaning. Further, even though it seems intuitive, negative emotional reactions are not always to be evaluated as dysfunctional or a lack of resilience (Freund and Staudinger 2015). This is likely to be the case if they persist, but recognizing grief and desperation as steps in a healthy regulation process has become state of the art of resilience. It has been found that resources supporting short-term resilience can differ from mid- and long-term resources. Similarly, what has been identified a resource in dealing with a life-threatening illness may not be effective or even be dysfunctional in dealing with a marriage crisis. Also, resources supporting the maintenance of cognitive functioning differ from those that support resilience in the personality realm, not withstanding that fact that there seem to be some wildcard resources such as internal control beliefs or physical activity (Staudinger et al. 1995).

### **Resilience as Integrative Concept: Theoretical and Empirical Perspectives**

Besides signifying an important developmental phenomenon, the concept of resilience has a

huge potential for theoretical integration of several (hitherto separately discussed) fields and issues such as self-regulation and self-stabilization, coping research, personality development, and successful aging. For instance, the focus on stability as a developmental outcome facilitates the insight that personality (i.e., the stability of the self) is, to a remarkable degree, the product of self-regulatory processes, which are not only producers, but at the same time products of developmental processes (Leipold and Greve 2009). In the following, we will outline three examples of how the concept of resilience serves this integrative function.

### **Resilience Constellations as an Attribute of Developmental Systems**

The conceptualization of resilience as constellation is firmly grounded in lifespan psychology (Baltes et al. 2006) and converges with earlier approaches of “developmental systems” (e.g., Ford and Lerner 1992; see Masten 2014). Without going into more detail, it is important to emphasize the common claim that one particular phenomenon (e.g., developmental stability) can result from various (i.e., heterogeneous) functionally equivalent constellations. This is exactly the decisive point of the conceptualization of resilience put forward here: The fact that a certain person is able to regain the level of functioning under conditions of threat is certainly not to be explained by one and the exact same process, or condition, or constellation in each case. Rather, the specific interplay of various conditions and processes will result in resilience in different constellations (see Fig. 1). For instance, the maintenance of a sense of meaningfulness of life after retirement might be achieved by, say, continuation of working for your company (e.g., as an advisor), by offering your professional expertise to a different institution (e.g., as a volunteer in a charity organization), by refocusing your interests on your partnership or your grandchildren, or by retrospectively downgrading the work experience (“I’m so happy that this is over!”). Accordingly, competencies or attributes that prove to be a resource in one constellation may turn out to be detrimental in others. For instance, a relatively

high degree of self-esteem has been shown to be a buffer (and, thus, a resource) against stressful life conditions, but, at the same time, it poses a risk factor for antisocial behavior in adolescence (Greve and Staudinger 2006). Additionally, a certain developmental state or trajectory might be evaluated either as “crisis” or as “success” – depending on one’s personal perspective and framing (Greve 2015). In other words, resilience constellations are highly specific such that, e.g., the resources identified when using subjective well-being as an outcome have been found to differ from resources found to avoid depression as a developmental outcome (e.g., Staudinger et al. 1999).

### **The Ubiquity of Resilience**

The often-replicated finding that the majority of people prove able to maintain well-being and quality of life throughout late adulthood and (old) age asks for an explanation given that objective circumstances in old age lead us to expect otherwise (Staudinger et al. 1995). Even under very harsh developmental conditions more often than not, and with increasing age even more so, individuals prove able to maintain or regain quality of life and adequate levels of functioning (Staudinger and Pasupathi 2000). The fact that resilience is the rule rather than exception can be explained by the substitutability of protecting and stabilizing conditions (i.e., the functional equivalence of various resources, as mentioned above). In other words, the ubiquity of resilience redirects theoretical attention on developmental processes of stabilization (over and above of processes governing change). Based on extant evidence, there is no reason to assume that mastering adversities would require special person-specific skills or conditions that are only available to certain individuals. Rather, we can assume that they are different constellations of resources that make up resilience for different persons but even for one person across time or across different domains of functioning.

### **The Neurophysiology of Resilience**

As in many fields of psychological inquiry, during recent decades, investigations of resilience have

been expanded beyond the behavioral level to also include its (neuro)physiology (e.g., Staudinger and Pasupathi 2000; Reuter-Lorenz and Park 2010; Ryff and Singer 2000; Schindler and Staudinger 2005). For instance, there is a close association between low and variable heart rate as well as a relatively stronger resting activation of the left prefrontal cortex and a person being less inhibited, more sociable, and approach oriented and having a tendency toward positive affectivity (e.g., Schindler and Staudinger 2005). All of which can be considered resources in a resilience constellation. Furthermore, mechanisms that support flexible HPA axis deactivation have been discussed as a neurobiological wild card resource when buffering stress (Kalisch et al. 2015). The advances in understanding the neurophysiology of stress and its interindividual variability hold the potential to add further precision when deciphering resilience constellations; however, they also hold the danger of reductionism (e.g., Freund and Staudinger 2015; Kalisch et al. 2015; McEwen 2007). A person’s resilience constellation is not preempted by early or even intrauterine experiences or by genetic makeup; rather, it is dynamic and in constant flux (Schindler and Staudinger 2005; Shanahan and Hofer 2011).

### **Future Directions**

Although theories of resilience in late adulthood and old age are embedded in the lifespan perspective on human development (Baltes et al. 2006), they have rarely been connected with approaches on resilience in childhood and youth (Luthar 2006). Both for theoretical and for practical reasons, it might prove important to learn to which degree and how processes that underlie resilience constellations in old age develop earlier in life (Thomsen and Greve 2013): Aging starts early. It may be helpful to try to predict interindividual differences in resources of resilience by focusing on early developmental trajectories. In particular, a deeper understanding of the early developmental conditions of adaptive competencies may finally make truly primary prevention possible: The seeds for the resources of resilience which

are useful or even necessary in later life have probably been planted in earlier phases of development.

The better we understand the developmental conditions for resilience resources, the more effective we will be able to intervene and overcome risks and vulnerabilities in time. Although studies show that exogenous improvement of resources is possible (see above; Voelcker-Rehage et al. 2011), a systematic approach to strengthening resilience resources throughout the life span is still lacking. Certainly, at different stages of life, different interventions are appropriate or necessary (and differently so for different people). However, several “polyvalent” resources might prove useful throughout the life span (e.g., sense of control, adaptability of one’s goal system, the individual’s capacity to reframe, etc.). Building and replenishing resilience resources throughout the life span by incorporating biological, psychological, and social-cultural features as well as their interactions represent a major contribution to modern public health.

## Cross-References

- ▶ [Activity Theory, Disengagement Theory, and Successful Aging](#)
- ▶ [Age-Related Changes in Abilities](#)
- ▶ [Cognitive and Brain Plasticity in Old Age](#)
- ▶ [Life Span Developmental Psychology](#)
- ▶ [Life Span Developmental Psychopathology](#)
- ▶ [Plasticity of Aging](#)
- ▶ [Psychology of Wisdom](#)
- ▶ [Stage Theories of Personality](#)

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## Resilience and Health

Barbara Resnick  
University of Maryland School of Nursing,  
Baltimore, MD, USA

### Synonyms

Buoyant; Elastic; Hardy; Strong; Supple

### Definition

Resilience is the ability to spring back or recover from a physical, emotional, financial, or social challenge.

## Resilience as a Key Factor in Health

The word “resilience” comes from the Latin word “salire,” which means to spring up, and the word “resilire” which means to spring back. Resilience is defined as the ability to spring back or recover from a physical, emotional, financial, or social challenge. Being resilient means that the individual has the ability to adjust or deal with trauma, adversity, hardship, and ongoing significant life stressors. Resilient individuals are able to respond appropriately to changes and challenges encountered and adapt and adjust their behavior. Most importantly, individuals who are resilient are able to move beyond the challenge, regain equilibrium, and gain knowledge, experience, and a stronger or better sense of well-being following the challenge (van Kessel 2013; Wild et al. 2013). Resilient individuals will also be less likely to succumb to illness, including both mental and physical illnesses.

There are some individuals who respond to illness with negative emotions such as depression and anxiety, while others are more optimistic and establish a more positive perception of health status and recovery, regardless of the disease. The World Health Organization defined health as a general sense of well-being, including physical well-being, mental, social, and functional improvement (World Health Organization 2002). Thus maintaining health requires that individuals address many challenges throughout their lifetimes and adapt to changes as they occur. It is possible that healthy aging and longevity are associated with personal resilience, while individuals who are less resilient tend to succumb to illnesses and experience excessive morbidity.

### Health Resilience

There are many types of resilience and individuals vary in terms of their resilience across these different domains. Most commonly, resilience has been differentiated into health resilience (Sanders et al. 2008), psychological resilience (Boardman et al. 2008), emotional resilience (Chow et al. 2007), and dispositional resilience (Rossi et al. 2007). Health resilience is the capacity to

maintain good health in the face of significant adversity. Evidence of health resilience is the ability to maintain good health in the face of challenges, with good health including both physical and mental health. The specific health challenge encountered by an individual might be physical, psychological, or social. For example, those without health insurance and less access to health-care resources would be challenged to maintain health if they had to pay for health-promoting activities (e.g., immunizations) out of pocket. Likewise, it might be challenging to maintain good psychological health without any social supports such as what occurs in older age when one has outlived family and friends.

### Factors That Influence Resilience

Resilience is believed to be a component of the individual's personality although it develops and changes over time through ongoing interactions with the physical and social environment and the challenges that one encounters throughout the life course (Hughes 2012). From a physiologic perspective, resilience has been associated with the individual's flexibility in his or her neurochemical stress response systems and the neural circuitry involved in stress responses. Prior research has shown that being exposed to stress, whether this is chronic or acute stress, can result in depression, anxiety, or other types of negative psychological and physical outcomes (Taliaz et al. 2011). Stress can cause alterations in brain structures associated with cognition, mood, and behavior within the hypothalamic pituitary-adrenocortical (HPA) axis (Bowes and Jaffee 2013). In addition, the response to stress impacts neurotransmitters, neuropeptides, and hormones, and some individuals respond with resilience, while others decompensate when exposed to the same type and level of stress.

Serotonin has been the most commonly studied neurotransmitter, and the serotonin gene, solute carrier family 6 neurotransmitter transporter (*SLC6A4*), is the gene most commonly associated with resilience at least among older adults (O'Hara et al. 2012; Feder et al. 2009; Resnick

et al. 2015). Some additional genes that are believed to be involved with prefrontal cortex reactivity associated with fear and other stressors have also been associated with resilience. These genes include brain-derived neurotrophic factor (*BDNF*), corticotropin-releasing hormone receptor 1 (*CRHR1*), peptidyl-prolyl cis-trans isomerase (*FKBP5*), glutamate receptor metabotropic 1 (*GRM1*), solute carrier family 6 member 15 (*SLC6A15*), and catechol-*O*-methyltransferase (*COMT*).

Some additional genes have been associated with response to stress and subsequent depression in animal models and/or humans and consequently are anticipated to be associated with resilience. These genes include neuropeptide Y (*NPY*), neurotrophic tyrosine receptor kinase 1 and 2 (*NTRK-1*, *NTRK-2*), and guanine nucleotide-binding protein beta polypeptide 3 (*GNB3*) (Taliaz et al. 2011). Overall the genetic aspects of resilience provide support for the personality component of this characteristic.

Genetics is not the only factor, however, to influence resilience. Resilience is known to be a dynamic process that is influenced over the course of one's life by significant life events and challenges. Resilience related to health is an accumulation of learned experiences as well and ways in which the individual has coped with health challenges over time. In older age, for example, if one has never had to deal with health challenges, the normal changes that occur associated with aging can become overwhelming. Conversely, chronically ill individuals tend to cope with age-associated changes and common illness associated with aging such as degenerative joint disease easily.

Many factors or qualities within individuals have been associated with resilience (Table 1). These include such things as positive interpersonal relationships and building social connectedness with a willingness to work with others, strong self-efficacy, and positive self-esteem, establishing a sense of purpose, using humor and creativity, accepting and even embracing changes encountered such as those associated with aging, being self-determined, having an optimistic or positive perspective about life, keeping things in

**Resilience and Health, Table 1** Resilient qualities or traits commonly noted in older adults

Resilient qualities
Positive interpersonal relationships
Strong self-efficacy
Positive self-esteem
A sense of purpose
Spirituality
Ability to use humor
Creativity
Acceptance of changes (physical and mental)
Maintaining a positive attitude
Ability to identify and utilize resources
Self-determination
Optimism
Keeping things in perspective
Taking care of oneself – physical and emotional care
Avoid seeing crises and insurmountable problems
Setting goals and working toward them
Taking decisive action

perspective, setting goals and working toward them, and taking decisive action (Bonanno et al. 2007; Charney 2004; Lamond et al. 2008; Ong et al. 2006).

### Positive Interpersonal Relationships

Interpersonal relationships include interactions with family, friends, colleagues, and other acquaintances that the individual may interact with for physical, social, or psychological purposes. With regard to health resilience, relevant interpersonal relationships include interactions with health-care providers encountered through any variety of health-care situations. Interpersonal interactions and activities, whether receiving help from others or providing support or help of some kind to others, serve as a psychological buffer against physical and emotional stress, anxiety, or depression. Interpersonal activities also help individuals cope with losses. When one individual is helping another individual with physical tasks and specific services (e.g., providing a ride to an appointment) or providing social support and friendship, it generally results in a sense of belonging and purpose and strengthens self-esteem and self-efficacy. Thus individuals who volunteer to do such things as work with children

in reading programs, deliver the mail in continuing care retirement communities, or serve on committees or boards tend to be more resilient than those who are not willing to engage with others in this manner.

### Strong Internal Resources: Self-Efficacy, Self-Esteem, Determination, and Problem Solving

Self-efficacy is the belief in one's ability to organize and execute a course of action to achieve a specific outcome (Bandura 1997) and as such impacts one's resilience. Different than self-efficacy, self-esteem is reflective of one's appraisal of his or her self-worth. Individuals who have a positive sense of self-worth, accept and like themselves, and refrain from being "too hard on themselves" are more likely to be resilient and maintain their psychological health.

Determination, or hardiness, is another important component of resilience. There are just some individuals who are determined and this is noted to be a central aspect of their personality. Determined individuals tend to be more confident in their ability to cope with health challenges such as the diagnosis of a malignancy or the ability to access resources to maintain health. These individuals are also more likely to seek out and find necessary resources to achieve their health-related goals.

### Optimism, Positivism, and Keeping Things in Perspective

Optimism is one of the most commonly considered components of resilience or of a trait associated with resilience. Optimism has even been used as a proxy measure of resilience (Ronaldson et al. 2015). Repeatedly it has been noted that having the ability to stay focused on positive outcomes in the face of challenges and avoid focusing on negative facts is critical to resilience. As with resilience overall, optimism is learned throughout life based on experiences and interactions with others. At any point in time, optimism can serve as a buffer to becoming psychologically or physically unhealthy (Chung et al. 2015). Interestingly, optimism does not need to be rooted in truth to positively impact resilience and optimal coping. That is, unrealistic optimism may serve as

**Resilience and Health, Table 2** General intervention strategies to strengthen resilience

Developing dispositional attributes	Improving socialization practices	Strengthening self-efficacy, self-esteem, and motivation	Creative engagement
The use of humor to facilitate a sense of optimism and vigor	Facilitate social interactions such as dinner dates and bridge games	Reinforce successful completion of activities (e.g., making a dinner date)	Encourage participation in art classes
Help individuals keep challenges in perspective	Encourage participation in exercise classes	Verbally encourage to engage in specific activities	Encourage journaling
Review prior successes and strengths	Encourage volunteering within communities or settings of care	Expose to role models of others doing specific activities of interest	Encourage enrollment in a foreign language class or class to learn how to play an instrument
Help maintain a sense of hope		Decrease the unpleasant sensations around performing a specific activity (decrease anxiety around setting a dinner date)	
Help set realistic and achievable goals		Eliminate negative self-talk	

an important buffer that can help individuals remain resilience in the face of challenges that might otherwise result in negative outcomes such as subsequent worsening of health, depression, or anxiety.

### Spirituality

Spirituality, considered broadly, includes a sense of self and purpose, creativity, humor, and a curiosity and willingness to learn and experience new things. Spirituality is not the same as religion. Rather it is a process of personal transformation, in accordance with traditional religious beliefs or based on subjective experiences and psychological growth independent of any specific religious context. Spirituality is a resource that is used to support the individual through challenges and can optimize and influence resilience in the face of health challenges such as the diagnosis of a malignancy.

### Interventions to Strengthen Resilience

Although some individuals may be more likely than others to be genetically predetermined to be resilient (Feder et al. 2009), interventions can be

implemented to strengthen resilience among all individuals. Examples of established approaches to helping individuals who are experiencing health challenges become more resilient are shown in Table 2. These interventions generally address four areas: (1) developing disposition attributes of the individual such as vigor, optimism, and physical robustness; (2) improving socialization practices; (3) strengthening self-efficacy, self-esteem, and motivation through interpersonal interactions as well as experiences; and (4) creative engagement. Two additional areas will also be highlighted including the use of general lifestyle interventions and technology.

#### Developing Dispositional Attributes

Developing positive attributes such as vigor, optimism, and a sense of physical robustness can be done by using a variety of techniques. Humor, for example, may be helpful in accepting changes in function and ability and help turn negative thoughts to more positive acceptance. Laughing about the physical changes that normally occur in aging, for example, is a useful approach to adjusting to these changes rather than becoming depressed or responding to such changes negatively by no longer being willing to go out in

public. Trying to keep challenges from becoming insurmountable and unresolvable problems can also help keep the challenge in perspective and maintain optimism. Likewise, reviewing prior and current strengths and trying to see oneself in a positive light can help build optimism. Encouraging hope, whether or not that hope is realistic in nature, can also build an optimistic attitude. Believing one will walk following an acute neurological event, for example, can be extremely useful in terms of helping the individual be resilient and continue to engage in what may be difficult therapy sessions. Motivational interventions such as developing realistic and achievable goals related to the challenge being encountered can also help to build a sense of success, robustness, and ability to recover.

### **Improving Socialization Practices**

Throughout life there are losses that occur within one's social network including losses among family members, friends, and colleagues. Maintaining and assuring adequate social resources, however, are critical to building resilience. Therefore, helping individuals reach out and make connections with others and develop relationships can be an extremely effective way to strengthen resilience. Specifically, offering concrete ways in which to engage socially provides a framework for individuals to initiate social activities. Examples might include such things as making lunch or dinner dates, setting up bridge games, starting walking groups, attending exercise classes, or participating in volunteer activities. All of these activities can help build relationships that can grow into social supports. One particularly important skill to help older adults develop following a challenging event is to reach out and ask others for help. This also should be encouraged as an important development in building socialization practices.

### **Strengthening Self-Efficacy and Self-Esteem**

Self-efficacy is generally behavior specific and is strengthened using four sources of information including (1) successful performance of an activity, (2) verbal encouragement to perform an activity, (3) seeing similar others perform, and (4) elimination of unpleasant sensations

associated with an activity and strengthening or highlighting the pleasant experiences that result from the same activity (Bandura 1997). Generalized self-efficacy has been noted to be more comprehensive and more likely to be associated with an individual's beliefs about personal abilities in general. General self-efficacy is defined as an individual's belief in their capability to manage or perform tasks across a wide variety of situations and is associated with self-esteem. Building self-efficacy is best done by helping individuals feel successful in their ability to complete a task. Facilitating success can be done by breaking a task down to small achievable goals, providing consistent positive reinforcement toward task completion and showing the individual how others similar to him or her have successfully completed the task and being sure that the positive rewards and sensations associated with the activity are appreciated by the individual.

Self-esteem refers to a person's positive evaluations of himself or herself. Self-esteem has been associated with an overall sense of well-being, mental health, and positive engagement in recovery as well as routine activities. Interventions that have been shown to be effective in strengthening self-esteem include such things as engaging in structured life reviews or successfully participating in an exercise class, eliminating negative self-talk, recognizing one's self-worth, and being able to accept mistakes and rejection.

### **Creative Engagement**

Exploring creative endeavors is particularly helpful for individuals during times of crises. Creative interventions have been shown to positively affect mental and physiological health. This might include journaling, painting or other types of art classes, dance and movement classes, and trying new activities such as learning to play an instrument or speak a foreign language. It is not unusual, however, for individuals to perceive themselves as not being creative and thus reluctant to engage in such activities. Innovative ways to encourage creativity, particularly for older adults, include encouraging individuals to complete focused projects such as having them write their life stories for grandchildren.

### General Lifestyle Interventions

Lifestyle changes can also help to improve health-associated resilience and enhance individuals' sense of well-being (Southwick and Charney 2012). Lifestyle interventions include such things as nutrition, exercise, complementary and alternative medicine approaches, and meditation. Nutritional intake can certainly influence health and decrease the risk of heart disease and inflammation. Diets high in fruits and vegetables and those that focus overall on caloric restriction while maintaining nutritional balance are important to maintaining optimal health and possibly extending life. Along with nutrition, exercise has clearly been associated with maintaining a sense of overall health and well-being and can therefore facilitate resilience. Exercise has the benefit of improving both physical and psychological health and helping to prevent physical diseases such as cardiovascular illness and psychological problems particularly depression.

The use of complementary and alternative medicine for some is useful to optimize mood and strengthen one's resilience to interpret health status as good regardless of the underlying disease (Charney 2004; Chan et al. 2006). Interventions include such things as the use of vitamins and supplements (e.g., omega-3 fatty acids, ginseng), acupuncture, yoga, meditation, and pastoral care or other types of spiritual interventions.

### Technology-Based Interventions

The use of technology to provide telehealth, behavioral monitoring, optimize safety or build independence, and provide psychological and social support is a new and important way in which to strengthen resilience. Participating in self-help communities online can help build confidence and provide the critically important social support to continue to adhere to health behaviors or help adjust to new diagnoses. Further, social interactions via the Internet can help prevent loneliness and depression in times of crisis and alleviate stress-related diseases.

### Conclusion

Health resilience is central to successful aging and adjustment to the many changes that occur throughout the life span. Some individuals may be genetically predisposed to be resilient. Others may develop resilience through life experiences or via focused interventions. Interventions to strengthen resilience include such things as strengthening general self-efficacy and self-esteem, engaging in social activities and interactions, using humor and maintaining an optimistic attitude, accepting change, and looking for ways in which to make the change a growth experience, among many others. Deliberately trying to strengthen one's resilience can result in significant health benefits with regard to physical health as well as psychological health and may even buffer the impact of disease and decrease morbidity and mortality.

### Cross-References

- ▶ [Psychosocial Well-Being](#)
- ▶ [Well-Being in Centenarians](#)

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## Respite Care, Current Status and Future of

Kaitlyn Dykes<sup>1</sup>, Kristen Sarkinen<sup>2</sup>, Katie Louwagie<sup>2</sup> and Joseph E. Gaugler<sup>2</sup>

<sup>1</sup>Sidney Kimmel Medical College, Thomas Jefferson University, Philadelphia, PA, USA

<sup>2</sup>School of Nursing, University of Minnesota, Minneapolis, MN, USA

### Synonyms

Adult day services; Caregiver intervention; Community-based long-term care; Home care; In-home help; Long-term services and supports

### Definition

Respite care refers to support for family/unpaid caregivers through the provision of short-term, intermittent relief from care responsibilities that is delivered in a home, community, or institutional setting (Mason et al. 2007; Nottoli 2008). Respite care is not disease or age specific. This paid or unpaid service may be provided to caregivers by health-care professionals, community agencies, or untrained personnel including volunteers, friends, and family members. The length of respite care service utilization tends to vary. For example, respite care may be used for short breaks from caregiving duties during the day or may provide more extended relief (e.g., overnight respite, where older persons can receive 24-h care for several days that allows a family member to take a vacation or attend to other responsibilities; see <http://helpguide.org>).

The overall goal of respite care is to offer rest and recovery for the informal caregiver in order to enhance caregiving relationships and support the in-home care provided by a family member (Nottoli 2008). A secondary goal is to improve health or quality of life of older care recipients or at least to maintain function and independence on the part of the older person. In-home care may

take the form of unpaid support from family or friends, companionship through volunteerism, or skilled care provided by health-care professionals. Some of the services provided by in-home respite care include assistance with meal preparation, daily activities such as toileting and feeding, and other specific health-care needs. Respite care provided outside of the home may occur in adult day service programs, respite camps, or more formal health-care and long-term care settings such as hospitals or nursing homes (<http://helpguide.org>).

### Respite Care and Population Aging

The population of older adults continues to increase worldwide. As life expectancy lengthens, more older adults will require care. About 25% of households in the USA contain a caregiver (Nottoli 2008) or a person who provides help and assistance to another due to a health need. Many informal (or unpaid) primary caregivers also have additional non-caregiving responsibilities, such as paid work. Smaller family size and more women in the workforce pose challenges to providing adequate family care, as caregivers are most likely to be women (Genet et al. 2011). A generation of caregivers in the UK, known as the “pivot generation,” simultaneously manages the care of their children or grandchildren while also caring for a parent, other older family member, or a friend. These duties can contribute to adverse emotional, psychological, social, and financial stress, which may lead to negative health behaviors such as smoking (Hoffman and Rodrigues 2010). One option that is believed to help support family caregivers with multiple role responsibilities is respite; it is thought that the provision of time off from care responsibilities can provide relief to family caregivers, thus allowing these family members to remain in their caregiving roles for longer periods of time and potentially delay other costly health transitions for disabled older adults (e.g., residential long-term care admission).

In 2012, 4,800 adult day service programs served 273,200 clients in the USA (Harris-Kojetin

et al. 2013). Adult day programs are designed to not only provide family caregivers with respite but to also offer a range of therapeutic activities and services to help maintain the independence and function of clients (many of whom are older adults). In 2011, approximately 4.7 million individuals received services from home health agencies in the USA; however, it is not clear the extent to which these services were utilized as a source of respite for family caregivers (Harris-Kojetin et al. 2013). As of 2004 it was estimated that approximately 40% of caregivers in the UK received respite; one-third of these respondents felt that the availability of respite services was insufficient (Mason et al. 2007). Policies supporting respite exist in most European countries; for example, Germany offers publically financed respite care for up to 4 weeks, while in Luxembourg respite support is provided over a 3-week period. The 2006 Act on Family Caregiving in Finland provides 3 days of respite a month for “continuous” caregivers. In Denmark, respite care is offered at the municipal level and is fully funded from public sources, although in Spain, the UK, and northern European countries municipal organization and financing of respite care lead to wide disparities in availability across communities. In some European countries, such support does not extend to in-home respite care (e.g., Austria, Finland, and Hungary) (Colombo et al. 2011, pp. 128).

The use of respite care is often believed to decrease the perceived financial, social, and emotional hardships associated with caregiving responsibilities. For example, respite holds the potential to decrease caregiver stress and in turn reduce the need for transitioning an elderly relative to a nursing home (Gaugler et al. 2006). Despite these benefits, barriers to respite care include challenges in access, cost, lack of knowledge of available respite, and fear of potential disruption to the care recipient’s routine (Hoffman and Rodrigues 2010; Colombo et al. 2011). Moreover, conclusions of efficacy/effectiveness must be made with caution due to the varying quality of evidence (i.e., randomized controlled trials) available.

## Research on Respite Care

Evaluation research on respite care emerged in the 1970s (Gaugler et al. 2011). Current research on respite takes place largely in Canada, the UK, and the USA (Mason et al. 2007; Gaugler et al. 2011; Gaugler and Zarit 2001; Fields et al. 2014). Published studies on respite care vary widely in terms of their study design (e.g., since the early 1980s there have been few randomized controlled evaluations of various types of respite such as adult day services; see Gaugler and Zarit 2001; Fields et al. 2014), outcome measures, data collection, analysis, and conclusions (Gaugler et al. 2006). For example, research on respite care tends to feature a range of study designs, including ethnographic/observational methods, correlational studies, quasi-experimental designs, more advanced controlled experiments, and much less frequently randomized controlled evaluations (Mason et al. 2007; Pinquart and Sörensen 2006). Each study design has distinct strengths that contribute valuable insights into respite care, although a lack of randomized controlled evaluations makes conclusions of efficacy difficult to interpret. Meta-analyses that have attempted to pool empirical data or even systematic reviews are often hampered by this heterogeneous design quality as well as variations in outcome measures (Mason et al. 2007; Gaugler et al. 2006; Pinquart and Sörensen 2006; Shaw et al. 2009). There are a host of measures commonly investigated in respite care research. These include but are not limited to care recipients' activities of daily living and self-care abilities, cognitive status, emotions, physical functioning, and behaviors. Additionally, evaluations of respite care sometimes aim to determine if respite care delays nursing home placement among older care recipients in addition to whether respite care reduces emotional and psychological distress of family caregivers. The scope of respite care research is also diverse due in part to a lack of standardized terminology and definition of respite care as well as the duration of respite use and the samples included. As a result of heterogeneous study methodology, it is perhaps not surprising that individual research studies have yielded different conclusions

regarding the efficacy and effectiveness of respite care (Gaugler et al. 2006).

Systematic reviews and meta-analyses of respite generally indicate that these services are either unable to demonstrate evidence in support of benefits for family caregivers or older persons or that respite care is only marginally beneficial (Mason et al. 2007; Gaugler et al. 2006, 2011; Fields et al. 2014; Pinquart and Sörensen 2006; Shaw et al. 2009). Existing studies do indicate that respite care is not harmful, nor does utilization of respite result in adverse events for older users or their family caregivers (Mason et al. 2007). Caregivers typically perceived respite care as valuable and were highly satisfactory with these services; as noted above, survey data from the UK suggests that many families desire much more respite care for their own situations (Mason et al. 2007; Gaugler et al. 2011).

To date, the potential efficacy of respite care remains unclear, although slightly more robust evidence seems to suggest its effectiveness. One meta-analysis conducted by Shaw and colleagues found tentative conclusions on the effects of respite care on the caregiver. This analysis suggested that caregiver burden was reduced at 2–6 months' follow-up in single-sample studies but not in randomized control trials or quasi-experimental studies. Shaw et al. also revealed that caregiver depression was reduced in home care and randomized control trials in the short-term but not with the use of adult day services. However, these effects were tentative and were not significant in more rigorous, randomized controlled designs (Shaw et al. 2009). A more recent consideration of descriptive and quasi-experimental research on adult day services suggests the potential links between adult day service use and improvement in the psychosocial well-being of family caregivers and their relatives who attend such programs, implying some degree of effectiveness (Fields et al. 2014). Shaw et al. did not find any effect of respite on caregiver anxiety, although respite care did have positive effects on caregiver morale, anger, and hostility. Additionally, it has been suggested that respite care improves caregiver stress levels, provides a break for caregivers, preserves the relationship

of caregivers with care recipients, and fosters quality provision of family care in the home.

Syntheses of extant literature imply potentially undesirable outcomes. For example, single group studies indicated that caregiver quality of life was reduced after respite use and care recipients sometimes increased their rates of institutionalization following a family member's respite use (Mason et al. 2007; Shaw et al. 2009). However, this does not indicate a causal relationship; instead, such findings may be a result of using respite relatively late in the trajectory of family caregiving (Mason et al. 2007; Gaugler and Zarit 2001). Indeed, descriptive, longitudinal studies suggest that earlier use of home- and community-based services by dementia caregivers could result in delayed institutionalization of care recipients, although still other reviews suggest that respite care has no significant effect on institutionalization (Pinquart and Sörensen 2006; Gaugler et al. 2005).

In summary, respite care appears to exert benefits for caregivers and to a lesser extent older care recipients in some studies, but overall the scientific evidence is mixed. This is particularly evident when randomized controlled trials are taken into account (Mason et al. 2007; Gaugler et al. 2011; Shaw et al. 2009). A current gap in the existing scientific literature is a lack of understanding of the process/mechanisms of respite whereby such services may (or may not) exert benefits. Much of the existing evaluations of respite tend to treat these services as "black boxes" where the main objective is to ascertain *whether* respite provides relief to caregivers and reduces health service utilization on the part of older adults; *how* respite is able to achieve such benefits remains largely misunderstood. This is perhaps why a disconnect exists between scientific findings and the anecdotal reports of providers and families themselves, who often view respite and its benefits quite positively during the course of caring for a disabled elderly relative (Gaugler 2014).

Another area of clinically valuable research is the cost-effectiveness of different models of respite care. A review of prior evidence suggests that adult day service use was associated with similar or higher costs and either similar or

slightly increased benefits relative to usual care (Mason et al. 2007). However, limited economic data on respite care makes it difficult to assess for whom and what type of respite care is particularly cost-effective on an individual basis. Only slightly more than one-third of respite care studies included economic evaluations (Mason et al. 2007).

Although research on respite care is varied in terms of its type and evidence-based rigor, it has yielded some recommendations related to quality indicators. Shaw et al. state that respite must provide a "mental break" for the caregiver in addition to providing a temporal one (Shaw et al. 2009). This can be accomplished by respite providing active information about services, support early in the caregiving career, access to a variety of services with flexible offerings, reliable transportation, continuity of care, appropriate environments, care that yields benefits for care recipients, and appropriate activities for care recipients' abilities and interests. In light of this extensive list, quality respite care for diverse individuals can be achieved by offering a range of respite types, providing flexibility in terms of when respite is provided, and programmatic receptivity to change in both caregiver and care recipient preferences and needs over time (Shaw et al. 2009). As noted above, however, the extent to which current respite services feature such elements is currently unknown.

Available research has attempted to identify caregiver and care recipient characteristics that influence respite service use. Respite use is positively influenced by more positive caregiver attitudes toward respite provision, greater knowledge of and availability of services, a perceived positive impact of respite care on care recipients, accessibility of respite services, perceived higher quality of available respite care, and flexibility of service provision (Shaw et al. 2009). Further, caregivers helping individuals with severe cognitive and functional deficits are more likely to utilize respite care than other caregivers (Gaugler et al. 2006). Nonetheless, it has been found that 22–50% of dementia caregivers refuse respite care despite the absence of concerns related to cost on the part of families (Gaugler et al. 2006). Reasons

for this finding are unclear. Existing evidence suggests that some families delay respite use and do not use it for long periods of time, possibly because families are uncomfortable with someone else providing care or because the care recipient is too impaired to benefit. More research that identifies those factors that promote or inhibit respite use could help programs tailor their services for certain types of caregivers, thus making respite more attractive and beneficial to caregivers in need and allowing these services to be utilized earlier (thereby potentially increasing their chances of exerting benefits over time).

### Future Research on Respite Care

Research on respite care is difficult due to the diversity of the “treatment.” There are various forms of respite care available (Gaugler et al. 2011). Such variation limits any synthesis of overall efficacy or effectiveness of respite care. Further, lack of evidence from existing studies in support of respite care may be due to low respite service use, liberal targeting (i.e., inclusion of family caregivers or older adults who may not benefit from the service that respite provides), short-term evaluations, inappropriate or poorly targeted outcome measures, a failure to account for heterogeneity in study populations, and control/comparison groups seeking out respite care themselves in addition to respite treatment conditions (Gaugler et al. 2006).

Because of the need to better understand the process of respite for older adults and their family caregiver (see above), several other considerations are required when researching the effects of respite. First, development work that quantifies caregiver needs and preferences should be carried out to better match families with appropriate respite care services (Shaw et al. 2009; Kane et al. 2006). Additionally, care recipient outcomes must be defined and validated based on caregiver expectations and on the aims and processes of the intervention (Gaugler et al. 2006). Further, the boundaries between different forms of respite care must be clarified (Mason et al. 2007). Then, more high-quality trials of a substantial size

should be conducted that utilize randomization and appropriate comparison groups (whether “usual care” or perhaps comparative effectiveness designs that evaluate one type of respite care against another) (Mason et al. 2007; Shaw et al. 2009; Institute of Medicine 2009). Trials must also include economic evaluations and should consider both short- and long-term outcomes (Shaw et al. 2009). Additional studies are needed to determine the optimal time for provision of respite to provide maximal caregiver relief (e.g., earlier during the course of caregiving) (Gaugler et al. 2005) and to evaluate interventions that break down barriers to respite implementation or utilization. Greater attention to how respite is perceived and utilized across various ethnic groups could also enhance understanding of the potential benefits of respite care or lack thereof for diverse and underrepresented older adults and their caregiving families (Shaw et al. 2009).

### Practice and Policy Implications of Respite Care

A variety of resources provide information for families when selecting the appropriate type of respite care. For example, respite locators are available in the USA to help assist families identify a respite care provider in their area. These services also provide families with suggested criteria for selecting an appropriate respite care service to meet their needs or the needs of their relatives who are care recipients (<http://archrespite.org/respitelocator>). When considering the various forms and providers of respite care, caregivers should assess the geographical location, availability, varying costs, and special needs or preferences of their families and relatives who will receive respite (Nottoli 2008). Respite programs such as adult day services may employ a range of professional or paraprofessional care providers, including social workers, case managers, nursing staff, and physical, occupational, or speech therapists to meet the needs of their clients (Gaugler et al. 2011). When evaluating respite care programs, it is recommended that families actively inquire about emergency procedures as

well as staff training, background, and screening (<http://nadsa.org>; <http://Helpguide.org>). Visiting a respite care provider can also assist families during their selection process. Additional information is provided regarding the screening of respite care providers at the National Respite Network or similar resources in the USA (e.g., <http://archrespite.org/>).

The funding for and costs of respite services in Europe vary considerably across countries due in part to diverse funding mechanisms (e.g., municipally based programs) and accessibility (Tarricone and Tsouros 2008). For example, with the exception of Hungary, Norway, and Poland, and European countries in the Organisation for Economic Co-operation and Development, all European countries offer respite services, but as described above accessibility, availability, and funding mechanisms vary not only across but within countries (Colombo et al. 2011). In the USA, some states offer Medicaid waiver programs or state funding as a part of the National Family Caregiver Support Program through the Older Americans Act Amendments of 2000 (Nottoli 2008). Other sources of funding for families include veterans' benefits, foundation grants, insurance and long-term care policies, disability coverage associated with supplemental security income, or specific state agencies.

Health-care professionals are in a key position to provide referral and education to family caregivers regarding respite care services. However, research has found that health-care professionals often have negative attitudes themselves regarding the use of respite or simply do not view such services as preferred referral options for older adults or their caregiving families (Kane et al. 2006). Therefore, ongoing education for health-care professionals regarding the needs of family caregivers and the benefits of respite care is desirable. Health-care professionals require the appropriate training and education to adequately assess family caregivers in order to give meaningful referrals to respite programs that are individualized to fit each caregiver's situation (Gaugler et al. 2011, 2014).

Due to the lack of evidence regarding the effectiveness and cost-effectiveness of respite care,

informing policy development and clinical practice is challenging (Mason et al. 2007). The National Adult Day Services Association (NADSA) highlights a public policy agenda for adult day services. NADSA focuses on facilitating access to adult day services. NADSA also advocates for modernizing Medicare to allow caregivers to take advantage of cost-effective nursing services, physical therapy, occupational therapy, and social work services offered by many adult day services.

As noted by several researchers, community-based long-term care services including respite may actually serve to increase long-term care expenditures, rather than reducing them due to delayed residential long-term care admission. As Grabowski and colleagues suggest (Grabowski et al. 2010), ongoing support for community-based long-term care programs may still be necessary even in the absence of cost savings because (1) many older adults in the USA and in other developing countries do not wish to leave their homes in favor of residential long-term care, and in the USA at least older adults actively fear this proposition, and, (2) while respite may not result in cost savings, cost-effectiveness is still possible given the degree to which families value such programs. For these reasons, continuing to advance the current state of the science from efficacy to effectiveness would likely better demonstrate the value of respite services for caregiving families in need as well as their disabled elderly relatives (Gaugler 2015).

## The Future of Respite Care

A balance is required between families' desire and perceived need for respite care services with evidence-based determinants of service quality and patterns of utilization (Gaugler et al. 2011). The use of respite services on the part of families may be attenuated due to high costs, lack of knowledge of available respite resources, and a concern that respite care may be too disruptive to the care recipient (Hoffman and Rodrigues 2010). An emerging development for respite care services has been consumer-directed care options,

where older persons themselves can choose to use public funds to pay family members to provide help and assistance. Evaluations of these approaches have suggested at least moderate benefits for older adults and their caregivers (Hoffman and Rodrigues 2010; Gaugler 2015). Consumer-directed approaches are able to tailor services to individual clients' needs and allow for increased flexibility. Ongoing concerns include lack of regulation, coverage of costs, and barriers related to payment streams and funding control (Genet et al. 2011). In addition, it is not clear if the use of consumer-oriented options would work effectively in instances where older adults are decisionally impaired. Whether the use of consumer-oriented options in instances where families are paid directly for care actually results in providing relief or respite to families also remains unclear; such approaches may incentivize family care provision and thus may place some family caregivers at risk for overload, exhaustion, or other psychosocial stressors.

Technology has the potential to improve respite care. Advancements in technology ranging from online information, assistance, and consumer ratings to remote health monitoring systems may ease the burden of caregiving, resulting in more time for informal caregivers to remain active in their community and other life responsibilities (Tarricone and Tsouros 2008; Gaugler 2015). A challenge to implementing such advances, however, is the low level of computer literacy among many older adults and their caregivers as well as costs related to purchasing and utilizing various technologies.

## Cross-References

### ► Late Life Transitions

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## Retirement and Cognitive Functioning, A Tricky Association

Catherine Grotz and Stéphane Adam  
Psychology of Aging Unit, University of Liège,  
Liège, Belgium

### Synonyms

Aging; Cognitive functioning; Dementia;  
Retirement

### Definition

Retirement can be defined in various ways. One common definition of retirement is to consider individuals to be fully retired if they left the workforce and are not working for pay (Maestas 2010). Over the past half century, the time spent in retirement has increased considerably (i.e., 8 years on average in 1960 as opposed to 20 years nowadays). This extension results mainly from growing life expectancy, decreasing birth rates, and promotion of early retirement in most developed countries. In this regard, the crisis of the 70s and the emergence of mass unemployment have led many European countries to promote early retirement and to redistribute work to the young. This demographic change presents a major

socioeconomic issue and raises many questions: Was it useful to open up the job market to young people? Will it remain financially viable? How much will the health care cost? How will pensions be financed?

To date, the possible implications of these policies have been mostly discussed from the economic perspective and less in terms of cognitive health. Yet, a better understanding of factors related to cognitive aging seems especially relevant due to growing interest in dementia and Alzheimer's disease.

This entry first provides an overview of scholarships that studied the association between retirement and cognitive functioning of older adults. After covering this relationship, the causality issue will be discussed. Third, the effect of deferred retirement on dementia and, in particular, on Alzheimer's disease will be discussed. This will be followed by key findings that should be drawn from empirical data and an outlook for future directions.

### Activity-Retirement and Cognition of Older Adults

Recent evidence shows that activity (Schooler and Mulatu 2001) is associated with better subsequent cognitive functioning. This falls in line with the theoretical concept of the cognitive reserve developed by Stern (2002). In particular, the concept of cognitive reserve postulates that all activities conducted in life will allow individuals to build a sort of *reserve* that will help them to compensate for the age-related or pathological detrimental effects. Thus, several factors have been identified as contributing to the development of the cognitive reserve including educational attainment (Le Carret et al. 2003), leisure activities (Newson and Kemps 2005), and occupational activity (Andel et al. 2007; Schooler et al. 1999). However, many scholars that study the effect of activity have focused on what individuals undertook earlier in life and how these activities may affect subsequent cognitive functioning rather than wondering whether engagement in such activities in late adulthood (no matter past

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activities) has a positive impact on cognitive health. In other words, the question that remains is whether individuals who engage in activities could still have some control over their cognitive aging beyond the age of 60 for instance.

It is within this context that Adam and colleagues (2013) investigated whether engagement in different activities over the age of 60 (i.e., professional activities, nonprofessional activities, physical activities, and other factors), regardless of past activities, is associated with cognitive functioning (measured by semantic fluency, episodic memory test, global cognitive assessment). To do so, data from the first wave of SHARE, a European survey of more than 55,000 individuals aged 50 and over, were analyzed using a measurement approach known as stochastic frontier analysis that tests the effect of potential factors simultaneously. The analyses revealed that all types of activities considered were associated with cognitive performances. For instance, a 60-year-old individual delays his/her cognitive aging by 1.75 years if he/she engages in charity/voluntary work, by 1.38 years if he/she continues employment, or by 3.08 years if he/she attends an educational course. The first conclusion that can be drawn here is that not all is played during childhood or adulthood: people aged over 60 years old can still have some control over their cognitive functioning through the maintenance or development of activities.

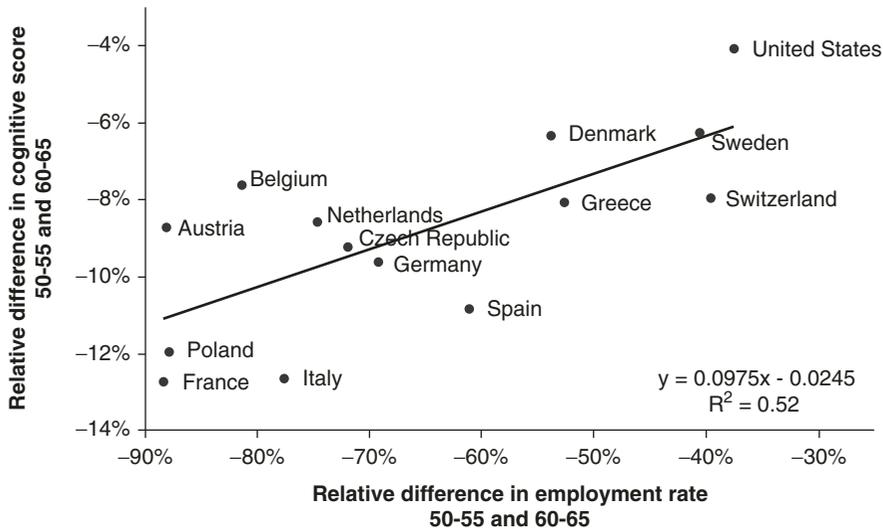
However, the cross-sectional nature of these data does not address the causality issue between activity and cognitive functioning. In that sense, does being active predict cognitive functioning or do cognitive deficits causes decrease in activity? As suggested by Schooler and Mulatu (2001), there may be a reciprocal relationship between these parameters. Nevertheless, while there is strong evidence that cognitive deficits have detrimental effects on daily life activities, the reverse causality is less evident. One possible way of dealing with the thorny question of the causality is through retirement transition. Indeed, retirement has the main advantages of: (1) being precisely dated and (2) varying across both individuals and countries. Consequently, given that countries have different retirement policies

(the age of retirement is not set based on the level of cognitive functioning of the population), the potential consequences of these policies on cognitive functioning can be grasped.

## The Causality Issue

The work setting offers opportunities for social interaction and intellectually demanding activities. One could therefore argue that leaving the workforce is likely to affect engagement in stimulating activities, which helped to maintain a high level of functioning. Therefore, once the stimulation previously provided by the workplace ends, one could expect a decrease in cognitive efficiency during retirement. This outcome was observed in most (Mazzonna and Peracchi 2012; Rohwedder and Willis 2010) but not all studies (Coe et al. 2012). For example, Rohwedder and Willis's (2010) results suggest that early retirement has a significantly negative effect on cognitive performance (retirement causes a drop close to 40% in average cognitive score).

Moreover, a group of authors provided arguments in favor of a causal effect of retirement on cognitive functioning using two large surveys: the American Health and Retirement Study (HRS) and the European SHARE. The first argument comes from the use of cross-country differences in the age-pattern of retirement (Adam et al. 2013). Indeed, given that countries do not set the eligibility age for retirement based on the cognitive functioning of individuals, the authors argue that the reverse causality is unlikely. The cross-country analysis revealed that cognitive scores of older adults were better in countries in which the eligibility age for retirement benefits tends to be higher (e.g., 65 years old in Sweden) as compared to those where it is lower (e.g., 60 years old in France). Figure 1 highlights the strong association between the relative decrease in cognitive score (measured by a ten-word recall test) between 50–55 years old and 60–65 years old (see Fig. 1, vertical axis) and the relative decrease in employment rate (see horizontal axis) between those age categories.



**Retirement and Cognitive Functioning, A Tricky Association, Fig. 1** Employment rate and memory score. Notes: Relative difference between individuals aged 60–65 and 50–55 years. Survey of Health, Ageing, and Retirement in Europe 2004–2006. Health Retirement

Study 2004 for the United States. The relative difference in employment rate/cognitive score is defined as  $(Y_{60-65} - Y_{50-55})/Y_{50-55}$  for  $Y_i$  = the average employment rate/cognitive score for the age category  $i$  (Figure reproduced from Bonsang et al. (2010))

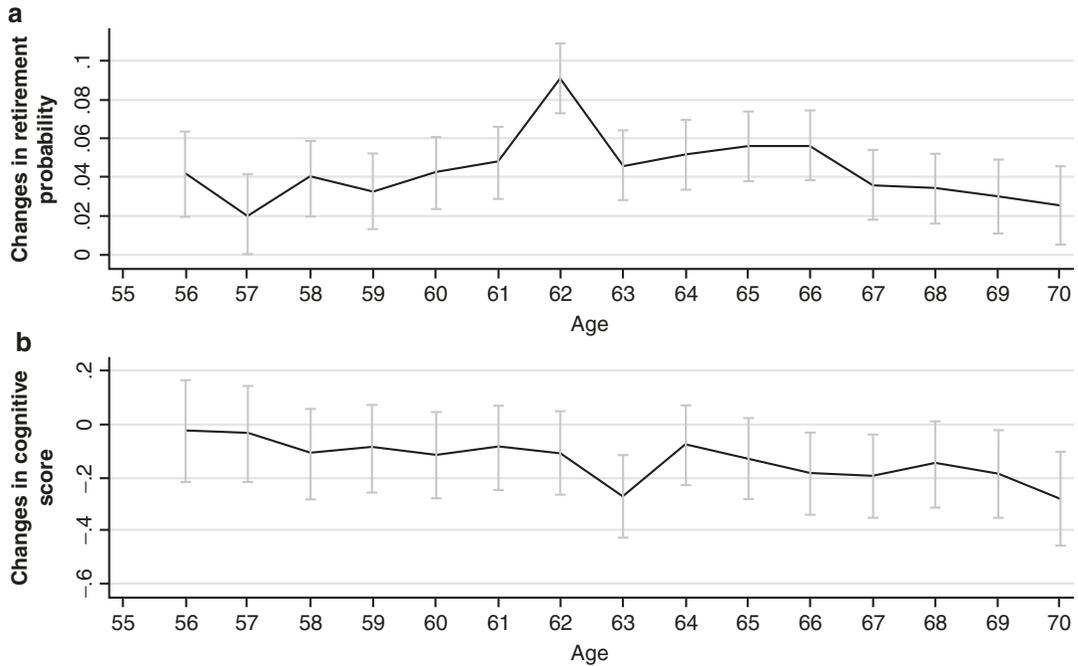
Longitudinal data (1998–2008) from the nationally representative HRS – an ongoing biennial US panel survey (14,710 American aged 51–75 at baseline) – were also used in order to test the causal relationship between retirement and cognitive functioning (Bonsang et al. 2012). Using the eligibility age for social security as an instrument for retirement, they demonstrated that cognitive performances slowly decreased with time, but interestingly, they also showed a significant drop in cognitive scores from 62 to 63 years old. No physiological reason can explain such abrupt cognitive change at those particular ages, but this does correspond to the minimum age at which social security benefits can be claimed and also to one of the peaks of retirement waves in the United States. Their analysis also pointed out that the effect of retirement on cognitive functioning is not instantaneous but occurs with a lag of about one year. Figure 2 illustrates that the curves of the rate of retirement and memory decline can be overlaid with a lag of about a year. While the rate of retirement in the United States is higher at 62, 65, and 66 years of age (Fig. 2a), a significant cognitive decline with a lag of about a year is observed at 63, 66, and 67 years old (Fig. 2b).

In general, these data suggest that retirement has a detrimental effect on cognitive functioning of older adults or conversely that people benefit from staying longer in employment. One step further would be to address whether retirement also influences the development of neurodegenerative disease such as Alzheimer's disease.

### Retirement and Dementia: Caution Is Advised

To date, the issue of retirement in the context of pathological aging has received little attention. Only four studies have addressed this issue and found that later age at retirement is associated with both reduced risk of developing dementia (Dufouil et al. 2014; Grotz et al. 2015a) and delayed onset of Alzheimer's disease (Grotz et al. 2015b; Lupton et al. 2010). Nevertheless, one recent study calls for caution when studying the effect of retirement on a sample of patients with Alzheimer's disease (Grotz et al. 2015b).

In this respect, the first research in this area was a cross-sectional study of 382 men with Alzheimer's disease, which found that each



**Retirement and Cognitive Functioning, A Tricky Association, Fig. 2** Changes in retirement probability and changes in cognitive scores by age. Notes: Health and Retirement Study 1998–2008. All respondents were

aged between 55 and 70. The figures show the coefficient estimates and the corresponding 95% confidence interval (vertical grey lines) (Figure reproduced from Bonsang et al. (2012))

additional year of employment delayed the onset of Alzheimer's disease symptoms by 0.13 years (Lupton et al. 2010). However, this study has two main limitations (Grotz et al. 2015b). First, in Lupton et al., the selection of patients with Alzheimer's disease who were diagnosed after retirement (to discard the possibility that cognitive impairments push them to retire) creates a selection bias that may lead to overestimate the effect of retirement on the onset of Alzheimer's disease. Indeed, patients who retired later were necessarily those who were diagnosed at a later age. This is because all subjects had already been diagnosed with the disease at inclusion, and those who had been diagnosed before retirement were excluded from the analyses. For instance, a person who retired at 60 years of age could only be diagnosed after this age, whereas a person who retired later, e.g., 80, could only be diagnosed after the age of 80. Second, this selection strategy (i.e., considering only patients with Alzheimer's disease and excluding those who retired after the disease

onset) does not completely resolve the causality issue. Given that the prodromal phase of Alzheimer's disease could last more than a decade (Amieva et al. 2008), it is therefore not sufficient to exclude the possibility that patients may have encountered cognitive deficits that inclined them to retire long before the diagnosis of dementia was made.

Using a design similar to Lupton et al. (2010) (i.e., patients with Alzheimer's disease who were diagnosed after retirement), Grotz et al. (2015b) replicated Lupton's results by showing that each additional year of employment delayed the age of onset of symptoms by 0.30 years. They then showed that once the selection bias was considered, the association between retirement age and age of onset of the disease was still significant, but to a lesser degree (i.e., association reduced by half). Finally, they attempted to reduce the possibility of a reverse causality by excluding individuals who were diagnosed within 10 years after retirement (given that the prodromal phase of the

disease lasts more than a decade). In this case, the association between retirement and the onset of dementia was no longer significant – only a tendency was observed.

These initial results highlight the need to be cautious when studying such complex relationships that, as it will be discussed later, have major social and political stakes. In addition to the potential methodological biases brought to light, one should also consider the interpretation of these data. There is often a tendency to consider that retirement has a direct impact on the brain, yet, this relationship is not as simple as it might seem.

### **Effect of Retirement on Cognition: Only a Brain Issue?**

The most common explanation for the association between retirement and cognitive aging is that the effect of retirement on cognition is only a brain issue. The more individuals stay employed, the more it stimulates the brain in such a way as to compensate for the effect of age-related cognitive impairment and pathology.

However, a recent scholar showed that the beneficial effect of deferred retirement on the risk of dementia cannot be explained by more years spent at work but rather by the fact that retirement transition occurs later in life (Grotz et al. 2015a). Along the lines of the “use it or lose it” hypothesis (Katzman 1995), work life and especially occupational settings are a great source of social and intellectual stimulation, which may support brain function further into older adulthood. Individuals who stayed in employment longer can function at a higher level for a longer time. An analogy with holidays can be drawn. The stimulation provided by the working life keeps individuals cognitively alert: people manage various activities and life is punctuated by work and weekdays. When people plan holidays, they look forward to indulging in a full complement of activities. However, once on holidays the plans often are discarded and people become cognitively relaxed. After a few days, they no longer even know what day of the week

it is. If their cognitive performances were to be tested before and after holidays, there would certainly be a difference, and this can be explained by the cognitive relaxation. Nevertheless, if people were to be evaluated once they are back at work for some time, their performance would be similar to baseline. The effect of retirement could be similar to that of the holidays: once retired, the brain relaxes and this affects cognitive functioning.

On the other hand, the transition from work to retirement is not only an objective life event but is also a complex process. It entails major changes in social roles and status (George 1993), which are negatively perceived by many western countries. Older adults and retirees are the targets of negative stereotypes – a form of ageism with harmful effect on cognition. For instance, the simple fact of activating negative stereotypes associated with age (intellectual performance declines with age so older adults may perform more poorly than younger individuals) adversely affects cognitive performance of older subjects (Abrams et al. 2006). While the negative stereotypes conveyed by modern societies (e.g., less useful, lack of productivity, burden to society) may affect the perception that retirees have of themselves, it could be argued that the transition to retirement may be smoother for those who retire above the normative age of retirement. In that sense, leaving the workforce at a later age is a normal and socially accepted phenomenon.

Other psychosocial factors could also explain such results. For instance, people who retired at a later age probably had additional time to prepare for retirement (e.g., plan postretirement activities). The choice to remain in the workforce above the societally normative retirement age may provide them a sense of control, which is related to adjustment quality (Hershey and Henkens 2013). Nevertheless, while factors that are important for retirement adjustment quality have been identified (e.g., control over the departure from the workforce, financial status, marital status, and postretirement leisure activities) (Wang et al. 2011), only one study has considered various factors (job-related variables, retirement transition related variables, postretirement

variables) that are likely to influence cognitive functioning of retirees (Grotz).

## Conclusion and Future Directions

Later retirement age is associated with both cognitive functioning of older adults and dementia. Nonetheless, it is becoming evident that the effect of retirement cannot be comprehended as blunt and forthright. The current evidence should not serve the economic interests to justify increasing retirement age. Therefore, one should not suggest that increasing the age of retirement would be beneficial for everyone's health based on those initial results. On the contrary, researches on retirement and cognition mostly underline the importance of activity in a general sense rather than just the professional ones.

Further studies should seek to specify the association by considering the different nature of various professional activities. In particular, the impact of retirement on cognitive functioning may be different depending on whether the occupation is intellectual or manual, including light or heavy workload, involving high or low social network, and stressful or not. The nature of the occupation may cover different realities. For example, one study found that retirement is beneficial for blue-collar workers (i.e., manual occupation) (Coe et al. 2012) whereas it could be argued that later departure for white-collar occupations may be beneficial. In addition, one recent scholar revealed that shift work has detrimental effect on cognitive functioning (Marquié et al. 2014). Therefore, one could imagine that later departure from the workforce for those occupations may even be more harmful to cognition.

Moreover, as discussed before, the retirement transition is a complex life event. It involves numerous factors that may also influence cognitive functioning. Consequently, the implications of retirement should be viewed in light of various psychological and social factors surrounding retirement (variables related to individuals, work, retirement transition, and postretirement). A better understanding of the factors related to retirement that are important for cognitive

vitality would lead to the development of health policies that are more tailored to the professional and psychological specific context of each individual.

To date, the only constructive element from a political perspective is to consider that if an individual who reaches the age of retirement wishes to continue working beyond the legal age of retirement, there is no reason to stop him/her. On the contrary, forcing him/her to stop working could have deleterious consequences for his/her health. Beyond the issue of employment, other solutions need to be considered. For instance, Adam and colleagues (2013) showed that being professionally active has a positive impact on cognition, but other activities such as volunteering and educational courses also have a beneficial effect. In addition, studies often suggest that it is important to promote activity among elders in all its forms. Nevertheless, a key issue that has to be addressed is: what constitutes a constructive activity for the well-being and quality of life of seniors? It is now important to gain a better understanding of the concept of activity: What does it mean to "be active" in aging; what type and amount of activity should be offered, etc.? This issue has to be examined in a very critical light, so that one does not end up engaging in a sort of activism and mandating that older adults remain permanently active. Above all, critical reflection on what constitutes a constructive activity for older adults and patients with dementia is required. For instance, it seems that not all activities are equally beneficial for cognitive health (Adam et al. 2013). Most importantly, clinicians and scientists should determine the kinds of activities that provide meaning to the individual's life and that promote well-being.

## Cross-References

- ▶ [Flexible Work Arrangements](#)
- ▶ [Health and Retirement Study, A Longitudinal Data Resource for Psychologists](#)
- ▶ [Retirement and Continuity Theory](#)
- ▶ [Volunteering in Older Adults in Retirement](#)
- ▶ [Work to Retirement](#)

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## Retirement and Continuity Theory

Ashley D. Cooper and Terry A. Beehr  
Central Michigan University, Mount Pleasant,  
MI, USA

## Synonyms

Aging; Early retirement; External continuity;  
Internal continuity; Work ability

## Definition

Continuity theory helps describe the psychological development of middle-aged and older individuals, particularly with regard to retirement. The theoretical assumption of Continuity theory is that individuals are regularly guided by existing internal mental frameworks, which make them more likely to maintain similar patterns of behaviors or lifestyles across time, changing only slowly (Atchley 1999). Robert Atchley began the initial framework for the theory in 1968. He studied transitions into retirement and witnessed that older individuals were not in crisis as other existing theories posited (e.g., Disengagement theory or Role theory). Rather, most individuals in the study were effectively adapting to retirement. Atchley built upon the Continuity theory framework between 1975 and 1999 during the Ohio Longitudinal Study of Aging and Adaptation (OLSAA).

## The OLSAA Study

The OLSAA provided a large proportion of empirical support for Continuity theory. The project was funded through the National Institute of Mental Health and surveyed individuals on their retirement adaptation. Participants were surveyed every 2 years, except when the project lost funding between 1981 and 1991. In 1991 the Ohio Long-Term Care Research Project took over funding of the OLSAA and data collection resumed. Atchley acquired data from over 700 initial participants in 1981, using both fixed-alternative and open-ended questions in interviews. Around this time, Atchley began to realize retirement had little to no effect on an individual's ability to effectively maintain satisfaction with their activities and lives. In 1995 the number of cohort participants had dropped to 273, but the data collected from the OLSAA was telling. Continuity theory ultimately extended Activity theory, which posits that individuals remain in good mental states and health if they continue to remain active (Rosow 1967). In contrast with this notion is Disengagement theory (Cumming and Henry 1961). Disengagement

theory states that a natural withdrawal from typical activities and social systems is normal as one ages. Therefore, Disengagement theory argues that people tend to make large changes in their older ages (by disengaging from their previous activities and roles), but Continuity theory argues that people remain relatively the same over time as they age. The OLSAA data collected by Atchley provided support for Activity theory and for the theoretical underpinnings and elements of Continuity theory.

## Original Elements of Continuity Theory

Over time, Atchley further outlined Continuity theory as it is understood today. The premise of Continuity theory is built upon feedback systems. Older individuals follow internal frameworks, built from years of feedback and experience, to make decisions and maintain their satisfaction. Adults place value in these internal frameworks, or schemas, to guide them successfully through life. A certain level of continuity emerges as they age and as individuals repeatedly rely on these schemas. However, Continuity theory does not imply total lack of change. Continuity theory assumes a certain amount of change will occur, particularly in older individuals who experience life-altering experiences (i.e., unwanted retirement or physical decline accompanying aging). Rather, although Continuity theory emphasizes stability, it argues for a dynamic process and should not be considered to be mutually exclusive with change. Continuity implies that certain patterns or persistent themes will appear across time, but those slight changes are common.

## Internal Versus External Continuity

Continuity theory further distinguishes between internal and external continuity (Atchley 1999). Within Continuity theory it is expected that individuals, despite age, will work to maintain similar internal and external patterns. Internal patterns are the relatively stable mental schemas created by an individual's thoughts, mental abilities, and memory.

They help people understand their environment and determine the ways that they interpret information and events in their world. These internal forces lead to concepts such as personal goals, philosophies of life, moral frameworks, values, and coping strategies. Furthermore, individuals tend to maintain these individual traits, skills, attitudes, or abilities as they age. Atchley referred to this as *internal continuity*. Data from the OLSAA supported the concept of internal continuity; a majority of participants showed moderate to high levels of continuity for their personality, ideas of the self, self-confidence, personal goals, and emotional resilience. Additionally, beliefs specifically about retirement were also enduring; in fact, the slight changes that occurred were due to individuals feeling *less* inclined to believe the negative stereotypes associated with retirement, which probably would help them adjust comfortably to retired life.

People's interests, personalities, ideas, and self-concepts are internal patterns or schemas, but equally important, external patterns in people's environment and their behaviors or activities in that environment tend to be stable according to Continuity theory. These are represented by mental schemas associated with their relationships, social roles, activities, environments, and geographic places. For example, if people were interested in attending or participating in music, sporting, or social events when they were younger, they will tend to be interested in the same activities when they are older. *External continuity* is tantamount to preserving external patterns. In general, Continuity theory states that these external factors will stay constant. External continuity is especially significant for older individuals, as it serves as a gauge for their own personal security and well-being. The OLSAA evaluated several dimensions of lifestyle, including household composition, lifestyle arrangements, marital status, modes of transportation, and income. The majority of dimensions remained consistent across time. The only real evidence of marginal discontinuity was with physical activity, but Atchley noted this can be attributed to physical aging rather than to people's preferences or inclinations to engage in physical activities. Further, many participants in the OLSAA tried to maintain their physical

activity patterns, but due to uncontrollable factors they usually had to reduce or stop their activities.

## Alternate Theories

Activity and Disengagement theories were often directly contrasted with Continuity theory during the theory's development, but there are still other theories that describe development in older life. Two of the most common are Role theory (Mead 1934; Biddle 1979) and the life course perspective. Role theory argues that most daily behaviors can be categorized as positions within the social structure. Examples of specific roles include wife, grandfather, and retiree. Roles consist of expectations that one's self and others have regarding the behaviors and obligations for the person occupying a role in a social situation. Furthermore, roles are interconnected in role sets. A wife and a husband or the people in a workgroup might constitute a role set, for example, and each person in the role set has expectations that define the role of the others. Role theory posits that as individuals age they may experience a loss of some of these roles, which is more consistent with Disengagement theory than Continuity theory. For instance, role loss is expected to occur when a spouse dies (e.g., a wife transitions to a widow), when an individual takes a new job, or when an individual retires. Role theory contends that without roles to help define people, they struggle to adapt to older age. However, Role theory does not take into consideration the possibility that individuals may reenter into new roles at a later stage in life, the ability to learn or cope from experiences, or the widespread variation in how individuals adapt to role loss. The dynamic internal/external patterns explained by Continuity theory help to explain how individuals cope with role loss and how different variations in adaptation occur. If they tended to think, feel, and behave in certain ways in one role, they may continue to think, feel, and behave similarly in other parts of their life. So the person who acted as a leader in past roles gravitates toward leading in new social situations, just as the person who was the class clown in high school tends to offer comic entertainment in the workplace and also

later in his or her group of retiree peers. Furthermore, Continuity theory would expect that people do not just passively or randomly fall into new social sets; they would tend to choose new friends who resemble their former friends, making role continuity easier and more likely.

The life course perspective is another dynamic theory, surmising that themes or events from people's younger years influence how they proceed in older age (Elder 1985). This perspective is dominated by the influence of critical life incidents, cohort events, or turning points that lead to change in people's lives. As people proceed through life, they enter into social spheres that mold their development. Timing, context, and processes are key dimensions of the life course perspective of adult development. The life course perspective does not focus on the individual differences that may lead to varying forms of adaptation to aging or role loss, but rather it focuses on the impact of environmental influences. It emphasizes the impact of generational cohorts or social spheres leading up to any one specific point, rather than the specific mechanisms of individual adaptation. Often the life course perspective is used in conjunction with Role theory or Continuity theory to help explain individual aging and retirement.

## Applications to Retirement

Since the OLSAA studies, Continuity theory has frequently been used to explain retirement decisions and the lifestyle adjustments of retirees. Retirement is typically characterized by a decrease in work hours, work-related income, and mental attachment to work. Traditionally, retirement has followed a specified age (65 in America), but in the last few decades, retirement options have expanded with advancements in modern medicine and a better understanding of individual health – and with labor laws banning mandatory retirement ages (in the USA). Increasing proportions of older individuals are deciding not to retire, or at least not to withdraw fully from the workforce, because they can still effectively maintain relationships, physical activities, and mental capacities. Moreover, a portion of retirees

would actually prefer to continue working beyond retirement (Gobeski and Beehr 2009). The decision to retire is multifaceted, consisting of many forms, and this has made understanding the antecedents and outcomes of retirement difficult.

The decision to retire can be divided into three phases (Feldman and Beehr 2011). In the first stage an individual begins to imagine what they would like their retirement to look like. Continuity theory is readily applicable to this stage, as individuals will probably focus on developing a retirement similar to the parts of their current lifestyle that they enjoy. The second stage requires the individual to make a decision on whether they want to retire (at a given time). It has been proposed that retirement decisions are driven by one's attitudes toward retirement, their perceived control over retirement, and the retirement norms they perceive in their social groups (Beehr et al. 2014). In the last stage of retirement, individuals actually take action on the decisions they have made. The most common retirement decisions are either full retirement or partial retirement. In partial retirement, often referred to as bridge work, an individual chooses to continue working after retiring. Consistent with Continuity theory, if retirees liked their former career job, they will try to obtain a bridge job that is similar to it (Gobeski and Beehr 2009; Wang 2007). In addition, there are some who opt for early retirement, either partial or full retirement. Of course, if there is no mandatory retirement age, the term "early" retirement loses some of its meaning.

In the last couple of decades, there has been a movement to distinguish different periods of aging. In particular, some have argued that there is a period in life referred to as the "third age," which is distinguished from the "fourth age" or onset of noticeable age-related physical declines (Laslett 1991). This concept of third age might help to explain early retirement. Individuals might retire early because they are still in good physical health and see retirement as an opportunity to live their remaining future freely before any physical health declines occur. Earlier retirement had become more popular over the last few decades, but has probably halted and might be reversing (Beehr et al. 2014). Furthermore, individuals no

longer place a negative stigma on retirement, but they see retirement as a normal transition in the aging process, which may also encourage early retirement if that is now a legitimate social status or role. Continuity theory would predict that these early retirees will try to maintain the same types of leisure activities they enjoyed before retiring.

When an individual decides to retire, a certain level of adjustment is expected. In regard to individual well-being after retirement, there are three mechanisms for adjusting including maintaining, recovering, and what has been referred to as the U-shaped pattern of adjustment (Wang 2007). The maintaining pattern of adjustment describes individuals who maintain their level of psychological well-being throughout the retirement transition. Recovering patterns posit that individuals may have a slight positive increase in their well-being, but that the increase will lessen over time. Finally, the U-shaped pattern of retirement adjustment argues that there will be a dip in psychological well-being, but then an increase after postretirement adjustment. It is expected that Continuity theory would help explain both the maintaining pattern and the U-shaped pattern as they both describe only slight changes in typical patterns. Furthermore, the majority of individuals exhibit the maintaining pattern, which most strongly supports continuity in retirement.

## Bridge Work

In addition to full retirement, there is also the option of partial retirement or bridge work. Bridge work can be any type of work employees take after transitioning from their career to retirement (Gobeski and Beehr 2009). Working beyond retirement can be important for human needs (e.g., social, financial), and many individuals opt for this type of partial retirement. Bridge employment can be career-related or noncareer-related. Career-related bridge jobs refer to work that is similar to a person's prior career. For instance, an English professor who retires but still works part-time as an author would be doing career-related bridge work. Conversely, the type of work would be labeled noncareer-related if the

English professor retired and decided to work part-time as a barista. Noncareer-related bridge work is the more common form (Gobeski and Beehr 2009). Perhaps because of this, bridge work is often a lower status, lesser paying position, and may not offer as many fringe benefits as traditional career work. An individual is most likely to take bridge work immediately or at least soon after retiring rather than after a long delay (Pleau and Shauman 2012). Other aspects of bridge work, which have yet to be fully vetted, concern the potential differences in impact of steady or intermittent bridge work, or self- versus other-employed bridge jobs.

From a continuity perspective, both career and noncareer types of bridge work can be seen as a desire to maintain internal and external continuity. Continuity theory posits that as individuals age, they will try to maintain the social status and image they have created for themselves. Abandonment of the physical things and social relationships that one holds dear can be detrimental to that effort. Therefore, individuals will work hard to maintain or substitute for things in their life that are important to them. Career bridge employment provides an opportunity to continue daily life with probably fewer adjustments than full retirement does. Noncareer bridge work still demonstrates some continuity however, simply because the person has decided to continue working. Individuals still have a role as an employee and still get to engage in social activities at work, etc. Sometimes noncareer-related bridge work can be viewed as a reinvention of oneself or one's image (Davis 2003). However, few individuals are interested in picking up drastically new behaviors or changing their attitudes later in life. In fact, starting new activities in retirement is uncommon, but if done, it is usually done by women (Iso-Ahola et al. 1994).

Besides financial ability to retire, a wide variety of factors seem to influence the decision to retire or to take on bridge work. Two of the strongest predictors of retirement include age and health. Numerous studies have shown that as individuals age they are more likely to retire and less inclined to engage in bridge work (Beehr 1986; Shultz and Wang 2007; Cahill et al. 2006)

Physical health is also a key antecedent to retirement; as an individual's health declines, they are less likely to maintain the capacity to work in particular jobs and more likely to retire (Beehr 1986; Shultz and Wang 2007). Thus, many individuals retire to less strenuous types of bridge work (e.g., customer service). Age and physical health are significant contributors to discontinuity in adults, but the majority of older adults in the OLSAA study tried to maintain good health. Perceived work ability has also been shown to predict bridge employment among retirees and is relatively constant across time (von Bonsdorff and Ilmarinen 2012).

Other individual-level factors include the financial security and marital status of an individual. For example, individuals in higher status or higher-paying jobs may retire earlier than lower status or lower-wage positions because they may have the financial means to do so. There has also been some research suggesting gender differences in retirement based on the sex's preferences regarding retirement (Nicolaisen et al. 2012). Specifically, women who engage in certain types of leisurely activities (e.g., volunteering) may delay retirement, whereas men who partake in fishing and hunting may be more likely to retire earlier. Future research is still needed, however, to fully understand possible gender differences in retirement decisions.

Some specific work-related attitudes and the job itself also have an impact on the decision to retire and what to do after retiring (Gobeski and Beehr 2009). Individuals may be less likely to retire if they have high career attachment. Individuals with high attachment have the desire to continue their work and have positive affect toward their career. Similarly, higher job satisfaction has been linked to a higher likelihood of taking a career-related bridge job rather than a noncareer-related bridge job. Lower levels of job-related strain (an indicator of stress) also predicted taking a career-related bridge work position versus noncareer-related bridge work. Specific job-related characteristics predicted career-related bridge employment over noncareer-related bridge work, and even predicted bridge work versus full retirement. Individuals with higher goal

attainment and greater job-related skills were also more likely to partake in career-related bridge employment.

As the current research illustrates, predicting retirement and understanding retirement decisions are nebulous tasks. Yet continuity and the notion that individuals will choose to maintain similar patterns and avoid drastic changes help to understand the more common themes in retirement research. As both full-time and part-time retirement options become more prevalent across the globe, gerontology will become increasingly paramount to understanding retirement trends.

## The Importance for Gerontology

There are growing concerns, among both Americans and people in other countries, about the outflow of baby boomers from the workforce and the resulting tax on nations' resources designed for retirees and older people (Eyster et al. 2012). Although working in older age is much more feasible due to improved healthcare, current birth rates are lower than previous generations, which could mean the proportion of available workers versus employees exiting the workforce will decline (Eyster et al. 2012). Conversely, the number of older individuals who plan on retiring early has actually decreased since 2000 (Eyster et al. 2012). Because of this, companies are preparing ways to manage the expected exit of older individuals and looking at options to retain employees as long as possible. In the context of Continuity theory, organizations should make adaptations to the work environment, which help older individuals remain successful in their current job tasks and work roles. For instance, companies may consider limiting the amount of physical activity a job contains as an individual ages, so that he or she can continue to perform the job well. Slight changes in the work context may encourage continuity in the workforce. Similarly, organizations might consider interventions or training programs specifically designed for retaining the aging workforce (Eyster et al. 2012).

Conversely, baby boomers departing from the workforce leave organizations at a potential disadvantage if the employer is not proactive. As these individuals leave their employing organization, there is a potential loss of tacit knowledge (Greller 2012). The majority of supervisors, managers, and CEOs are middle-aged or older-aged individuals, and organizations need to prepare for their imminent retirement (Greller 2012). Perhaps encouraging career-related bridge work, which would allow individuals to maintain internal and external continuity, could be mutually beneficial for the organization and the individual.

## Conclusion

Currently, Continuity theory is one of the most useful theoretical constructs for explaining the transition from work to retirement. Today, retirement is no longer seen as a major life stressor, but rather is an expected life transition that is somewhat predictable and controllable for the employee. Most individuals will be likely to maintain their similar lifestyle patterns during this transition, but current research does not help to fully understand how one arrives at the decision to retire or what type of retirement to choose. Based on existing research and the almost certain increase in numbers of retirees, it is expected that bridge work will increase as the need to maintain the current workforce also increases. Retirement will continue to be an important issue within gerontology. Therefore, continued research regarding the antecedents, processes, and outcomes of retirement is warranted, and Continuity theory is a promising guide for those investigations.

## Cross-References

- ▶ [Adaptive Resources of the Aging Self, Assimilative and Accommodative Modes of Coping](#)
- ▶ [Age and Blended Working](#)
- ▶ [Human Resource Management and Aging](#)

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## Retirement and Social Policy

Simon Biggs and Michael Thomas McGann  
School of Social and Political Sciences,  
University of Melbourne, Melbourne, VIC,  
Australia

### Synonyms

Pensions; Social security; Superannuation; Withdrawal from work

### Definition

Retirement, understood in terms of a period of pensioned rest or leisure at the end of working life, is a relatively recent development. It only became a widespread stage in life following the expansion of social security and pensions in the mid-twentieth century. The status of retirement has become more ambiguous in more recent decades as concerns about population aging and longevity have prompted policy debate about the social organization of work and retirement in later life.

### Introduction

With population aging and increased longevity, the social organization of work and retirement is

now the site of continuing political negotiation and transformation. Historically, the passage from work to retirement has played an important role in shaping the experience of aging, serving as the boundary point for entry into old age. For much of the twentieth century, the conventional definition of old age as starting at around 60 or 65 years coincided with the age when people became eligible for pensions and were expected (often forced) to retire. The transition from work to retirement thus became an important element in the fashioning of an old age identity “separate from that associated with work and paid employment” (Phillipson 2013a). However, with a large cohort of baby boomers entering retirement, policy makers have become increasingly concerned about a potential pensions’ crisis from economies having too many pensioners to support and not enough workers. These anxieties have caused cultural expectations about the status of retirement as a period of “pensioned leisure available to the general population of workers” to become increasingly unsettled (Ekerdt 2010). Changes in the nature of work and careers and increased emphasis on the market provision of pensions are also leading retirement transitions to become more uneven for many groups.

### The Shifting Policy Landscape

The concept of retirement as a period at the end of the life course free from the demands of work is a relatively recent phenomenon in historical terms. In the nineteenth and early twentieth centuries, work resembled a lifelong obligation for the majority of people. Only elite public servants covered by limited state pensions and the independently wealthy had the means to disengage from the world of work. For everyone else, the boundary between work and old age came at an uncertain point in the life course, whenever people “were simply no longer able to work” (Shultz and Wang 2011). The transition out of the workforce in later life was consequently experienced as a negative transition that was accompanied by deepening poverty and illness in old age.

It wasn't until the decades following the Second World War that most working people came to have any secure expectation of stopping work at a fixed age. This was partly driven by the expansion of social security regimes during the so-called era of "welfare capitalism" (1940s to early 1970s), as the political ethos of industrialized countries shifted in the direction of social democracy (Phillipson 2013a). In Europe, the provision of public or state pensions gave a degree of economic security following the end of people's working lives, as well as the expansion of publicly funded health insurance and health services, which helped to alleviate the risk of infirmity associated with aging. In the United States, social security was first introduced in 1935, although the program initially only covered workers in commerce and industry. The program was gradually extended from the 1950s to include workers in other industries such as hospitality, agriculture, and state and federal employees, while Medicare was also introduced in the mid-1960s to provide government-funded health insurance for older workers (Zickar 2013).

At the same time, a shortage of workers following the Second World War prompted companies to expand the proportion of employees who were covered by corporate or occupational pensions as a way of trying to attract and hold on to skilled workers. For example, in the United States, the number of employees covered by occupational pensions jumped from 3.7 million in 1940 to 19 million employees in 1958 (Zickar 2013). In the United Kingdom, almost half of all employees were members of occupational pension schemes by the end of the 1960s (Phillipson 2013a).

The expansion of public pensions and what Ekerdt (2010) calls "corporate welfare" during the postwar decades created the conditions for retirement to become a mass transition regulating the passage from work to the final stages of the life course (Kohli 1987). Underpinned by an intergenerational compact in which prime age workers pay for the pensions and healthcare of the retired in the expectation that other generations will do the same for them, retirement at the age of 60 or 65 became a *predictable* transition in the industrial "three box" life course of education,

followed by work, followed by retirement (Phillipson 2013b). As Phillipson (2013a) observes, for a brief period at least, the meaning of old age was temporarily resolved around "a vision whereby retirement and welfare were viewed as natural supports to the end of the human life cycle". With the increased availability of occupational and public pensions providing the material conditions for a phase of life beyond work, there was a cultural shift in attitudes towards retirement (Shultz and Olson 2013). Far from being considered an oppressive institution, Ekerdt (2010) notes that most people cooperated in their superannuation and indeed regarded retirement as "an aspirational status".

However, by the mid-1970s, various intermediary statuses between the end of employment and receipt of a state pension emerged and a predictable retirement transition unraveled as an increasing number of older people left the labor force before their formal retirement age (Phillipson 2013a; Guillemard 1997). The impetus for this change was the oil crisis of 1973, which plunged most industrialized countries into an extended period of recession. In the face of rising unemployment, and with a large cohort of young baby boomers looking to join the workforce, various measures were introduced within unemployment, disability, and associated social benefits, plus employer-controlled occupational pension arrangements, to enable older workers to leave the labor force (Guillemard 1997). These policies continued into the 1980s, rendering the point at which work ended and retirement began more ambiguous and contingent on personal biographies. The notion of a stable period of retirement was increasingly challenged "for a majority of workers through greater insecurity in the workplace; for a minority through the attractiveness of retirement given the safety net of an occupational pension" (Phillipson 2013a). In the view of several commentators, what happened over this period was a "dechronologization" of the life course and the emergence of a more "individualized" or fragmented experience of retirement (Kohli 1987; Guillemard 1997).

The 1990s saw an acceleration of such trends, as the policy environment surrounding work and

retirement has shifted from being “pro-retirement” to “pro-work” in almost all industrialized countries. The cause of this shift has been growing anxiety about population aging and the capacity of governments and businesses to cope with rising pension and other age-related costs. A new policy consensus has emerged around the extension of working lives, presented as a means of reducing pressures on social welfare systems (Taylor 2010). The reconfiguration of social security systems and working lives is now firmly on the policy agenda. Delaying retirement and indentifying pathways for older workers to remain in and return to work have eclipsed earlier attempts to foster early retirement/exit (Phillipson 2013b). Several member countries, including Britain, the United States, and Australia, are now in the process of gradually raising the age eligibility for receiving a full state or social security pension from 65 to 67 years of age (Taylor 2010). In the longer term, the state pension age in the United Kingdom will rise to 68 years of age, while Australia has proposed a pension eligibility age of 70 by 2035. Countries are also being encouraged to follow the United State’s lead and abolish mandatory retirement ages, as well as close off pathways to early exit in social security arrangements.

Along with longer working lives, building self-reliance through private pension provision is also now seen as a key part of the solution to the fiscal challenges posed by population aging. “Risks once carried by social institutions have now been displaced onto the shoulders of individuals and/or their families” (Phillipson 2013a). Intergovernmental organizations such as the Organization for Economic Cooperation and Development, the World Bank, and International Monetary Fund have been at the forefront of attempts to limit the scope of the welfare state by establishing an expanded role for private capitalized pension provision as a “second pillar” of retirement funding. Within the sphere of occupational or employer-provided pensions, traditional defined-benefit pensions have been progressively supplanted by defined-contribution pensions, “placing more risk on the individual” (Ekerdt 2010). Instead of receiving a guaranteed pension

based on salary and years of service for the duration of their retirement, a proportion of employees’ salary is now paid into an investment fund. Consequently, retirees must now bear the financial costs of their longevity and the risks of a stock market collapse.

## Changing Perspectives on Aging and Retirement

The development of retirement as a distinct stage in the life course prompted gerontologists to explore questions about the meaning of retirement and the challenges and opportunities associated with a new phase of life beyond career employment.

### Early Approaches: Continuity Versus Disengagement

The primary concern of researchers during the postwar decades was on how individuals could best adjust to the loss of the work role associated with transitioning to retirement. In the late 1940s and 1950s, gerontologists worried that the loss of work could lead to a major deterioration in well-being and health for older men if it was not successfully replaced with alternative activities and social roles (Phillipson 2013a; Lynott and Lynott 1996). Role, or activity theory as it later came to be described, emerged as the dominant perspective on aging and retirement during this period. It posited retirement and the cessation of paid work as the site of a potential identity crisis or breakdown, although as Ekerdt (2010) observes these expectations of retirement as a negative life event have not been borne out in the research literature. To maintain quality of life in old age and successfully adapt to being retired, role theorists argued that older adults needed to replace their previous work role with a large number and variety of other active social roles such as taking up new hobbies or leisure pursuits or joining church groups or voluntary associations (Lynott and Lynott 1996).

Following the publication of Cumming and Henry’s seminal work, *Growing Old: the Process of Disengagement*, in the early 1960s, the assumption that retirement adjustment was best achieved

by taking up new social roles became increasingly challenged. For disengagement theorists, later life constituted “a period in which the aging individual engages with society in a process of mutual separation” (Phillipson 2013a). Separation rather than the uptake of new social roles represented the criterion for successful aging. Social withdrawal by older adults was viewed positively by disengagement theorists, who argued that it was part of an adaptive process that helped to maintain morale and self-esteem in old age in the face of declining skills. It was also vital to generational succession, as older adults represented a “drag” on societal functioning: “whatever type of work they do, they do it less well as they age,” and they must withdraw from social roles to allow younger adults to take their place (Lynott and Lynott 1996).

### The Political Economy of Retirement

From the late 1970s, gerontologists began to adopt a more critical stance towards retirement. In the context of social policy and company arrangements that were encouraging older workers to leave their jobs at earlier ages, the expectation that people should retire from employment at particular ages came under scrutiny from critical gerontologists influenced by neo-Marxist perspectives in political economy (Walker 1980; Townsend 1981). Political economists of aging, as this group of critical gerontologists came to be known, held concerns about the “close link between retirement and poverty” (Walker 1980) and the role of retirement in fostering what Townsend (1981) termed “the structured dependency of the elderly”. This approach marked a radical departure from previous understandings in focusing attention on how “aging” and “retirement” were socially constructed phenomena and therefore contestable. Political economists argued that retirement was something that had largely been imposed on older adults by “changes in the organization of work and in the kind of people wanted for work” (Townsend 1981). In particular, they argued that the expansion of early retirement during the 1970s reflected government interest in masking the reality of shrinking employment and companies’ desire to regulate the age-composition of their workforce

so as to prevent people from growing old in their jobs (Kohli 1987; Townsend 1981). Viewed from this perspective, retirement constituted a largely passive and unwelcome transition that amounted to little more than “a euphemism for unemployment” (Townsend 1981).

The “poverty” of retirement went beyond the diminished economic circumstances associated with no longer being gainfully employed. Retirement also represented a residual or marginal social status that implicitly devalued the work and social contributions of older people. By removing the individual “from an important source of self-esteem and social contract,” it was argued that the institutionalization of retirement stigmatized older people as dependent citizens who “can no longer contribute to society’s productive activity” (Walker 1980).

### The Emergence of the Third Age

The political economy critique paved the way for more positive images of “old age” to emerge in the late 1980s and 1990s, when gerontologists began to emphasize the growing proportion of the population who were living longer and healthier lives. This prompted gerontologists to reflect on the individual and societal implications of a lengthy period of healthy retirement, and the sorts of opportunities available for continued growth and development in later life. Laslett (1989) popularized the concept of the “Third Age” to characterize this period between the end of employment and the onset of frailty and dependency in deep old age. It was argued that the improvements in health, education, and material living conditions that those approaching retirement in the 1990s had carried through their adult lives uniquely positioned them to engage in society in ways that were unavailable to earlier generations (Gilleard and Higgs 2000).

The emergence of the Third Age pointed towards a “blurring” of life-stages and even “the irrelevance of chronologically determined age-related statuses” (Featherstone and Hepworth 1989). In this vein, postmodern theorists of aging such as Gilleard and Higgs argued that “[i]t is increasingly meaningless to consider ‘age’ as conferring some common social identity or to treat

‘older people’ as a distinct social group acting out of shared concerns and common interests.” They argued instead for a vision of the Third Age as a “cultural field” of choice, autonomy and self-expression underpinned by greater engagement with contemporary “lifestyle culture” (Gilleard and Higgs 2000). This interpretation was associated with the aging of the postwar baby boomers and the “generational style” that they are carrying with them into retirement. This cohort was the first to grow up in a mass consumer society, where people’s social and personal identity was expressed through lifestyle as much as through occupation. A problem for the boomers was their tendency to define identity in contrast to preceding generations and as similar to younger age groups. Biggs et al. (2007) indicated that identity centered on finding a balance between “youthful” and “mature” points of reference. They also found that few boomers conformed to the stereotype of political activism. In this regard, the cultural field of the Third Age reflected the enhanced material circumstances enjoyed by baby boomers compared with previous generations.

### Productive Aging

If the “Third Age” described a trajectory of consumerism in retirement, growing economic concerns, amplified by the Global Financial Crisis, emphasized continued working life. Gains in health and longevity had increased people’s potential “for remaining productive later in life” (Caro et al. 1993). This variant of Third Age gerontology emerged in part as a response to characterizations of older people as dependent and a drain on social resources (Biggs 2001). Concerned that such age prejudice should be avoided, Robert Butler coined the term “productive aging” to highlight the significant number of people over retirement age who were still capable of working and contributing to their communities (Butler 1985). Definitions varied, with some authors defining productive aging as the capacity of people “to serve in the paid workforce, to service in volunteer activities, to assist in the family, and to maintain [themselves] as independently as possible” (Butler and Schechter 1995).

Others defined “productive aging” more narrowly as activity that “contributes to producing goods and services or develops the capacity to produce them” (Caro et al. 1993). Freedman, another key figure in the “productive aging” movement, suggested “a new phase of work in mid and later life” whereby older adults would leave their career employment to embark upon new encore careers as nonprofit managers, patient advocates, teachers, and in other occupations “that are not only personally meaningful but that mean something beyond themselves” (Freedman 2006–2007). Some authors argued that legitimizing aging in terms of work created new forms of ageism that restrict personal development and alternative forms of social contribution (Biggs 2001).

### Critical Perspectives on the Third Age

As concerns about the economic costs of population aging crystallized in the twenty-first century, approaches based on production and consumption became increasingly influential in policy circles, promising more older workers paying taxes and fewer pensions claimants. They also became the subject of renewed debate within social gerontology.

Critical gerontologists writing from a feminist perspective accused discourses about a new Third Age of healthy, active agers of failing to consider the impact of gender and other social inequalities on people’s experiences of retirement. Calasanti and King (2011), for example, claim that post-modern perspectives ignore the fact that, for women, retirement from the labor force rarely means the end of the responsibilities of the Second Age. For many women, work not only continues but can increase in later life, such as when they take on additional caring responsibilities towards grandchildren, or adult family members who become frail or elderly. Women generally retire with far fewer retirement savings than men as a consequence of discontinuous work histories, lower rates of pay over the course of their careers, and increased likelihood of part-time employment. Calasanti and King (2011) point to how differences in patterns of employment, income, and health accumulate over the life course putting

a Third Age of healthy, active retirement beyond the reach of many minority social groups. Polivka (2011) notes that most retirees in the United States still depend heavily on Social Security and Medicare, while the global recession and collapse of the housing and financial markets has “substantially increase[ed] the risk that the retirement security of the Baby Boomers will not match their parents’ experiences”.

A second criticism is that “productivist” and “consumerist” understandings ignore significant psychosocial development that occurs as one grows older, prompting a change in existential direction. Far from empowering and winning social recognition for older adults, such narratives of “positive aging” solve the problem of aging “by assuming that older people are no different from everyone else” (Biggs 2001). Further, they reduce “social, political, and public life generally to participation in the market and the citizen to just another consumer whose rights are determined by their power in the market, by their wealth or lack of it” (Polivka 2011).

This denial of difference conflicts with accounts that report changes in direction that emerge as people grow older to give later life “its very own meaning and character” (Tornstam 2005). Dittmann-Kohli (1990) suggests that the awareness that life’s time is running out prompts a fundamental reorganization of personal meaning system in mid and later life. This sense of finite brings about a rethinking of identity and a desire for authenticity that leads people to develop aspects of the self that have hitherto been hidden (Tornstam 2005; Biggs 1999). As Baars (2012) suggests, “When we realize that the times of our lives are limited, we become aware that we must *live* these short lives and face the challenges and opportunities that are most essential to us.” . . . “aging life may offer more opportunities and unexpected exciting challenges than are foreseen in a career-oriented planning of the life-course” (Baars 2012).

These criticisms draw attention both to the limited availability of a Third Age and to the danger that macroeconomic concerns can erase alternative contributions which emerge as life progresses.

## Retirement Patterns in the Twenty-First Century

Expectations about work and retirement in later life have changed as institutional supports for retirement have ebbed and flowed. In the early twentieth century the expectation was that individuals would work until they were no longer physical able to do so, leading withdrawal from work in later life to be viewed as something reserved for the infirm elderly. However, as Shultz and Olson (2013) observe, the increased availability of occupational and public pensions in the 1950s and 1960s prompted a cultural shift in attitudes towards retirement, which came to be seen as “an earned rite of passage and something that individuals should look forward to after a long career toiling at paid labor”. The emphasis on viewing older workers as a reserve army of labor during subsequent decades resulted in the emergence, particularly in European countries, of an expectation of early retirement (Taylor 2010). However, the trend towards earlier retirement ages appears to have abated and even gradually reversed in recent decades: beginning from around the mid-1980s in the United States (Ekerdt 2010) and from the mid-1990s in Europe (Taylor 2010).

Shultz and Wang (2011) point to the “changing nature of work, careers, families, and the organization of work” as all impacting how retirement is enacted in the twenty-first century. For example, a life course perspective emphasizes the interdependency of different life spheres: experiences in one life sphere such as work shape and are influenced by experiences in other spheres such as marital or family life, suggesting that “the retirement experience is played out in a network of shifting social relations” (Kim and Moen 2001). In this context, studies of people’s adjustment to retirement suggest that people who have a strong and vibrant relationship with their partner are more likely to achieve better transition and adjustment outcomes in retirement, whereas others with poorer perceived marital relationships may continuing working to distract themselves from their adverse relationship (Shultz and Wang 2011; Shultz and Olson 2013). Similarly, divorce

and couples waiting longer to have children may encourage people to work longer. On the other hand, with people living longer, many older workers, particularly women, are caring for elderly family members, which may pull them away from work due to a shortage of flexible working arrangements and the subsequent difficulties that women experience juggling paid work with caring responsibilities (Shultz and Wang 2011; Shultz and Olson 2013).

Changes in the nature of jobs and organization of work over recent decades are likely to be another key influence on changing retirement patterns. Industrial change since the 1970s has resulted in an increase in part-time, temporary, and transitional employment “leaving employment less secure and less certain” (Ekerdt 2010). The traditional linear model of career progression that underpinned retirement in the 1950s and 1960s has been eclipsed by more disjointed career paths involving multiple job and career changes over the course of people’s working lives (Shultz and Wang 2011). For example, Evandrou and Falkingham (2006) observe that, in Britain, the proportion of baby boomer men born in the 1960s who had ever experienced unemployment by the age of 35 was “very much higher than for previous generations”. With the policy emphasis on the “individualization of risk” and associated shift towards greater private pension provision, individuals’ financial security and ability to retire in later life is now far more dependent on their earlier labor-market experiences. Hence older workers who have had interrupted or more disjointed work careers over the course of their working lives may have “to soldier on due to financial necessity” (Ekerdt 2010).

Another important structural change in the economy has been the shift away from manufacturing and production towards greater emphasis on knowledge-based and service sectors of the economy. As a consequence, jobs on the whole are becoming less physically demanding which coupled with higher levels of education and health among older workers should position them to work for longer. However, other workplace changes such as tighter deadlines, more frequent organizational restructuring, and higher

expectations to work long hours mean that many jobs have also become more stressful, potentially pushing people towards retirement (Shultz and Wang 2011).

Drawing on data from the Survey of Health, Aging, and Retirement in Europe, Siegrist and Wahrendorf (2013) observe a pattern of earlier labor force exit among retirees who experienced low control or low reward in their jobs compared with retirees who had greater autonomy in their jobs. This leads them to suggest that “retirement is experienced as a relief from the burden of work” by those who work in stressful psychosocial conditions such as having low control over task performance in the face of high workplace demands. This sense of retirement as a “relief from the burden of work” also emerges in qualitative studies of older workers’ attitudes towards working longer. These studies show that many older workers, particularly those whose careers are spent in professional or creative occupations, regard work as central to their identity and find the prospect of stopping paid work at the age of 60 or 65 illogical and even frightening. However, a significant minority of older workers, particularly those who have mainly worked in heavy manual, semiskilled, or elementary clerical jobs, look forward to retirement as a time when they can “leave the employment treadmill, relax and enjoy life” (Parry and Taylor 2007). These workers view retirement and “getting the pension” as forms of reward and the beginning of a period of relative freedom in their use of time, something that has been absent from their working lives. Hence policies to increase pension ages may too readily take for granted the desirability of working additional years and may be “especially unfair on working class groups” (Phillipson 2013b).

In this context, one of the major explanations for the reversal in retirement trends since the 1990s is the change in incentives for work in later life arising from reforms to social security and employer-provided pensions. Despite the increasing emphasis on private and occupational pensions as key pillars of retirement funding, social security and public pensions remain the majority source of income for a large proportion of retirees, especially those from lower

socioeconomic backgrounds (Ekerdt 2010). Compared with the 1970s and 1980s, social security systems now provide fewer and smaller disincentives to work after pension eligibility age (Burtless 2013). In the United States, for example, previous limits on what a person can earn before their social security benefits are affected have been relaxed, while penalties for claiming social security before full-pension eligibility age have been increased (Shultz and Olson 2013; Taylor 2010). Other OECD countries have similarly made it more lucrative for people to delay receipt of a pension by continuing to work while simultaneously closing off avenues to early retirement within social security arrangements (Taylor 2010).

The change in the structure of employer-sponsored retirement plans from defined-benefit arrangements to defined-contribution arrangements has also increased the financial pressures for people to work longer. Workers now have to bear much more economic risk with regard to funding their retirement as the amount of income they can expect to live on will be sensitive to the ebbs and flows of the stock market (Ekerdt 2010; Shultz and Wang 2011). For example, over the period September 2007 to March 2009, an estimated \$3.4 trillion or 40% was wiped off the value of retirement savings held in defined-contribution plans and individual retirement accounts (IRAs) in the United States (Ekerdt 2010). In the United Kingdom, the collapse in housing and share markets caused the value of private pensions to shrink from £552 billion to £391 over this same period (Phillipson 2013a). If it was hoped that retiring baby boomers would redefine aging as a form of consumer lifestyle choice, this appears to be severely challenged by such transfers of risk. In the United States, this transfer of risk also includes the elimination of many employer-funded retiree health plans which, Burtless (2013) suggests, has combined with increases in the cost of health insurance to make it “riskier for workers too young for Medicare to leave jobs that provide a health plan”.

Taken together these trends indicate that retirement has become an increasingly “blurred” rather than “crisp” transition, involving “moves in and

out of paid work” (Phillipson 2013b). Men and women in their 1950s and 1960s are increasingly exiting their primary career jobs only to seek second or third careers or transitioning to short-term or part-time employment in jobs that serve as “bridges” to retirement. The promotion of such flexible pathways from work to retirement is now a cornerstone of policy attempts to extend working lives and is presented as providing major advantages for governments, businesses, and older workers. For example, Shultz and Olson (2013) argue that bridge employment provides older workers with financial security and enables those who are not quite ready to begin life as a retiree with no work responsibilities “to continue to engage in meaningful, productive activities”. Viewed from this perspective, the uptake of more flexible pathways from work to retirement such as “bridge employment” represents a strategic reinvention of retirement by older adults who no longer want to work full time but are neither ready to finish work entirely.

While a more gradual retirement may be beneficial for individuals in easing the transition out of the workforce, studies suggest that the degree of choice that individuals have over how and when they retire is just, if not more, important in determining how well people adapt to retirement (Shultz and Wang 2011). From this perspective, Ekerdt raises concerns about the characterization of bridge employment as being about older workers taking strategic control of their conditions of work and the course of their late careers. Late career switches to short-time positions or part-time employment, he suggests, may equally be “the result of job displacement or poor prospects for retirement income” (Ekerdt 2010). Writing in the context of the United Kingdom, Phillipson (2013b) observes that many older workers, particularly those at the lower end of the socioeconomic scale, “move into ‘bridge employment’ out of ‘financial necessity’ and often into contingent or ‘non-core’ areas of the workforce.” Concerning the rise in part-time working among older European workers in the early 2000s, Taylor (2010) observes that there

was also an approximate doubling of older workers wishing to increase their working hours or work full time, findings that indicate “significant constraints on the choices of older workers”. These constraints are reflected in higher levels of long-term unemployment among older workers, who spend longer periods in unemployment after losing jobs than younger groups of workers (Ekerdt 2010; Phillipson 2013b).

## Conclusion

While retirement constitutes a significant life transition, it emerges as one that is socially determined by the external policy environment. Changing constructions of retirement affect the perceived social value of later life and the values and attitudes that affect psychological adaptation. Not all social groups perceive retirement in the same way, and an overemphasis on work can eclipse alternative forms of personal development. There may also be reasons, arising from psychosocial research and retirement insecurity, that cast doubt on current policy directions. In particular, the individualization of retirement risk through the privatized market provision of pensions means that people’s experiences of retirement transitions and later life are increasingly sensitive to earlier experiences of working life. Declines in the real value of public pensions and an increased emphasis on private and occupational pensions point towards potentially more divided and unequal experiences of retirement in the future as earlier inequalities widen and accumulate with aging (Evandrou and Falkingham 2006).

## Cross-References

- ▶ [Financial Planning for Retirement](#)
- ▶ [Late Life Transitions](#)
- ▶ [Retirement and Continuity Theory](#)
- ▶ [Retirement Planning and Adjustment](#)
- ▶ [Women and Retirement](#)

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## Retirement Planning and Adjustment

Alexa M. Muratore<sup>1</sup> and Joanne K. Earl<sup>2</sup>

<sup>1</sup>Sydney, NSW, Australia

<sup>2</sup>Flinders School of Business, Flinders University, Adelaide, SA, Australia

### Synonyms

Retirement; Retirement adaptation; Retirement outcomes; Retirement satisfaction; Retirement transitions

## Definition

Retirement is a process rather than a single event. It may be thought of as broadly progressing across three key stages: preretirement, transition, and adaptation. This entry provides a framework based on these stages to enable future researchers to interpret, design, and evaluate retirement research from different disciplines, theories, and research areas.

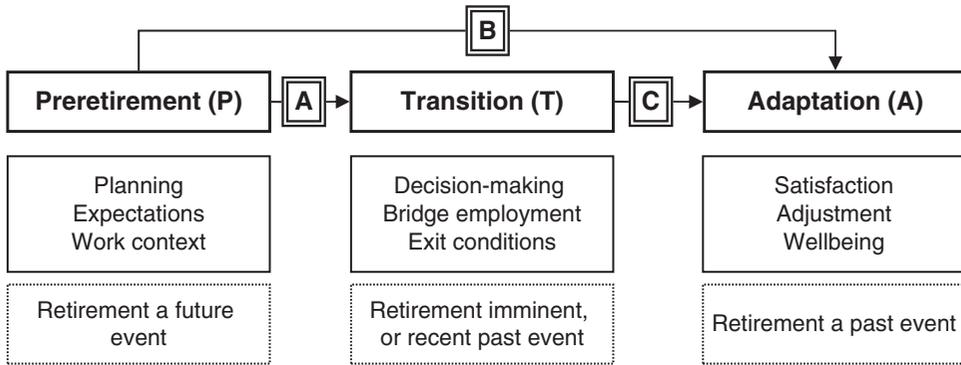
## Understanding Retirement Adjustment Can Promote Benefits and Ameliorate Risks Associated with an Aging Population

Adjustment to retirement is a dynamic and ongoing process (Sterns and Subich 2004), potentially with multiple alternating periods of stability and readjustment. An individual who successfully negotiates the retirement process is at ease with retired life (Wang et al. 2011), and a variety of constructs have been used to measure this, including happiness, psychological well-being, retirement satisfaction, life satisfaction, and depression (Wang et al. 2011). Interest in the characteristics of successful retirement is growing pursuant to the increasing number of retirees (Wang et al. 2011; Beehr and Bennett 2007; Ekerdt 2010), forcing retirement onto the agenda of researchers, health professionals, and governments (Beehr and Bennett 2007).

This population can represent a remarkable reserve to society (e.g., via caregiving, volunteer work, and labor force reserve) or a burden (e.g., due to poor psychological or physical health and reliance on pensions) (McKelvey 2009). Accordingly, identifying and promoting the factors that lead to retirees being self-sufficient and well-adjusted will help society realize the benefits and manage the potential risks associated with an aging population.

## A Conceptual Framework Will Help Researchers to Consolidate Insights About Retirement Adjustment

A range of variables including individual attributes, job and organizational factors, family



**Retirement Planning and Adjustment, Fig. 1** Retirement phases that organize the existing (and future) literature into three broad research areas. The figure shows the three phases of retirement and the outcomes and temporal orientation to retirement typically observed in the corresponding literature. Note that the outcomes of interest at each stage can predict outcomes in later phases. Specifically, outcomes of preretirement can influence what happens during the transition (a) and adaptation (b) phases.

Outcomes of the transition phase can influence outcomes in the adaptation phase (c). Phases are not as clearly divided as is implied in the figure, but are expected to overlap. For example, after choosing gradual retirement, an individual may start adjusting to retirement as they reduce their work hours, yet still face decisions about when and how to retire completely (Taken from Earl et al. 2015)

factors, and socioeconomic contexts have been investigated within a number of different research frameworks (Wang and Shi 2014). The diversity in individuals’ retirement experiences has driven many distinct research approaches within and across disciplines as researchers attempt to identify those characteristics that are crucial to producing positive outcomes (Ekerdt 2010). Recent reviews offer excellent analysis and summaries of the many issues that inform retirement research (Wang et al. 2011; Wang and Shi 2014; Wang and Shultz 2010); however, integrating these ideas can be difficult. Using a framework to conceptually organize retirement literature can help researchers to connect the diverse investigations that belong to this field and promote the important scientific goal of consolidating knowledge (Shultz and Adams 2007). Therefore, rather than repeat the findings presented in previous review articles, the purpose of this entry is to provide the reader with a framework that will facilitate the integration of findings from retirement adjustment research and their implications. Accordingly, the present entry draws on a recently developed framework, the preretirement transition adaptation (PTA) framework, which facilitates the interpretation of studies across different disciplines,

theories, and research areas to aid interpretation and evaluation of retirement adjustment research.

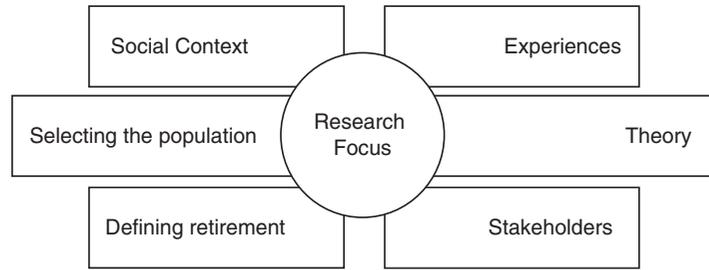
### The Preretirement Transition Adaptation (PTA) Framework Facilitates Interpretation of Adjustment Research

The PTA framework provides the means to interpret, design, and evaluate retirement research from different disciplines, theories, and research areas. Rather than focusing on summarizing what we know about retirement, the PTA framework highlights the conceptual detail that underpins this knowledge. Specifically, the PTA framework organizes retirement research according to three phases (preretirement, transition, and adaptation, shown in Fig. 1) and six elements (social context, selecting the population, defining retirement, experiences, theory, and stakeholders, shown in Fig. 2). The three phases organize the existing (and future) literature into three broad research areas, and the six elements define a research focus within each of these areas, described in more detail below.

The framework is broad enough to encompass studies from different disciplines, theories, and



**Retirement Planning and Adjustment, Fig. 2** *The elements of a research focus.* The figure identifies the elements that underpin a precise retirement research focus



research areas. This breadth offers a particular advantage because many articles do not state their theoretical approach, which may prompt reviewers to organize the literature by empirical themes (Wang and Shultz 2010). As a result, studies are categorized according to whether a variable is treated as dependent or independent. Using the PTA framework, we can make a more meaningful distinction by organizing studies according to research area. For example, the characteristics of workforce exit may be a dependent or an independent variable. Applying the PTA framework, when exit is a dependent variable, the study focuses on the transition phase. When exit is an independent variable, the study focuses on the adaptation phase (refer to Fig. 1). This encourages researchers to think temporally about retirement research, appreciate retirement as a process, and identify the part of the process that their own research illuminates. With better understanding of the existing research on retirement, we can identify pertinent questions for future research, thereby linking new and old investigations. The framework is introduced below, along with findings from and implications for retirement adjustment research.

### Three Phases Identify a Study's Research Area

A study's research area can be identified as preretirement, transition, or adaptation based on the variables being investigated and the temporal treatment of retirement. Using three phases highlights that circumstances earlier in the retirement process influence retirement adjustment and acknowledges the temporal nature of retirement variables. It is generally agreed that the individual is principally engaged in work (preretirement), begins a transition toward retirement that may

last any length of time and involve multiple changes in employment status (transition), and then is principally engaged in retirement (adaptation) (Richardson 1993). Wang and Shi (2014) refer to this as a temporal process model of retirement (Wang and Shi 2014). The PTA framework uses these phases as the foundation for interpreting research.

The respective focus of individuals, researchers, and practitioners changes at each phase as different issues become more or less relevant (Sterns and Subich 2004; Richardson 1993). This provides the means to prioritize the multitude of variables relevant to retirement when designing a research (Wang and Shultz 2010) as well as identify published studies with a particular phase based on the variables that form the basis of the investigation. For example, the adaptation phase concerns how individuals adjust to retirement. Adjustment is a dynamic and ongoing process (Sterns and Subich 2004), potentially with multiple alternating periods of stabilization and readjustment. In this phase, retirement is a past event, yet individuals may still be involved in paid work in the form of bridge employment (Wang et al. 2009). Of interest are the predictors of outcomes such as well-being, adjustment, and satisfaction over time. Second, action or inaction earlier in the process can affect outcomes in later phases (Sterns and Subich 2004; Richardson 1993). For example, retirement adjustment research focuses on outcomes in the adaptation phase but should acknowledge the potential influences of events from the preceding phases. Third, variables have temporal properties. Just as retirement may be a future, present, or past event, other variables may be viewed prospectively or retrospectively and individual concerns may change

with their proximity to the transition (Feldman and Beehr 2011; Topa et al. 2009). This means that comparisons between individuals at different stages of the process should be made with caution (Topa et al. 2009), because the same variable measured at preretirement or at adaptation may not be equivalent.

It is important to note that Fig. 1 is an abstract representation of the retirement experience. In reality, the individual may experience a nonlinear transition with multiple moves into and out of the workforce (Wang et al. 2009) that could mean a recycling through the phases. Viewed in this way, retirement is indisputably a process. Accordingly, existing studies that may use narrower definitions of retirement can be understood as providing insight into a particular phase of a broader progression.

### Six Elements Define a Study's Research Focus

Using six elements to analyze research focus facilitates knowledge integration because within each research area, studies may, for example, use different populations, theoretical frameworks, and definitions of retirement. Accordingly, once a study is identified as addressing the preretirement, transition, or adaptation phase, its research focus can be precisely defined using the following six elements (Fig. 2). When designing research, prescribing elements for explanation rather than exhorting the use of a common definition of retirement offers a particular advantage. Specifically, definitions can be derived according to research purpose, leading to greater research precision (Wang and Shultz 2010).

**Social context.** Policies from broader societal structures, such as organizations, the government, and the economy, underpin retirement (Atchley 1993; Adams and Beehr 2003). To a large degree, an individual's work and retirement opportunities are determined by his or her position within these structures (McKelvey 2009). Policies are formulated in response to changes within societal structures such that changes in employment relationships, government resources, and the norms of a leisure lifestyle drive changes in retirement (McKelvey 2009; Wang and Shi 2014). For example, older workers may become a more attractive

labor pool in light of the growing strain on government resources, an extended lifespan, shrinking labor market, and anticipated skills shortage (Ekerdt 2010; Adams and Beehr 2003). Accordingly, contemporary government policy encourages individuals to retire at a later age (Ekerdt 2010).

This means that (a) individual circumstances are to some degree externally determined and researchers should not neglect these constraints when interpreting research findings, (b) retirement trends change over time and so the need for research is ongoing and comparisons between studies from different time periods should be thoughtfully made (Beehr and Bennett 2007), and (c) government policies and resource structures that dictate retirement serve broader social and economic requirements, which may not support the best possible outcome for the individual (Atchley 1993).

It is also important to note that countries regulate retirement differently. Some countries still enforce a mandatory retirement age, while in others, retirement is not yet institutionalized, such as in developing countries (Adams and Beehr 2003). Accordingly, researchers should carefully consider whether research contexts are comparable before consolidating findings. As changes take place in global economies and mandatory retirement ages are raised or abolished, there is an opportunity for shared learning to inform future public policy and government direction.

**Defining retirement.** The multifaceted nature of retirement makes a universal definition difficult (Adams and Beehr 2003; O'Rand and Henretta 1999). Different retirement definitions point to whether the whole retirement experience or just one portion is under investigation challenging whether studies have a comparable focus. Observed in Fig. 1, retirement in its entirety is most accurately depicted as a process. Alternative definitions capture some part of the experience, and these may be introduced when aligned to the researcher's purpose (Wang and Shi 2014). Examples of the various definitions used by researchers are briefly described below.

Retirement has traditionally been understood as the point of separation from work (Ekerdt 2010). This perspective emphasizes the loss of the work role and ensuing stress as well as attempts at finding satisfying substitutions (Topa et al. 2009). It may become increasingly challenging to apply event definitions in contemporary research. Such definitions have trouble accounting for the complexity of modern retirement (O’Rand and Henretta 1999) and suggest a distinction between work and retirement that may be too simple (Hedge et al. 2006). Note that studies that conceptualize retirement as a past event will likely provide insight into the adaptation phase.

Alternatively, researchers may define retirement as the period of time between two relatively stable and distinct life stages. This definition complements the conceptualization of retirement as a decision-making process (Wang and Shi 2014). From this perspective, retirement might be considered in the context of the life course with reference to age norms, how it affects multiple life domains, and reduced psychological commitment to work (Adams and Beehr 2003). This focuses on how the individual deals with change (i.e., as crisis, opportunity, or continuity) and accounts for diverse retirement pathways including gradual exit from work (Topa et al. 2009; Atchley 1993). Studies that focus on consequences of the transition for adjustment may provide insight into the adaptation phase.

As another option, researchers may focus on the construction and experience of a new lifestyle in retirement, which is directly relevant to understanding the adaptation phase. This perspective corresponds with investigations into the retirement role or retirement identity and how it is socially and individually constructed. Definitions based on this perspective refer to the duration of the stage, the shift to leisure and consumption, and the potential for freedom and development (Atchley 1993). With the increasing incidence of paid work, retirement may also be considered a career development stage (Wang and Shi 2014).

Finally, researchers may define retirement as a process, in line with contemporary consensus (Wang and Shi 2014). Process definitions acknowledge that the line between work and

retirement is blurred, that the process begins before the end of work and continues well into retirement, and that it can involve multiple work status changes (Adams and Beehr 2003). Using a process definition of retirement may be particularly appropriate if the elements of retirement, including planning, decision-making, and adjustment, are considered dynamic (Wang et al. 2011; Topa et al. 2009). Studies that focus on the outcome of this process will provide insight into the adaptation phase. Process definitions are particularly suitable to investigating retirement adjustment because retirement adjustment can itself be viewed as a process (Wang et al. 2011). Furthermore, using process definitions of retirement acknowledges the potential influence of earlier phases, for example, characteristics of the individual’s work or career that may influence attitudes or later adjustment (Wang and Shi 2014).

**Selecting the population.** Identifying “retirees” is complicated, mainly because definitions rely on arbitrary concepts such as aging and work transitions (Ekerdt 2010). Studies rely on a variety of different criteria to select participants. Economic criteria infer retiree status from employment status and whether the individual receives a pension (O’Rand and Henretta 1999). However, reliance on economic criteria may be increasingly impractical as participation in a variety of paid work in retirement is increasing (Adams and Beehr 2003). Furthermore, economic criteria may ignore cultural and social processes that underpin the retirement status of parties such as women and minority groups (Richardson 1993).

On the other hand, social phenomenological criteria allow for subjective and personal interpretations of retirement (Richardson 1993), but may make quantitative research difficult and challenge the extraction of general principles. Individuals may have personal reasons for identifying themselves as retired or not retired. For example, an individual may be reluctant to identify as retired due to negative associations with old age (Teuscher 2010) or may prefer to identify as retired because it is more positively perceived than being unemployed (Lamberg et al. 2010). With the former, this may mean that those who

are particularly negative in their view of retirement are excluded from research, clouding researchers' understanding of retirement adjustment and limiting support. With the latter, it may mean that the incidence of unemployment at older ages is underestimated.

These complications suggest the use of social criteria that incorporate subjective and objective elements (Richardson 1993), for example, using workforce status and whether or not the individual identifies as retired (Wang and Shi 2014). Given that contemporary retirement may include multiple work status changes as well as a change in roles or identity, using a combination of indicators seems particularly appropriate (Wang and Shi 2014). Researchers should be aware that the population selected for any study is determined by whether the study uses economic, identity, or a combination of indicators to infer retiree status (Ekerdt 2010), and this will have important implications for whether results may be generalized to all retirees or just a subset.

**Experiences.** Experiences refer to the individual characteristics or circumstances that indicate opportunities or constraints. For example, individual experience of retirement may vary according to demographics (such as age or gender), pathways into retirement, and the meaning attached to retirement. A study may seek to understand one dimension of experience, for example, early retirement, or to generally understand positive experiences. Depending on the variables included in a single study, predictors may be ascribed different importance. For example, including the dimensions of both control over workforce exit and a gradual workforce exit demonstrated that control was the more important dimension (de Vaus et al. 2007). If these dimensions were not included concurrently, their relative contribution could not have been compared. Wang and Shultz (2010) and Wang and Shi (2014) provide a comprehensive summary of retirement experiences that warrant investigation (Wang and Shi 2014; Wang and Shultz 2010). A brief summary of current understanding of key influences on retirement adjustment is provided here.

Accumulated evidence suggests that health, finances, social support, and leisure are important

predictors of adjustment (Adams and Beehr 2003). The way in which one exits the workforce stands to influence a variety of retirement outcomes including available income, satisfaction, and well-being (Wang and Shi 2014). Evidence consistently shows that individuals who have choice in how and when they retire report better outcomes (Adams and Beehr 2003).

It is also important to acknowledge the potential role of meaning in retirement adjustment. Meaning in life is central to well-being and includes an individual's understanding of the world, sense of purpose, ambition and achievement, and associated positive feelings (Ho et al. 2010). In reality, it seems likely that individuals attach multiple meanings to their retirement, both positive (e.g., opportunity to pursue pleasure) and negative (e.g., the start of old age). Indeed, there can be substantial stress in the retirement transition, but also the potential for growth, development, and freedom (Sterns and Subich 2004; Atchley 1993). Acknowledging the multiple meanings of retirement facilitates specific predictions and informs the design of targeted interventions.

**Theory.** The theoretical framework adopted by the researcher should be selected according to study focus (Wang and Shi 2014). It is incumbent upon researchers to consider whether the theoretical framework used in the study was tested completely and appropriately. Due to the many theories that have been applied to retirement research (Wang and Shi 2014), researchers may also evaluate whether the framework selected was the one best suited to explaining the phenomena under investigation. Theory may explain experiences of individuals or subsets of individuals within a particular phase or provide a more comprehensive explanation of the retirement process (Wang et al. 2011). Theory can be drawn from a variety of disciplines including economics, sociology, psychology, gerontology, and business (Shultz and Adams 2007).

As a result of the accumulation of diverse experience (O'Rand and Henretta 1999), life course differences exist in available resources and expectations between men and women, majority and minority groups, and white- and

blue-collar workers (O’Rand and Henretta 1999). Significantly, the variation both within and between groups is expected to increase as individuals age (O’Rand and Henretta 1999). In addition, late career transitions are variable and complex due to the number of options, multiple life roles an individual holds, and issues specific to the older worker, such as health concerns and age discrimination (Wang et al. 2009; O’Rand and Henretta 1999). Once retired, an individual’s circumstances may be affluent or disadvantaged and may change over time or be influenced by concurrent life events or societal trends (McKelvey 2009; Adams and Beehr 2003).

Despite this, theory and research have often failed to take account of diversity (O’Rand and Henretta 1999). Universalistic theories that suggest the experiences of group members are equivalent are still used (Kolb 2004), and differences within an older cohort are ignored or marginalized (Mein et al. 1998). An overreliance on cross-sectional research provides only a snapshot of a continuing process and confounds aging and age-cohort effects (Adams and Beehr 2003). These challenges have led researchers to question the value of theories that seek to prescribe a universal retirement experience and whether a single theory can account for the entire process for all individuals (Moody 1988). Indeed, certain theories may have greater utility in explaining certain phases (Wang and Shi 2014).

A life course perspective, role theory, continuity theory, and a resource perspective are prominent models in retirement research and may particularly apply to retirement adjustment (these theories are briefly described in Wang et al. 2011). The life course perspective draws attention to the multiple past, present, and interlinked contexts that influence retirement, such as those of society, family, organization, community, and the individual. Role theory posits that retirement constitutes a role transition as the individual may exit a worker, organizational member, or career role and reinvest in family and community roles. Adjustment may be a result of three dimensions that can change from old to new roles, specifically, the clarity of role identity, role investment, and role demands. According to continuity theory,

how well people transition depends on whether they can replicate preferences, preretirement and postretirement. Being able to maintain preferences, social relationships, and lifestyle patterns can help ease the transition. Resources represent the capacity an individual has to meet core needs and can be physical, cognitive, motivational, financial, social, and emotional (Wang and Shi 2014). Resource change predicts well-being, such that an increase, decrease, or stability in well-being after the retirement transition is a result of an improvement, depletion, or maintenance of resource level (Wang and Shi 2014). A resource perspective may be particularly useful in explaining retirement outcomes because it can explain multiple patterns of change in well-being after retirement, whereas life course, continuity, and role theory can each only account for a subset (Wang and Shi 2014). For more detail on theories applied within retirement research, refer to Wang et al. (2011) and Wang and Shi (2014).

**Stakeholders.** Stakeholders refer to bodies at the political, organizational, and individual level that have a vested interest in retirement (Beehr and Bennett 2007). Every stakeholder has an agenda and decisions made about retirement structures may be at the detriment or benefit of other stakeholders. For example, government policy changes to delay access to pensions may reduce government spending but force people to work beyond their physical or psychological limits (Adams and Beehr 2003). A study’s stakeholders indicate who will feel the benefit of recommendations based on results.

Retirement adjustment research focusing on outcomes for the individual may investigate factors that influence individual risk and may seek to understand changes that accompany retirement or older age including adjustment to new roles, social context, and time organization or improve well-being in retirement (Wang and Shi 2014). At the organizational level, research may focus on the implications of losing skilled workers and opportunities to retain these workers or to provide retirement programs (Adams and Beehr 2003). At the societal level, research may focus on fostering valuable activities such as volunteering, caring, and paid work to address skills shortages

(Adams and Beehr 2003). Encouraging unpaid activities is beneficial not only to the individual but to the broader community although these may be undervalued (McKelvey 2009).

## Future Directions

The breadth of variables investigated with respect to retirement research needs to be expanded by including social and spousal resources, personality, motivation and self-regulatory processes, and socioeconomic context (Wang et al. 2011; Wang and Shi 2014). In addition, the potential moderating effects of variables warrant closer examination (Wang and Shultz 2010). The reasons behind particular decisions may be an important antecedent of adjustment (Wang and Shultz 2010). For example, the reason a person retires is expected to influence how they evaluate subsequent outcomes (Wang and Shultz 2010). Similarly, financially motivated bridge employment may indicate financial strain or dissatisfaction with retirement and hence poorer retirement outcomes (Wang and Shi 2014). Researchers should consider simultaneous investigation of factors from multiple levels such as individual, group, family, organizational, and social context (Adams and Beehr 2003) because retirement has important implications for all of these (Beehr and Bennett 2007). In addition, measuring multiple domains of a phenomenon can improve our understanding of its antecedents because predictors may only be associated with a particular outcome or may be differently related to outcomes (Wang et al. 2011).

A particularly important area of research at the societal level is whether policy will have the desired effect on the individuals it is designed to influence. Individuals may not be aware of policy, may not understand it, or may be unable to respond to its incentives (Ekerdt 2010; Powell et al. 2007). Individuals differ in their resources, knowledge, and life experiences, and these may be stronger drivers of retirement preparation than generic government policy that assumes individuals to be informed, responsible, and self-sufficient (Powell et al. 2007). Policies to promote work may be ineffective if other barriers to work, such as age

discrimination, poor health, caring responsibilities, career plateaus, and low self-efficacy, are not addressed (Ekerdt 2010; Wang and Shi 2014; Wang et al. 2009). Therefore, investigating individual understanding and response to retirement issues can help to inform effective policy (Ekerdt 2010; Wang and Shi 2014).

Future research also needs to consider that there are some groups whose experiences are argued to be markedly different from the majority (Wang and Shi 2014). For example, we would expect retirement plans and experiences to differ between individuals living in rural versus urban areas, between those who are self-employed versus part of an organization, and those who move to a new location versus those who seek to age in place. Losing a spouse can have a profound impact on the retirement experience (Wang and Shi 2014). Individuals with disabilities may not have a clear understanding of retirement and may benefit from additional tailored support (Wang and Shi 2014). Finally, migrants may be at risk due to a poorly formed social network, challenges of integrating into the new culture, and ineligibility for government support (McKelvey 2009). These different experiences increase the variability among older adults and could be studied systematically.

Future researchers may also explore whether differences exist between individuals who are partially and fully retired, who are facing their first or second retirement, and who are comfortable adopting the retiree identity and those who are not. For example, partial retirement or bridge employment may be a way to resolve ambivalence and facilitate adjustment toward full retirement (Wang and Shi 2014), and this population may be different from those who have fully retired. Distinguishing between participants who have retired once versus multiple times may also be important because multiple shifts into and out of the workforce are increasingly common over the retirement transition (Ekerdt 2010). Mentioned earlier, individuals may be reluctant to adopt the retiree identity due to negative associations or may adopt it in preference to identifying themselves as unemployed. Whether this indicates particular difficulty adjusting to retirement should be investigated.

The implications of retirement as a process are starting to permeate the literature demonstrated by the acknowledgement that planning, decision-making, adjustment, and bridge employment are themselves sequential and dynamic (Wang and Shultz 2010; Topa et al. 2009). Consequently, calls for longitudinal investigation to establish trajectories and their causes as well as dynamic theories to explain observed patterns are increasing (Wang et al. 2011; Adams and Beehr 2003). This opens opportunity for more complex data analytic techniques. Hierarchical linear modeling, latent growth curve modeling, time series analysis, spline regression, and logistic regression can answer questions on longitudinal data, discontinuous change, and dichotomous phenomena (Adams and Beehr 2003). The application of item response theory may enable the development of improved psychometric measures (Adams and Beehr 2003).

Additional frameworks, methodologies, and important concepts may be drawn from the fields of aging and careers in the future. Aging and retirement are concurrent processes respectively describing individual developmental and life course pathways (Schaie and Willis 2011). Therefore, successful adaptation to retirement and successful aging appear interdependent. Supporting this, recognizing the potential of the third age and plasticity in later life has encouraged individuals to demand more than inevitable decline from retirement (Beehr and Bennett 2007). Accordingly, concepts, theories, and methods that apply to adult development (Schaie and Willis 2011) may similarly lend insight into retirement adaptation, for example, selective optimization with compensation (discussed previously Baltes and Baltes 1990) and successful aging (Shultz and Adams 2007).

Careers and retirement are changing (Adams and Beehr 2003) such that career theory may help to explain retirement experiences in the future. The line between work and nonwork is blurring (Hedge et al. 2006) as is the temporal distinction of learning, work, and leisure across the life course (Ekerdt 2010). Self-management plays an increasing role in career and retirement (Adams and Beehr 2003). Hence, career perspectives that prescribe a personal capacity for flexibility,

resiliency, adaptability and self-assessment for career success, such as a protean career, may similarly secure favorable retirement (Wang and Shi 2014). Other career concepts, such as career adaptability, that indicate readiness and resources for coping with anticipated changes may be particularly useful constructs to apply to retirement (Savickas 2005). Finally, career counseling that helps individuals to navigate uncertainty and create meaning in their careers, for example, life design, may also help individuals overcome similar challenges in retirement (Savickas 2012).

## Conclusion

The body of research relevant to retirement adjustment is complex because researchers investigate many different variables from diverse theoretical and disciplinary perspectives. To make use of this wealth of information, researchers can benefit from conceptual frameworks that facilitate knowledge integration. The PTA framework applied in this entry improves our understanding of adjustment research by making clear the contributions of theoretical, empirical, and review papers, facilitating knowledge consolidation.

## Cross-References

- ▶ [Psychological Theories of Successful Aging](#)
- ▶ [Retirement and Continuity Theory](#)
- ▶ [Retirement and Social Policy](#)
- ▶ [Timing of Retirement](#)

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## Retirement Villages

Dimitry A. Crisp  
Faculty of Health, University of Canberra,  
Canberra, ACT, Australia

## Synonyms

Continuing care retirement communities (CCRSs); Independent living community/units; Lifestyle communities/villages; Retirement communities

## Definition

A managed purpose-built housing community targeted to people over 55 years of age.

## Introduction

Various terms are used throughout the literature to describe retirement villages. Indeed, any review of the literature around retirement villages is frequently complicated by the broad use of the term often encompassing discussion of a range of housing options for older adults which may include naturally occurring retirement communities (NORCs) as well as formally organized retirement villages. However, while definitions may change in accordance with government regulations, retirement villages are purpose-built housing complexes characteristically targeted at adults aged 55 years and over, which often combine independent living units with other services and facilities such as nursing home care, and community and recreational facilities (Stimson and McGovern 2002). Key features of modern retirement villages include community centers, libraries, games rooms, swimming pools, exercise/sports facilities, café or dining facilities, hair-dresser/salon, outdoor gardens, and workshop space. Accommodating for the needs of residents, the physical environment of a retirement village combines the features of security, independence, and communality (Gardner et al. 2005; Graham and Tuffin 2004), and through options for incorporating formal living assistance can provide an avenue for older adults to obtain manageable housing with the social and physical supports that enable them to age in place for longer and enter more formal residential care (e.g., nursing homes) later than people in the community (Gardner et al. 2005). Physically, retirement village housing is often very similar to other medium-density housing in the community. However, with the incorporation of physical health, recreation and social supports for those with varying care needs, the residential environment differs

considerably from most other housing within the community.

Retirement villages within Australia and New Zealand (as with other countries around the world) are subject to legislation regulating the rights and obligations of residents and retirement village operators. However, even within jurisdictions various models exist for the structure and specifically the contractual and financial arrangements entered into by residents. Tenure models include: leasehold, freehold, loan/licenses, and rental systems. Importantly, retirement village models have over time evolved in response to the needs and expectations of older adults, and will no doubt continue to evolve into the future. Therefore, distinct from other forms of aged care accommodation (e.g., hostel and nursing home style care), retirement villages represent a desirable housing choice for an increasing number of older adults.

## Perceptions of Retirement Villages

Retirement villages are often perceived and promoted in a positive light with emphasis placed on the opportunities they award for a change of lifestyle, socialization, and support for older adults to maintain independence and age in place well into the later life. While some of this may be driven by promotional strategies within the industry, retirement village residents themselves generally report positive perceptions of their village communities. Research from Australia, the USA, and the UK has found that residents, and prospective residents, perceive retirement villages as safe, low maintenance, supportive housing options that provide opportunities for a greater sense of community, security, and independence than living in the general community (e.g., Bohle et al. 2014; Stimson and McCrea 2004; Hollinger-Smith et al. 2012). However, while a growing body of work has found residents report the experience of living in a retirement village as being associated with a number of positive benefits, as will be discussed further below, not all attitudes toward retirement communities are positive. Criticisms

have focused on the concentration of health and welfare service demand to a single area, the exclusiveness and affordability of some villages, and the inherent “agist” nature of identifying age-segregated housing. However, while these issues may represent the concerns held by some, they do not reflect the general status of retirement villages, or importantly, the problems encountered by many residents. The notion that retirement villages promote ageism and the exclusion of older adults is refuted by research highlighting the reduced social isolation and increased independence of retirement village residents in comparison to older people living in the community who may have difficulty accessing services. While this type of housing may not be appropriate or desirable for all older adults, perceptions that the retirement village environment represents dependence and social isolation can generate fears that relocation to a retirement village reflects a loss of independence and privacy (Graham and Tuffin 2004) can in itself reinforce negative stereotypes associated with aging (Fisher 1990; Peterson and Warburton 2012).

### **Making the Decision to Move**

Substantial variability exists in the reasons for relocation to a retirement village. While the perceptions of retirement villages outlined above undoubtedly influence individual decisions to relocate, internationally diverse research investigating the accounts of both older adults and their families highlights that there are a number of motives which may drive relocation to a retirement village. Principally they include: (1) declining health in one’s self or one’s partner; (2) personal security; (3) feelings of social isolation and the desire for greater social connection; and (4) financial pressures (Stimson and McCrea 2004; Bekhet et al. 2009; Krout et al. 2002; Sergeant and Ekerdt 2008). Importantly, though it appears that a combination of push and pull factors underlie relocation. Push factors refer to stressors prompting an individual to leave their current residence (e.g., difficulties and costs

associated with home maintenance; social isolation; and health and mobility issues and the resulting need for assistance). Pull factors refer to desirable characteristics associated with an alternative environment that encourage a move (e.g., village attributes and affordability, location and proximity to public transport and social activities, and the ability to maintain aspects of their existing lifestyle in terms of proximity to family, friends, and services (Stimson and McCrea 2004)).

Importantly, retirement village housing attracts persons aged 55 years and over who display great diversity in their employment, health and functionality, and family status. Research indicates that younger retirees who remain relatively healthy and are likely to be more financially comfortable and married, relocate with the intention of finding a better quality of life and increased access to facilities and services such as community, health, and recreational clubs. In comparison, older retirees, who are likely to have experienced decreases in health and functionality and as such are more dependent and more likely to be widowed, relocate based on assistance needs with the purpose of support services, or to be closer to family (Stimson and McCrea 2004). Secondly, research supports a distinction between “planners,” who indicate future health concerns as major considerations in moving, and the “reactors” who, often older, move because of current health problems (Gardner 1996). Understanding the motives driving relocation provides an important basis for understanding the experience of living in a retirement village.

### **Health, Functioning, and Safety**

Changes in physical health and functioning, and the suitability of the home environment are the most commonly cited motives driving decisions to relocate in later life. Although many older adults retain the ability to remain independent in their own homes, as people age, a decline in physical and cognitive functioning can result in difficulty caring for one’s self and a current or anticipated need for future residential care. As such, declining health of oneself and/or one’s partner may prompt an individual to leave their

current residence (push factor), or the facilities offered within a retirement village for maintaining independence in the face of health decline may encourage relocation to a suitable retirement village (pull factor) (Gardner et al. 2005; Stimson and McCrea 2004; Bekhet et al. 2009; Krout et al. 2002; Groger and Kinney 2006). Moreover, the desire to reduce responsibilities and burden associated with managing a large house or property in favor of downsizing to a smaller unit (Bekhet et al. 2009; Krout et al. 2002; Groger and Kinney 2006), the desire to plan for future health needs, and importantly, a desire to have input into one's future whilst able to do so (Groger and Kinney 2006), all represent motives for relocation to a retirement village.

Concerns regarding neighborhood safety can also be an important motive behind the decision to move to a retirement village (Sergeant and Ekerdt 2008). The neighborhood environment is an important factor in maintaining independence in later life and can have a substantial influence on older adults' continued engagement in positive health behaviors such as physical activity. Confrontational relationships with neighbors, safety concerns, and traffic can all present barriers to older adults maintaining health and remaining in the community and as such are motives for relocation. Retirement village residents report that feelings of vulnerability associated with reduced functional capacity are lessened through relocation to a village where predominantly residents feel safe and secure (Graham and Tuffin 2004).

### **Social Connection**

The perceived social isolation which may accompany changes to one's social networks in later life; and the contrasting community friendly design of many retirement complexes represent important push and pull factors influencing residential location. Research investigating the migration of adults toward retirement village communities in mid to late adulthood suggests that relocation is often motivated by social considerations, particularly when individuals live alone or do not live in close proximity to children (Silverstein and Zablotzky 1996). Specifically, the loss of social support systems as individuals experience the loss

of a partner or the relocation of friends and neighbors can represent major motives for relocation (Bohle et al. 2014; Sergeant and Ekerdt 2008; Gardner 1996). Naturally, these motives center on the location of a retirement community placing older adults desiring social contact in closer proximity to family and pre-existing friends.

Retirement communities may also be a solution to perceived social isolation or loneliness through their community-friendly design and encouragement of social engagement and participation (Graham and Tuffin 2004). Surveys of retirement village residents have found that the community environment, the opportunities for making new social contacts and friends and the social activities can be a principle reason for relocating and significant advantage (Sergeant and Ekerdt 2008; Gardner 1996; Buys 2001; Crisp et al. 2012). Importantly, regardless of the effort made to form new social contacts, condensed housing environments (such as in the case of retirement villages) can increase the likelihood of engaging in informal social interactions with others.

### **Financial Pressures**

The affordability of retirement village living and changes in economic status or financial constraints in later life reflect further important considerations influencing relocation (Finn et al. 2011). Reduced income following retirement or a change in personal circumstances (e.g., the death of a partner) may dictate the viability of residential options. Financial pressures may initiate a move through a need to downsize to a more affordable residence (Stimson and McGovern 2002). Similarly, the financial status of the individual in retirement may influence perceptions of retirement village housing affordability (Finn et al. 2011; Bridge et al. 2011). An examination of the issues reported by retirement village residents in Australia has highlighted various financial concerns impacting the relocation process. Prior to relocation, prospective residents face financial considerations pertaining to the sale of the family home and concern for ensuring financial stability throughout retirement (Finn et al. 2011). Moreover, adding to financial stressors is the perception that retirement communities have complex tenure and leasing

arrangements (Bridge et al. 2011). The influence of housing tenure and the differential ease with which renters in comparison to owner-occupiers may be able to adjust and pursue new accommodation options has important implications.

### **The Experience of Relocating to a Retirement Village**

A growing body of research has found that the experience of living in a retirement village can have a positive impact on maintaining independence, perceived health, social relationships and social integration, and reliance on community services (Buys 2001; Buys and Miller 2007). Investigating health and well-being outcomes, research has indicated greater participation in physical activities following relocation (Buys and Miller 2007); better physical and mental health outcomes over time (Kingston et al. 2001; Rossen and Knafel 2007; Smider et al. 1996); and that residents report a renewed sense of vitality and overall better quality of life in contrast to comparable general community samples (Gardner et al. 2005; Grant 2007). While, these benefits may be attributable to aspects of the retirement community environment, the pursuit of activities and relationships that provide motivation to maintain an active lifestyle, the more manageable residence, and the access to support services, further research is required to establish the magnitude of these benefits.

As a strong motive for relocation, and key factor in maintaining positive health and well-being in later life, the benefits to social networks and engagement are perhaps of greatest significance to retirement village residents and those wishing to understand the experience of retirement village living. Through both organized activities and informal social interactions with other residents as a function of the condensed housing environment, the retirement village environment increases opportunities for social interaction and engagement that can reduce social isolation and have consequent benefits for the health and well-being of residents. Available research examining the impact of residential location on contact with friend networks has found support for retirement village living promoting the

development of a sense of belonging, new social networks and reducing social isolation (e.g., Buys 2001; Grant 2007). Moreover, research has indicated that residents retrospectively report greater satisfaction with friendships and their social life following relocation (Gardner et al. 2005; Graham and Tuffin 2004).

In light of the benefits to relocation that have been noted it should be recognized that relocation to a retirement village is a major transition and can have a significant impact on not only the individual but also family and the wider community. Importantly, the relocation process can be a stressful experience. It can produce feelings of grief, insecurity, and a loss of control or sense of identity (Morgan et al. 1997). Additional stressors such as changes in social networks, widowhood, illness or financial strain, may underlie motives for relocation but also provide challenges in adjusting to the new environment. Further, negative consequences including increased health decline and associated increases in health care utilization, reduced financial independence, and decreased quality of life may then also accompany the move (e.g., Krout et al. 2002). Moreover, retirement village life is more restrictive than community living. Residents are not only governed by contractual rules but also the behavioral and social norms of the community which evolves. This is a further characteristic associated with this housing model which may negatively impact individuals (e.g., cause stress) through the requirement to conform to expectations (Stein and Morse 2008).

Finally, it is unclear from the literature whether specific factors may influence the apparent benefits to be awarded by retirement villages, and if there are subgroups of older people who may be relatively more or less advantaged by retirement village living. For example, while it appears that living in a retirement village is largely characterized by opportunities for positive social contact and engagement in activities that serve to benefit older adults, the reality may not be such for all residents. Simply living in proximity to others may not combat loneliness for all individuals. Importantly, the impact of age-concentrated housing may vary with individual and social factors (e.g., age, marital status, personality

characteristics), which may influence the relationship between the proximity of residents and the degree of social engagement. While some research exists (e.g., Smider et al. 1996), further investigation is required into specific factors (individual or village level) that may drive the experience of retirement village living.

## Conclusion

While a common feature in Australia and the USA, retirement villages as a housing option in later life are a relatively new development in countries such as the UK and New Zealand. However, in light of the aging population they are becoming a housing option of increasing interest to researchers, policy makers, and the community worldwide. In the experience of normal aging-related declines in health and mobility we look for avenues to aid us in maintaining independence. Retirement villages are one housing option that offers independent living in close proximity to facilities and services that may help facilitate this goal. Distinct from other forms of housing for older adults, retirement villages combine independent living with access to a range of recreational, health and care services in a community environment. Overall, current research suggests that retirement villages are an accommodation option that can enhance social networks, engagement and well-being, and provides some evidence that the supportive residential environment can buffer the impact of other lifestyle transitions for those who choose to move to a village. However, variability in the reactions of individuals to this transition suggests that retirement village life should not be regarded as a housing option suitable for all older adults. Issues of privacy and barriers to the formation of meaningful social relationships can and do exist. However, the nature of living in close proximity with other people in a setting such as a retirement village, can indirectly influence the amount of informal contact older adults have with each other. For those individuals in particular who seek alternative accommodation due to isolation or loneliness, the retirement village may be an attractive option and ultimately have a positive impact

on health, well-being and overall quality of life. While future research is required to extend our understanding in this area, it is suggested that environmental factors, social supports, and an individual's sociodemographic characteristics may explain the variability in the reactions of individuals to this transition. Further consideration of the characteristics and motives of those individuals most attracted to retirement village living is important in understanding the nature of the retirement village community and the potential future demand for this type of housing.

## Cross-References

- ▶ [Age-Friendly Communities](#)
- ▶ [Housing Solutions for Older Adults](#)
- ▶ [Late Life Transitions](#)

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## Risk Taking in Older Adulthood

Evgenia Folts<sup>1</sup>, Natalie L. Denburg<sup>2</sup> and Georgina Moreno<sup>3</sup>

<sup>1</sup>Department of Pediatrics, University of Iowa Carver College of Medicine, Iowa, IA, USA

<sup>2</sup>Department of Neurology, University of Iowa Carver College of Medicine, Iowa, IA, USA

<sup>3</sup>Department of Psychology, New York University, New York, NY, USA

### Synonyms

Aging; cognition; older adulthood; decision making; risk; risk taking; risk aversion; affect-based mechanisms; cognitive neuroscience of aging

### Definition

This entry summarizes several studies that reveal the equivocal nature of the research findings on risk preferences in older adulthood, as well as explores various mechanisms put forth in the literature that have helped in our understanding as to why these discrepancies exist.

As the population of older adults continues to rapidly increase, the need to better understand dynamic age-related changes that occur in cognition has become clear. In a report put forth by the National Research Council (2006), this urgency was made evident when it recommended that the National Institute on Aging increase research support in the domains of social, personality, and lifespan psychology, with a particular emphasis on decision making. Nonetheless, there is a paucity of research investigating how decision making is characterized in older adults and how it changes with age. When it comes to financial decision making, older adults free of neurological and psychiatric illness have been shown to fall victim to fraud (Scheibe et al. 2014) and to be more susceptible to making suboptimal financial choices (e.g., suboptimal use of credit card balance transfer offers, misestimating of the value of

one's house; Agarwal et al. 2009). It goes without saying that the consequences of suboptimal decision making can be devastating at not only the individual level but at the societal level as well.

Although inconclusive, investigation of a specific type of decision making – risk – has started to reveal promising insights and future directions for the fields of psychology and gerontology. In the research domain, decision making under risk is considered to occur when choice outcomes are not certain, but the probabilities of these outcomes are known and can be confidently judged (e.g., 50% chance of winning \$100). While some studies suggest that risk taking decreases with age, other studies have indicated that risk taking increases or remains stable across the lifespan. In this entry, several studies are summarized that reveal the equivocal nature of these research findings on risk preferences among older adults. Additionally, various mechanisms put forth in the literature that have helped in our understanding as to why these discrepancies exist are discussed.

### **Risk Taking Decreases Throughout the Lifespan**

In general, risk taking has been thought to decrease throughout adulthood. That is, when one thinks of decision making and age, a common notion is that adolescence and young adulthood is a time of impulsiveness and risk seeking, whereas as one ages, one becomes more risk-averse, with older adulthood being the pinnacle of cautious decision making and risk aversion. Although this is a pervasive societal conception, only a handful of studies have provided evidence to support this stereotype. To illustrate, in a study conducted by Deakin et al. (2004), 177 healthy participants aged 17–73 years were presented with a gambling task and their decision making preferences were assessed on five key metrics: (1) deliberation time (the time to choose red or blue box), quality of decision making (when a subject chooses a box which is associated with greater probability); (2) risk taking (the proportion of the points a subject wishes to gamble on a trial); (3) delay aversion (the degree to which a subject is willing to withhold a response); and (4) risk adjustment (the degree to

which a subject adjusts his/her risk-taking behavior depending on a ratio of red to blue boxes, e.g., when a subject bets larger amount on a red box when the probability for that choice to be a winning one is higher). Older age was found to be related to increased deliberation time, poorer quality of decision making, reduced risk adjustment, and decreased risk taking. By contrast, older age was found to be unrelated to delay aversion (Deakin et al. 2004). Moreover, a factor analysis of these five metrics led to the conclusion that two independent traits, risk tolerance and delay aversion, underlie performance in risk taking, with age being related to decreases in the risk tolerance factor, but unrelated to the delay aversion factor. Similarly, a study conducted by Lee et al. (2008) demonstrated that older adults engaged in risky behavior less often than younger adults during a task where participants were required to decide whether to take a risk in both safe and risky conditions.

In a novel experiment, Dohmen et al. (2005) administered a survey to a large representative sample of roughly 22,000 individuals with the goal of assessing ecologically valid risk preferences. In this survey, the willingness to take risk was assessed by asking individuals to rate, generally, how “willing” they were to take risks on a scale from 0 to 11, with “0” indicating completely unwilling and “11” indicating completely willing. These investigators found that decreased ratings of willingness to take risks were negatively correlated with increased age. Moreover, a field experiment carried out in a subset of the original sample showed a relationship between the participant's willingness to take risks and real-life risk-taking behavior, including driving, finances, recreational activities, career, and health. However, willingness to take risks was not correlated with performance on a risk lottery task, a common instrument used in the literature to assess risk taking, leading the authors to speculate on the real-world validity of such measures.

### **Risk Taking Increases or Remains Stable Across the Lifespan**

Although it is a prevalent notion that older age is associated with increased conservatism and thus a

decrease in risk-taking behavior, as noted above, there is a growing body of evidence suggesting otherwise. For example, a study carried out by Lauriola and Levin (2001) found that age-related risk taking was particularly dependent on the context of the choice. When asked to make a series of choices between option pairs where no one option was advantageous or disadvantageous because their expected values (i.e., probability-weighted averages) were equal, older adults were less risk seeking than younger adults when deciding between two gains. However, when making a similar choice (i.e., options had equal expected values) between two losses, older adults were more risk seeking than younger adults. Moreover, a meta-analysis of studies examining risk preference found age-related increases in risk seeking in the domain of losses, but no age-related changes in risk taking in the domain of gains (Weber et al. 2004). Furthermore, Weller et al. (2011) reported that on a task that probed decision making under risk in both gain and loss scenarios, there were age differences in risk seeking dependent on whether the decision was in a gain or loss context. More specifically, risk taking decreased with age when the choices were between a sure gain and a larger but uncertain gain, but not when the choices were between a sure loss and a larger but uncertain loss. Interestingly, the approach used in this latter study revealed an important aspect of investigating age-related changes in risk-taking behavior: the domain aspect. A recent study utilized model-based analysis of risk attitudes across the lifespan in both gain and loss domains; conflicting findings were reported (Tymula et al. 2013). In this study, risk attitudes were modeled by taking the subjective value of each option using a power utility function, providing estimates that indicated risk neutrality as well as risk-averse and risk-seeking attitudes. In the gain domain, individuals were risk-averse, regardless of age group. Moreover, an inverted U-shape trajectory was reported in the gain domain for risk aversion across the lifespan, with adolescents and seniors being even more risk averse than young adults and midlife adults. In the loss domain, however, only older adults showed

distinct risk preferences, evidencing more risk seeking than midlife adults, younger adults, and adolescents. These findings raise an interesting question of whether differences in risk-taking behavior in older adults may be partially, or even fully, attributed to the characteristics of the task (e.g., gain and loss domain), rather than choice preference.

A meta-analysis of 29 studies was carried out by Mata et al. (2011) to investigate the discrepancies reported in the literature regarding age-related risk taking. They found that indeed age-related differences were observed in risk taking, but primarily as a function of the learning requirements of each individual task. More specifically, they found no differences in risk-taking behavior in the majority of the tasks and no clear age-related differences as a function of gain or loss framing. In this meta-analysis, the authors concluded that age-related differences in risk taking were most likely a function of decreased learning performance – older adults were more risk seeking compared to younger adults when learning led to risk-avoidant behavior; however, older adults were more risk averse when learning led to risk-seeking behavior. Together, this work suggests that changes observed across the lifespan in risk may be more so dependent on task demands and task characteristics, rather than individual risk preferences (Mata et al. 2011).

In support of this notion, learning has been shown to play a critical role in risk taking across the lifespan using a popular instrument to assess risk taking in clinical and nonclinical populations, the Balloon Analogue Risk Task (BART; Lejuez et al. 2002). Rolison et al. (2012) modeled the process by which younger and older adults make decisions on the BART. Their modeling indicated a divergence in task process early on in the task, with younger adults being more willing to take greater risks, whereas older adults seemed to be more cautious when their decision making was based on their initial perceptions of risk. However, as the task progressed and participants gained knowledge regarding the BART, the two age groups were comparable in their risky decisions.

## The Role of Emotion in Decision Making Under Risk Throughout the Lifespan

Although a consensus has yet to occur on how risk taking changes across the lifespan, research investigating the various mechanisms that could be at play has helped inform our understanding as to why these discrepancies exist. Emotion is one mechanism thought to potentially account for individual differences in risk taking across the lifespan. For example, Peters et al. (2007) conducted a review on how affective and deliberative information processes alter decision making in older adults. The researchers came to the conclusion that despite the age-related decline in deliberative decision making process, older adults are able to adapt and compensate for such a decline by relying on an increased focus on emotional information processing and experience (Peters et al. 2007). Thus, the affective component of the situation may influence risky decision making. For example, if an older adult experiences positive affect during a particular situation (as opposed to a situation with negative affect), then that individual may be more willing to engage in risky behavior at that given moment. One might speculate that this affect-based mechanism in decision making may be an underlying cause of why older adults often become victims of fraud such as deceptive advertising.

Many of the differences observed due to framing of risk taking in gain and loss scenarios support this interesting notion that valence plays a critical role in value-based decision making under risk. Emotion itself is thought to change across the lifespan (Carstensen 2006), and many of the mixed findings with respect to risk taking in gain and loss domains can potentially be explained by these changes in emotion.

## Neural Underpinnings

Another approach of investigating the source of age-related changes in risk-seeking behavior is aimed at understanding the neural processes that underlie decision making in older adults. A study

conducted by Lee and colleagues (2008) used functional neuroimaging to investigate whether differences in neural activity could account for their finding that older adults were less risk seeking than younger adults. Older adults, compared to their younger counterparts, demonstrated increased activation in the right prefrontal area, in particular in the orbitofrontal cortex (OFC), an area of the brain known for its involvement in complex decision making. Along with the increased activation in the OFC, older adults also demonstrated stronger activation in the right insula when a risky option was chosen over a safe option. Interestingly, increased activation in the right insula was interpreted as being related to the emotional processing of risky situations, providing further support for the theory proposed by Peters and colleagues (2007) which suggests that older adults may rely heavily on affective information processing when making decisions under risk, more so than younger adults.

In a review by Mohr et al. (2010), it was suggested that dopaminergic and serotonergic pathways play crucial roles in economic decision making, especially in the context of aging. During the course of normal aging, dopaminergic systems are thought to undergo a substantial decline. According to Mohr and colleagues, the dopaminergic system and the serotonergic system interact in value-based decision making as well as in reward-based learning. Thus, these changes are paralleled by changes in economic behavior, specifically in risk taking, delay discounting, and reward-based learning (Mohr et al. 2010). Relatedly, functional neuroimaging work by Samanez-Larkin et al. (2010) indicated that age-related suboptimal decision making on a financial risk task was associated with temporal variability in the nucleus accumbens, a region of the brain often implicated as playing a role in decision making and that is rich with dopamine receptors.

## Individual Differences

Another way in which the underlying mechanisms of risk-seeking behavior have been

investigated is through individual difference variables, such as personality and sex effects. For example, Lauriola and Levin (2000) examined the relationship between the “Big Five” personality traits (neuroticism, extraversion, openness, agreeableness, conscientiousness) and risk-taking behavior in a sex- and age-stratified sample. The investigators hypothesized that extraversion would predict risk taking positively because of its relationship to the need for arousal; neuroticism would predict risk taking negatively because of its relationship to trait-anxiety; and finally, a combination of hostility, lack of conscientiousness, and openness would predict risk taking positively because a combination of these traits relates to impulsive, aggressive, and antisocial tendencies. The participants were 76 subjects (38 males and 38 females) distributed into three age groups: 21–40 ( $n = 26$ ), 41–60 ( $n = 27$ ), and 61–80 ( $n = 23$ ). The results of the study demonstrated that personality factors did indeed relate to risk-taking behavior. According to the findings, neuroticism and openness predicted risk taking to achieve a gain, both when these factors were considered individually and when their combined effect was considered in conjunction with demographic variables. Participants scoring high on neuroticism and low on openness took less risk than participants scoring high on emotional stability (i.e., low neuroticism) and openness. Interestingly, neuroticism was the only personality trait predicting both risk taking for gains and for losses when controlling for age and sex (Lauriola and Levin 2001). Sex also had a significant effect on risk-taking behavior with males choosing a risky option more often than females. Interestingly, males scored significantly lower than females in neuroticism and agreeableness, which might help explain why males take more risks than females. Overall, the results of the study supported the hypothesis that

## Conclusion

In summary, although research has investigated whether risk taking changes across the lifespan,

the field of geropsychology is still far from fully understanding this very nuanced process. While findings are equivocal, detail and precision in the measurements we use to assess risk is critical. Conditions such as domain (e.g., gain, loss), learning demands, and task characteristics (e.g., survey, questionnaire, lottery task) are all vital in properly informing the extent to which risk preferences shift across the adult lifespan. Moreover, a number of factors such as sex, emotion, structural and functional brain activity, and personality are also important to consider in the context of aging and risk. A continued and concentrated effort to better understand various aspects of decision making, including but not limited to risk, will only help to further inform public policy, as well as facilitate successful aging.

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## Rumination in Geriatric Depression

Katie Van Moorleghem<sup>1,2</sup> and Kaitrin Conniff<sup>1,3</sup>

<sup>1</sup>Palo Alto University, Palo Alto, CA, USA

<sup>2</sup>Sierra Pacific Mental Illness Research Education and Clinical Center, VA Palo Alto Health Care System, Palo Alto, CA, USA

<sup>3</sup>Veterans Affairs Palo Alto Health Care System, Palo Alto, CA, USA

## Synonyms

Repetitive thought; Rumination; Ruminative thinking

## Definition

Rumination is a repetitive thinking style comprised of excessive, recurrent thoughts or themes of previous stressful life events, current difficulties, and anticipated future difficulties, which restricts other types of mental activity (VandenBos 2015; Papageorgiou 2006). While the term “rumination” is broad, it is considered a common cognitive response style to negative mood states, which can increase vulnerability to depression and other psychological disorders (Smith and Alloy 2009; Papageorgiou and Wells 2004). Several theories of rumination exist, each holding differing views of rumination.

Rumination is a risk factor for developing depression both in the general population and in older adults. It is associated with experiencing more frequent, more intense, and longer periods of negative mood states. In addition, rumination is more likely to occur in the context of medical and cognitive problems (Nolen-Hoeksema et al. 1993). Indeed, rumination has been shown to play a role in the development, maintenance, and recurrence of affective disorders, such as major depressive disorder, obsessive-compulsive disorder, and generalized anxiety disorder (VandenBos 2015; Lyubomirsky and Tkach 2004).

## Rumination and Mood

Rumination is a general term for negative, recurrent thought processes. These thoughts involve recalling past, personal negative events associated with loss and failure that tend to restrict a person's ability to engage in other forms of mental activity (VandenBos 2015; Papageorgiou and Wells 2004). As such, rumination plays a key role in the development and maintenance of depressive and anxiety states (Smith and Alloy 2009; Papageorgiou and Wells 2004). Individuals engage in ruminative thinking often with the belief that it will give them insight into a problem (Aldao et al. 2010; Papageorgiou and Wells 2004). These recurrent negative reflections of past failures, however, create a vicious cycle of

recalling painful past events without finding a solution to the problem (Coleman 2005).

## Theories of Rumination

Rumination is commonly described as a maladaptive coping strategy. Despite a rich supporting literature, there is no overarching definition or unified mechanism for measuring it (Smith and Alloy 2009; Papageorgiou and Wells 2004). Models describe rumination in terms of a cognitive thinking style, emotion-regulation mechanisms, or action tendency (i.e., a desire to act in a way that demonstrates or is connected to a specific feeling) (Smith and Alloy 2009). The problems associated with differing definitions of rumination are reflected in the existing measures of rumination (Papageorgiou and Wells 2004).

*Response Styles Theory.* The most widespread theory of rumination is the response styles theory, proposed by Nolen-Hoeksema (1991). Nolen-Hoeksema defines rumination as a repetitive, passive, symptom-focused thinking style which occurs in response to depressive symptoms and the possible causes and consequences of one's symptoms (Nolen-Hoeksema 1991). Rumination is a pattern of thoughts and behaviors that focus attention on emotions and in the process hinders attempts at distraction from the negative mood (Nolen-Hoeksema 1991). This passive response style typically does not lead to active problem-solving and serves to prolong and exacerbate depressive symptoms (Nolen-Hoeksema 2004). Further, there are four mechanisms within response styles theory in which rumination serves to worsen depression (Nolen-Hoeksema 2004). First, rumination exacerbates depressed mood making it easier to recall negative memories and thoughts. These memories and thoughts are triggered by depressed mood and then are used to interpret an individual's current circumstances, creating a cycle of negative thoughts and moods (Nolen-Hoeksema 2004). Second, problem-solving is compromised due to fatalistic and pessimistic thinking (Nolen-Hoeksema 2004). Pessimistic thinking can create negative biasing in

processing information, which can further exacerbate depressive symptoms (Nolen-Hoeksema 1991). Third, rumination interferes with active goal-oriented behavior. As a result, individuals who engage in ruminative thinking are less likely to actively problem solve and generate solutions to life problems and stressors (Nolen-Hoeksema 1991, 2004). Fourth, chronic rumination leads to reduced social support, which then reinforces and maintains depressive symptoms (Nolen-Hoeksema 2004).

*Goal Progress Theory.* Goal progress theory (GPT) views rumination as a reaction to the failure to successfully advance toward a desired goal (Smith and Alloy 2009). Research has shown that while depression and rumination are both precipitated by experiences of failure, ruminative coping remains stable regardless of whether actual or perceived failure experiences are present (Smith and Alloy 2009). Measures of rumination from GPT target several factors of rumination including cognitions (e.g., an employee obsesses over a negative comment made by employer), metacognitions (i.e., self-awareness of thought process), and personal motivation behind the tendency to ruminate which includes both cognitive and behavioral components (Smith and Alloy 2009).

*Self-Regulatory Executive Function Theory.* Self-regulatory executive function theory (S-REF) is an information processing model. In this model, rumination is viewed as an affective coping strategy, where negative beliefs serve to predispose individuals to engage in ruminative thinking, leading to a variety of emotional disorders (Martin et al. 2004). S-REF targets a person's beliefs about emotions and cognitions, which functions to perpetuate a cycle of worry and inhibits an individuals' ability to search for alternative coping styles and cognitive restructuring (Martin et al. 2004). Within S-REF, rumination can be described as a method of cognitive-emotion regulation in which a person works to cope with a self-discrepancy between meeting personal goals and the obstacles preventing them from meeting those goals (Martin et al. 2004). Since a discrepancy exists between a desired goal and one's current situation, an individual then engages in processing information related to

why and how this discrepancy exists without focusing on goal-oriented action to solve the problem (Martin et al. 2004).

### **Distinguishing Rumination from Related Constructs**

*Worry.* Depression and anxiety are the most common mental health problems seen in older adults, and worry is a commonly reported symptom in both depression and anxiety (Rewston et al. 2007). Worry can be pathological or non-pathological, with pathological worry being described as uncontrollable and excessive (Rewston et al. 2007). Rumination is hypothesized to be closely related to worry, with rumination and worry sharing the distinct characteristics of being intrusive, uncontrollable, and distressing (Luminet 2004). However, there are also distinct differences between worry and rumination. The most common distinction is the content of the worried or ruminative thoughts. Worry can be characterized by themes of anticipated threat or danger in the future; rumination, however, can be characterized by themes of past personal loss or failure (Papageorgiou and Wells 2004). Compared to rumination, worry has been associated with a higher compulsion to engage in worried thinking and greater confidence in problem-solving ability, as worry has been found to be more controllable. Further, worry has been associated with more active attempts at engaging in problem-solving (Papageorgiou and Wells 2004). Distinguishing between worry and rumination is important for planning targeted treatment interventions.

*Negative Automatic Thoughts.* Rumination and negative automatic thoughts are also common in depression. According to Beck's content specificity hypothesis, negative automatic thoughts are distinguished from rumination. Negative automatic thoughts stem from a negative view of one's self, others, and one's future (Purdon 2004). Within the content specificity hypothesis for depression, thoughts center on previous personal failure and loss (Papageorgiou and Wells 2004). According to cognitive theory, automatic thoughts occur in multiple, "diverse" situations and arise

from beliefs about how the world operates (Papageorgiou and Wells 2004). However, negative automatic thoughts are thought to be relatively fleeting appraisals, whereas rumination consists of longer series of negative, self-focused, repetitive thoughts (Papageorgiou and Wells 2004).

### **Consequences of Rumination**

The consequences of rumination are variable and can either serve to be maladaptive, perpetuating negative mood, or adaptive, fostering recovery from negative events (Watkins 2004). As a maladaptive coping style, ruminating about oneself and one's negative symptoms has deleterious effects on mood. It negatively biases thinking patterns and distorts how hypothetical life events are interpreted (e.g., minimizing successes and overgeneralizing failures). Rumination can also impair problem-solving, inhibit initiative and motivation, interfere with concentration and cognition, and increase stress (Lyubomirsky and Tkach 2004). Physical and social well-being, physical health, social relationships, and emotional adjustment can also be negatively impacted (Lyubomirsky and Tkach 2004). An individual may believe that engaging in rumination allows them to be realistic about their problems and that recurrently thinking about their problems allows them to face their problems directly (Nolen-Hoeksema 2004). In this view, engaging in rumination may be seen as an attempt to problem-solve or a mistaken belief that rumination will somehow help prevent future failures and mistakes (Nolen-Hoeksema 2004). However, research suggests that rumination tends to have a negative rather than a positive impact on well-being (Lyubomirsky and Tkach 2004). Additionally, once a person engages in rumination, it may be difficult to withdraw from this maladaptive coping mechanism. In short, negative cognitive coping styles tend to increase the likelihood of making maladaptive inferences when faced with stressful situations and leave individuals more vulnerable to developing depression (Lyubomirsky and Tkach 2004).

## Depression and Rumination in Older Adults

While depression is less common in older adults than younger adults, prevalence rates for depression in community-dwelling older adults are approximately 2–5% (Fiske et al. 2009; Edelstein et al. 2008). Further, the rates of depressive symptoms and subsyndromal depression in older adults range from 8% to 37% (Edelstein et al. 2008). Similar to younger adults, rates of depression are higher in older women than in older men. Depression in the older adult population is a serious health concern, as it can lead to an increased risk of morbidity and suicide, a decrease in physical, cognitive, and social functioning, and greater self-neglect (Fiske et al. 2009).

As compared to adolescents and younger adults, older adults experience fewer negative life events (Kraaij et al. 2002). However, older adults do experience more loss, such as declining health, the loss of the work role, and the loss of family and friends (Kraaij et al. 2002). Older adults who have experienced negative events such as the loss of loved ones, chronic medical problems, abuse, or relational problems have been found to experience more symptoms of depression than older adults who do not experience these negative life events (Kraaij et al. 2002). While the presence and number of negative life events is strongly associated with rates of late-life depression and depressive symptoms, not all older adults who have experienced negative life events develop depression or depressive symptoms (Kraaij et al. 2002). Whether an older adult who experiences a negative life event develops depression or depression symptoms may be related, in part, on his or her cognitive coping strategies. Certain cognitive coping strategies have been shown to be more or less effective in managing thoughts and emotions associated with negative life events. Understanding these coping strategies and determining which coping strategy is being employed by an individual can help guide treatment. There are a number of cognitive coping strategies used to manage the intake of emotionally arousing information and the resulting thoughts and emotions (Kraaij et al. 2002).

Common coping strategies include self-blame, acceptance, rumination, positive refocusing, focusing on planning, positive reappraisal, putting into perspective, catastrophizing, and other-blame (Kraaij et al. 2002).

As discussed previously, rumination has been defined as repetitive thoughts and the process of thinking attentively, repetitively, or frequently about the self and world (Sütterlin et al. 2012). Depressive rumination often involves repetitively focusing on one's own depression, on depressive symptoms, and on the causes, meanings, and consequences of one's depression (Nolen-Hoeksema 1991). Individuals who engage in rumination tend to fixate on their problems and feelings, often without taking any action (Sütterlin et al. 2012). Rumination has been shown to interfere with decision-making. Individuals who ruminate tend to be ineffective in active, interpersonal problem-solving (Sütterlin et al. 2012). Rumination has also been highly associated with brooding, which has been defined as passive and self-critical thoughts comparing an individual's current situation, thoughts, and mood against a desired goal or standard (Sütterlin et al. 2012). Rumination has consistently been found to be a risk factor for psychopathology, and rumination and brooding are associated with a greater frequency and severity of depressive symptoms (Aldao et al. 2010; Sütterlin et al. 2012). Depressive rumination is seen as a particularly unconstructive, maladaptive, and distressing cognitive coping strategy (Sütterlin et al. 2012).

One theory as to why older adults experience less depression is that older adults are more apt than younger adults at emotion regulation (Nolen-Hoeksema and Aldao 2011). Research has shown that ruminative thinking tends to decline with age, and older adults show low levels of ruminative thinking (Sütterlin et al. 2012; Nolen-Hoeksema and Aldao 2011). This could be due, in part, to better emotion regulation in older adults or that older adults are better at avoiding situations that would make them ruminate (Nolen-Hoeksema and Aldao 2011). However, for older adults who engage in rumination, depression severity may be worse and episodes of depression may be longer and

more frequent, putting them at an increased risk for medical and cognitive problems.

As noted earlier, older women have higher rates of depression than older men. Women appear to use a wider range of cognitive coping strategies than men; while they use more adaptive strategies than men, they also engage in more maladaptive strategies than men (Nolen-Hoeksema and Aldao 2011). Women use maladaptive strategies more often than men, which may put women at an increased risk for depressive symptoms (Nolen-Hoeksema and Aldao 2011). Research has shown that higher levels of rumination in women compared to men may account for some of the gender differences in depression rates (Sütterlin et al. 2012).

## Measuring Rumination

Assessing for the presence and severity of rumination in depressed older adults can have important treatment implications. Many of the measures currently used to assess for rumination are self-report scales (Luminet 2004). While self-report measures are relatively easy and quick to administer and score, self-report measures are not without their flaws. Self-report measures may not accurately measure the frequency and content of mental processes (Luminet 2004). They may require higher levels of insight or metacognition than the individual taking the measure is capable of, and the measure could be influenced by overly positive or negative moods or self-presentation biases (Aldao et al. 2010). Further, it can be problematic when using self-report measures with older adults, as many of the measures are initially developed for use with younger adults; normative data may not exist for older adults. Caution must be taken when using the following self-report measures with older individuals.

*The Response Style Questionnaire.* The Response Style Questionnaire (RSQ) is based on Nolen-Hoeksema's response styles theory, which states that when individuals are in distress, they respond to their moods in several different ways, including ruminating about their distress (Luminet 2004). The original RSQ is a 71-item

self-report measure that assesses four different reactions to negative mood: ruminating, distracting, problem-solving, and engaging in dangerous activities (Luminet 2004). The problem-solving and dangerous activities scales were later dropped due to very low reliability (Luminet 2004). The full RSQ is now comprised of the Ruminative Responses Scale (RRS) and the Distracting Responses Scale (DRS). The RSQ has shown good reliability and validity.

*The Ruminative Response Scale.* The Ruminative Responses Scale (RRS) is one of the two scales from the updated RSQ. The RRS can be given as a stand-alone measure of ruminative thinking. It is a 22-item scale with items focusing on the meaning of rumination, the feelings related to one's depressed mood, specific symptoms, and on the consequences and causes of the depressed mood (Luminet 2004). The scale has shown high internal reliability as well as good convergent and discriminant validity. The RRS has also shown good predictive validity for depression. There is a 10-item short version of the RRS, which has been found to be highly correlated with the original RRS and has demonstrated high internal reliability. Nevertheless, more research is needed to establish construct validity and test-retest reliability for the short version (Luminet 2004).

*Rumination on Sadness Scale.* The Rumination on Sadness Scale (RSS) is a 13-item self-report questionnaire that assesses an individual's repetitive thoughts about current distress and the circumstances surrounding the distress or sadness (Luminet 2004). The scale also assesses the intensity and repetitive quality of one's ruminative thoughts. It has been found to have high internal consistency and high concurrent validity with the RRS (Luminet 2004). The scale has adequate test-retest reliability (Luminet 2004).

## Treatment of Depression

There are a number of evidence-based psychotherapies that can be used to treat depression in older adults. Common treatment interventions include behavioral activation/behavioral therapy, cognitive behavioral therapy, cognitive

bibliotherapy, problem-solving therapy, brief psychodynamic therapy, and life review therapy (Fiske et al. 2009). Mindfulness-based approaches can also be effective, especially for individuals who engage in depressive rumination, as these approaches teach awareness and acceptance of thoughts and emotions instead of avoiding or ruminating on the thoughts or emotions (Fiske et al. 2009). Psychotherapeutic approaches that incorporate cognitive and problem-solving interventions can be especially beneficial for depressive rumination.

## Treatment of Rumination

Treatment of rumination can be difficult, largely in part to the lack of understanding about rumination, the factors that sustain ruminative thinking, and the potential factors or interventions that could halt ruminative thinking (Purdon 2004). Nonetheless, there are a handful of evidence-based therapies, which have been shown to be effective in treating older adults that show potential in treating depressive rumination.

*Cognitive Behavioral Therapy.* Cognitive behavioral therapy, which addresses negative automatic thoughts about one's self, the world, and the future, is one of the most well-established and effective psychotherapies for depression. Yet traditional cognitive behavioral therapy protocols do not specifically address depressive rumination (Purdon 2004). As depressive rumination can exacerbate depression and prime negative automatic thoughts, it is important to address depressive rumination in treatment (Purdon 2004). It is important to assess for rumination and the content of the ruminative thoughts, which can be done by using a rumination self-report measure. Cognitive restructuring around the ruminative thoughts may be an effective way of ending rumination (Purdon 2004). Further, as depressive rumination is often used as a coping strategy, teaching the individual new, more adaptive coping strategies could also be an effective method of treating rumination (Purdon 2004).

*Mindfulness-Based Cognitive Therapy.* Mindfulness-based cognitive therapy (MBCT) is

based on Teasdale's differential activation hypothesis and interactive cognitive subsystems model (Purdon 2004). The model proposes that individuals who experience a depressive episode create numerous associations between their depressed moods and their patterns of negative thoughts, which leaves them vulnerable to another depressive episode because a small decrease in their mood activates negative thought patterns, which can exacerbate mood symptoms (Purdon 2004). MBCT teaches individuals to identify negative moods and thoughts and respond to the mood and thoughts in a way that ends "ruminative depressive processing" (Purdon 2004). Unlike traditional cognitive therapy, negative thoughts are not challenged; instead individuals are taught to be aware of and disengage from the negative thoughts. MBCT is one of the first therapeutic interventions to target depressive rumination, and preliminary evidence has shown that MBCT is an effective treatment.

## Conclusion

Rumination is the act of thinking attentively, repetitively, or frequently about one's self and world. More specifically, depressive rumination is repetitive focusing on one's depression, on depressive symptoms, and on the causes, meanings, and consequences. Depressive ruminative thinking can be especially dangerous for older adults, as it leaves them susceptible to longer, more frequent, and more severe episodes of depression, which in turn can leave them more vulnerable to chronic physical, cognitive, and social difficulties and can lead to an increased risk for mortality. Assessment of rumination in older adults is important when planning targeted treatments. While this section reviewed common measures for rumination, caution is suggested when using these measures with older adults, as normative data for these measures with this population is scarce. Rumination can be difficult to treat; however, evidence-based practices, such as cognitive behavioral therapy and mindfulness-based cognitive therapy, have shown some promise at relieving the distressing nature of depressive ruminative thinking.

## Cross-References

- ▶ [Mental Health and Aging](#)
- ▶ [Subsyndromal Psychiatric Disorders](#)

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## Rural Health and Aging: Global Perspectives

Samuel D. Towne Jr<sup>1</sup>, Janice C. Probst<sup>2</sup>,  
Matthew Lee Smith<sup>1,3</sup>, Manisha Salinas<sup>1</sup> and  
Marcia G. Ory<sup>4</sup>

<sup>1</sup>Department of Health Promotion and Behavior,  
College of Public Health, The University of  
Georgia, Athens, GA, USA

<sup>2</sup>Arnold School of Public Health, University of  
South Carolina, Columbia, SC, USA

<sup>3</sup>Department of Health Promotion and  
Community Health Sciences, Texas A&M Health  
Science Center and School of Public Health,  
College Station, TX, USA

<sup>4</sup>Health Promotion and Community Health  
Sciences, Texas A&M Health Science Center and  
School of Public Health, College Station, TX,  
USA

## Synonyms

Non-metropolitan; Non-urban

## Defining Rural

Definitions of rurality differ across nations, governmental agencies, and levels of analysis. The United Nations (UN) indicates that “countries must establish their own definitions in accordance with their own needs” (source: <http://unstats.un.org/unsd/demographic/sconcerns/densurb/densurbmethods.htm>). The Organisation for Economic Co-operation and Development (OECD) regional typology classifies rurality based on the population density per square kilometer (source: [http://www.oecd.org/gov/regional-policy/OECD\\_regional\\_typology\\_Nov2012.pdf](http://www.oecd.org/gov/regional-policy/OECD_regional_typology_Nov2012.pdf)), while the US Federal Office of Rural Health Policy defines counties outside of urban or metropolitan areas (classified as non-metropolitan counties) as rural, with lower levels of geography (e.g., US census tracts) also used to identify differing classifications of rurality within county units (source: <http://www.hrsa.gov/ruralhealth/aboutus/definition.html>). Further, the US Census Bureau defines urban spaces based on population density relative to urbanized areas or urban clusters (source: <https://www.census.gov/geo/reference/urban-rural.html>). Several geospatial identifiers also exist in the USA (e.g., FIPS county code, ZIP code, census tract) that can be used to merge datasets with multiple rural classifications (e.g., Rural-Urban Commuting Area Codes or RUCA available at <http://www.ers.usda.gov/data-products/rural-urban-commuting-area-codes.aspx>; Urban Influence Codes or UIC available at <http://www.ers.usda.gov/data-products/urban-influence-codes.aspx>; Rural-Urban Continuum Codes or RUCC available at <http://www.ers.usda.gov/data-products/rural-urban-continuum-codes.aspx>).

## Introduction

In 2010, there were 524 million individuals aged 65 and older, also referred to as older adults, representing 8% of the global population (2011). By 2050, this number is expected to rise to nearly 1.5 billion, representing 16% of the global population (2011). Thus, global focus on issues facing older adults is needed now and in the future in order to better understand and ameliorate issues

negatively impacting quality of life, especially mental health-related issues. Older people in rural communities often face different health issues relative to their urban counterparts and in addition may be disadvantaged by poorer access to services due to remoteness or minority status. Instead of providing a comprehensive collection of *all* health and health-related issues affecting these individuals globally, this chapter will highlight some of the major health-related issues facing older adults in rural areas. These include, but are not limited to, mental health or substance use (MHSU) disorder, depression-related disorders, anxiety disorders, health-related quality of life (e.g., related to chronic disease), and overall quality of life.

This chapter pulls information from multiple countries globally; however, key information is taken from United States (US) studies given the USA may hold insights for rapidly developing nations with increasing aging populations. Some developing nations may soon experience epidemiological transitions, where the prevalence of chronic conditions increases with the number of individuals growing to older age and living longer. In addition, there are higher concentrations of indigenous populations in some rural areas throughout the globe, who may face disparities in mental health-related issues. Thus, examples of some of the issues facing these populations are included.

In the USA alone, there were 47.8 million persons, 14.9% of the population, that were aged 65 or older in 2015. By 2030, this population is anticipated to increase to 74.1 million, 20.6% of all US residents (Bureau 2014). Rurality is an aging issue in the USA as the proportion of the population that is 65 years or older increases with rurality from 11.5% in large metropolitan counties to 15.4% in large rural counties, and 17.2% in smaller rural counties (2011 data) (Meit et al. 2014). Given the sharp rise in aging populations globally, and in the USA, identifying strategies that enable older adults to age in place healthfully while maintaining or achieving a high quality of life is essential and timely. Of special need is a better understanding of factors that are associated with improvements in both physical and emotional health.

## Salient Issues for Older Adults Impacting Mental Health or Substance Abuse

Globally, rural older adults face multiple challenges that affect their mental health status and the likelihood that they will obtain effective treatment. In this chapter, we highlight some of these challenges including an increased risk for chronic disease, declining health, and death of significant others, each associated with risk for MHSU problems, barriers to receipt of care ranging from stigma to difficulty of travel, and shortages of MHSU professionals in rural communities.

Limited research is available for mental health-related issues solely in rural areas globally. Thus, we provide global examples of issues facing both rural and urban areas here. The World Health Organization's World Mental Health Surveys were conducted in 14 countries across the Americas (Columbia, Mexico, the USA), Europe (Belgium, France, Germany, Italy, the Netherlands, Spain, Ukraine), the Middle East and Africa (Lebanon, Nigeria), and Asia (Japan, PR China – Beijing, Shanghai). Findings from these surveys suggest that anxiety disorders were most common in general, followed by mood disorders, and substance disorders (Demyttenaere et al. 2004). Further, the rate of individuals reporting they “received health care treatment for emotional or substance-use problems during the 12 months” prior was higher in developed countries (highest at 15.3% for the USA) versus developing countries (lowest at 0.8% for Nigeria) (Demyttenaere et al. 2004, pp. 2585–2586). In addition, the severity of illness was related to the receipt of treatment, where those with greater severity have a greater likelihood of reporting treatment (Demyttenaere et al. 2004). The authors suggested that uncertainties exist with regard to the relationship between perceived versus actual need (Demyttenaere et al. 2004). Thus, identifying barriers to and facilitators to treatment for emotional or substance-use problems in both mild and severe cases is a critical need.

The US Institute of Medicine estimates that between 2.6 and 4.0 million older adults, or approximately 6.4–10.0% of the US population aged 65 and older, had an MHSU disorder in 2010

(Eden et al. 2012). When institutionalized persons and symptoms associated with dementia are added, the estimate increases to 5.6–8.0 million persons, or an upper estimate of 20% (Eden et al. 2012). The IOM anticipates this number to increase within the aging population and be seen through cohort effects, principally attributed to greater drug use among the “baby boomer” generation (Eden et al. 2012, p. 77). While limited research is available exploring rural-urban differences in MHSU problems among older adults, some underlying conditions may suggest a greater prevalence in rural populations as related to poorer health status and the greater likelihood of adverse health changes rather than rural residence alone (Probst et al. 2006). Further, effective care is further impeded by policies that place MHSU services in a different, and lesser, category than physical illness for insurance reimbursement.

## The Challenges of Age: Chronic Disease, Declining Health, and Loss

Older adults may be likely to suffer from a variety of psychosocial issues related to chronic conditions, thereby negatively affecting their health-related quality of life. Thus, these issues may be either causing or caused by the chronic condition. The prevalence of chronic disease and illness increases with increasing age and has been shown to be more prevalent in rural areas. In the USA, roughly 90% of older adults suffer from at least one chronic disease, while three quarters suffer from at least two chronic diseases (Anderson 2012). Comorbidities with physical chronic illness can affect the mental health of older adults, with depression-related symptoms serving as precursors to other serious mental health issues such as dementia (Karel et al. 2012). In addition, with the increasing number of comorbid conditions comes the potential to have greater complexity in the management of chronic disease (e.g., medication management, failure to adhere to complex medical regimens), which may further complicate or contribute to mental health issues. Furthermore, older adults have shown to be disproportionately underserved in mental health care (Sanders et al. 2008). Thus, these individuals are a particularly vulnerable

population in need of timely and accessible health-related care, which may be less available or accessible in rural settings.

Older adults experiencing mental health problems may have fewer social support systems and weaker informal networks to connect them to mental health services (Choi and Gonzalez 2005). This lack of social supports can be an additional burden to persons experiencing physical disability or chronic impairment, because they may be less able to effectively reach a mental health facility (Choi and Gonzalez 2005). In addition, rural older adults may live far from their family which can cause increased feelings of social isolation and loneliness, leading to adverse effects on well-being and mental health (Sanders et al. 2008).

### Special Problems of Indigenous Populations

Globally, there are over 370 million indigenous individuals also known as native or aboriginal peoples (World Health Organization 2007). They are represented in over 70 countries worldwide (World Health Organization 2007). It is outside the scope of this chapter to identify issues affecting all indigenous populations. Thus, select examples are incorporated here to introduce the topic.

In the USA, American Indian/Alaska Native (AI/AN) populations are most concentrated in highly rural states; Alaska, Oklahoma, New Mexico, South Dakota, and Montana have the highest concentration of AI/AN residents, often living in tribal reservations. A history of displacement, discrimination, and poverty has led to increased prevalence of physical and mental disorders. Post-traumatic stress disorder (PTSD) and depression-related disorders (i.e., alcohol dependence) in addition to poverty are more prevalent among American Indian population groups than the general US population (Beals et al. 2005).

Problems faced by indigenous populations are not unique in the USA. Paralleling the USA, Canadian indigenous peoples experience higher rates of heavy alcohol consumption than their nonindigenous counterparts (Canada 2014). In Australia, indigenous adults experienced higher rates of psychological distress than their nonindigenous counterparts (Jorm et al. 2012).

As stated previously, the prevalence of chronic disease and comorbidities is already high among older adults (Anderson 2012). Therefore, there is a combination of multiple health disparities among indigenous populations with the already high prevalence of chronic disease with increasing age. The combination of mental health issues and chronic disease is likely to further negatively influence one's quality of life. What's more, the additional burden experienced among potentially vulnerable individuals in traditionally low-resource settings is another potential complication for these older individuals. It is therefore timely and critical to understand factors associated with potential solutions to health disparities among these individuals that extends beyond national boundaries. Thus, there is a global need to focus health interventions and policy efforts with the goal of eliminating or ameliorating health disparities among indigenous populations. More attention by policy makers and more targeted research will be needed to identify how to increase access to care and eliminate health disparities among these diverse populations. Identifying social determinants of health within these populations and identifying ways in which to ameliorate these issues will be needed both for indigenous and rural-residing individuals in general.

### Barriers to MHSU Care for Rural Elders

#### Lack of Practitioners and Access to Care

One of the most significant issues facing rural areas is low accessibility of mental health services. Globally, rural areas face gaps in access to both mental and general health-care services (Strasser 2003). This gap in the availability, coupled with the higher likelihood of poorer health status among many rural individuals, places emphasis on both the current and future needs of rural individuals (Strasser 2003). Identifying ways to ameliorate these and similar disparities is in critical need. Identifying health professional shortage areas (including mental health professional shortage areas) or medically underserved areas will help to provide targets for potential interventions where they are most needed.

Services addressing the mental well-being of individuals are necessary for their overall health, yet are not easily accessible in rural populations. Rural communities are faced with greater disparities in mental health overall when compared to urban communities, with growing populations at risk for issues such as mental illness, substance abuse, and suicide (Rural and Center 2013). Individuals in rural communities may also face stressors such as isolation and political or social exclusion, which increases their susceptibility to poor mental health (Coyle and Dugan 2012).

Inadequate knowledge and awareness about mental health-care treatment and services on the part of the practitioner can affect the appropriate receipt of mental health care for older rural adults (Sanders et al. 2008). For example, mental health professionals, such as psychiatrists or psychologists, may not be appropriately trained in geropsychiatry, even if they see a large number of older adults in their everyday practice (Sanders et al. 2008; Choi and Gonzalez 2005). Thus, this population may not receive specialized treatment that would be most beneficial to their mental health and quality of life.

#### Transportation

Rural older adults may face barriers (e.g., transportation, limited supply of providers, low quality of care, social isolation, and economic issues) in accessing health care in rural areas (Goins et al. 2005). These barriers reduce the likelihood individuals will be able to seek care when needed. Thus, rural older adults are a particularly vulnerable population that should be targeted for interventions at the community and policy level to improve or reduce these barriers.

#### Stigma

Stigmas, or potentially negative views held by society or groups of individuals regarding seeking care for mental health issues, are another important concern. Individuals who feel self-stigma, or the internalization of public stigma, may be less likely to seek help for mental health problems, as they may have feelings of worthlessness or self-blame regarding their mental health status and behaviors (Stewart et al. 2015). This can affect

their attitudes and beliefs about mental health and affect behavior resulting in help avoided until an emergent crisis occurs, rather than early on when severe mental health problems can be prevented (Stewart et al. 2015). Rural residents in particular are more susceptible to higher stigma than those living in urban areas because they may live alone, with less access to resources, and in more socially isolated conditions (Stewart et al. 2015). Thus, there is an ever-pressing need to identify potential solutions to these and other issues facing these individuals.

## Potential Solutions

### Serving Older Adults with MHSU Needs

Evidence-based health and wellness programs delivered in community settings can reach individuals where they live. It is also important to have clinical interventions to ensure they are reached in any place they go in their community (and that there are adequate referral systems in place). Several evidence-based programs have been shown to be effective at improving individuals' health and quality of life (Towne et al. 2015; Ory and Smith 2015). Examples of these programs include, but are not limited to, the Chronic Disease Self-Management Program (CDSMP), A Matter of Balance (AMOB), and EnhanceFitness (Towne et al. 2015; Ory and Smith 2015). These programs have been able to successfully reach some individuals in rural areas, yet more must be done to increase this reach (Towne et al. 2015; Ory and Smith 2015). For example, AMOB focuses on reducing the fear of falling and improving self-efficacy in preventing falls among community-dwelling adults, while CDSMP and other chronic disease self-management education programs help individuals to better manage their chronic conditions (Towne et al. 2015; Ory and Smith 2015). These resources hold great potential for improving the quality of life and well-being among older adults, given high rates of falls and even higher rates of chronic disease, comorbidities, and complications associated with chronic disease in these populations (Ory and Smith 2015). These

programs may be even more effective for those with depression or with poor health-related quality of life, given the ability to improve several interrelated issues including chronic disease self-management, injury prevention, physical activity promotion, and social engagement. Implementing and sustaining such programs provide a critical resource for community-dwelling older adults. In addition, providing access to multiple evidence-based services for a variety of purposes, including chronic disease self-management education (e.g., CDSMP), falls prevention (e.g., AMOB), and physical activity promotion (e.g., EnhanceFitness), may provide additional benefits for the growing population with multiple chronic diseases and other varied health-related issues (Ory and Smith 2015).

Other community-based solutions may also be successful. In particular, the integration and/or colocation of both behavior and primary care services may be appropriate given limited resources in some rural settings. This has been suggested as one way to work toward providing better quality, better outcomes, and lower cost (Miller et al. 2014). Increasing access to telehealth may also increase access to high-quality care in rural settings. Further, increasing access to home health-care services may enable individuals to receive needed care in their homes and may potentially reduce utilization of more costly care in clinical settings where appropriate. In line with this, ensuring nonemergency medical transportation or other voluntary safe ride programs are accessible to those in need may benefit those in isolated areas and/or those without access to transportation.

### Training Clinicians in Rural Areas

Training mental health clinicians is another area with great potential for improvement. Rural providers may have limited access to training or continuing education opportunities (Adler et al. 2013), thus holding potential implications for the quality of care provided by individuals with less access to effective training. Providing training for clinicians via teleconferencing platforms has been shown to be met with satisfaction among clinicians (Adler et al. 2013). Thus, the opportunity for technology connecting

individuals across space, as seen with telehealth, may hold implications to increase connectivity (e.g., communicating remotely using technology) for providers in terms of training. More will be needed to explore this and similar efforts further.

### Policy

Policies affecting health and well-being for millions of older adults are varied. In the USA, the Mental Health Parity and Addiction Equity Act (MHPAEA) of 2008 was a first step at increasing access to MHSU services among older adults. In one of its provisions, Medicare co-payments for MH care were reduced from 50% in 2010 to 20% in 2015. However, the MHPAEA did not require insurers, including those who provide Medicare supplement plans, to provide MH services.

The Affordable Care Act (2010) classified mental health services as an essential benefit. This emphasis may focus greater attention on the needs of individuals with mental health-related issues. Similarly, the expansion of public health-care insurance (i.e., Medicaid) to additional low-income persons through the Affordable Care Act may improve access to care for individuals with chronic mental and physical health issues (Mechanic 2014). However, Medicaid expansion, and the Federal subsidies for low-income individuals that were tied to such expansion, was determined to be a prerogative of individual states. In 2015, the majority of rural uninsured persons lived in states that had not approved Medicaid expansion (Anthony 2014). More research will be needed to evaluate the lasting effects of these policy changes on the availability of care for older adults in rural settings.

Exploring policies in developing nations that have been successful at increasing access to appropriate care for rural older adults will also be needed. The rural cooperative medical scheme (RCMS) in China is just one example of a developing nation attempting to use policy to affect greater equity in accessing needed care. More research into this and other similar policies around the globe will be needed to identify the best policy solutions and most effective strategies to increase access to timely and appropriate health-related care in rural settings.

## Conclusion

Individuals in rural areas face several barriers in accessing both mental health services and other forms of health care. Rural older adults are a particularly vulnerable group, given anticipated rates of physical decline and related mental health issues. Identifying treatment gaps facing these populations and devising potential solutions is both timely and critical given the rapidly increasing older adult population in developed and developing nations.

Potential solutions include identifying ways to minimize the stigma associated with accessing mental health services. In addition, increasing the availability of both mental health-care services and other more general health-care services where individuals live is another critical step in reducing barriers to seeking care. Grouping such services in the same location may be one way of increasing access. Improving the delivery of multiple evidence-based and community-based health and wellness programs targeted to the unique needs of older adults may improve individuals' ability to manage their health and delay the onset of complications associated with chronic disease. In addition, exploring factors related to the built, natural, and social environments of rural communities will be needed to gain a fuller picture of barriers and facilitators to increased quality of life. Finally, identifying policies that can bridge the gap between those in need of these services and health-care professionals is essential. These and other solutions will be needed to respond to the increasing needs of rural older adults throughout the global community.

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## Schizophrenia and Other Psychotic Disorders in Older Adults

Rowena Gomez<sup>1</sup> and Laura Coopersmith<sup>2</sup>

<sup>1</sup>Pacific Graduate School of Psychology, Palo Alto University, Palo Alto, CA, USA

<sup>2</sup>Palo Alto University, Palo Alto, CA, USA

### Synonyms

Psychosis

### Definition

Schizophrenia and Other Psychotic Disorders: Psychiatric disorders involving poor understanding or breakdown of reality due to delusions and/or hallucinations.

### Introduction

Schizophrenia and other psychotic disorders are commonly characterized by positive symptoms (i.e., delusions and hallucinations) and less so by negative symptoms (i.e., flat affect, anhedonia, and poverty of speech). These disorders are believed to be one of the most severe types of mental illness with significant health-care and economic burdens around the world. In particular, schizophrenia has been labeled as the eighth

leading cause of disability in the world (Lopez and Murray 1998). In addition, the annual total costs (including health care, unemployment, and disability needs) associated with schizophrenia in the United States has been estimated to be more than \$62 billion (Wu et al. 2005).

Psychotic symptom severity does not necessarily worsen with age in late-life schizophrenic and psychotic disorders. In fact, there is evidence from several review articles of longitudinal studies that psychotic severity, especially positive symptoms, improves in old age compared with younger age (Berry and Barrowclough 2009). For instance, Cohen found that older patients with schizophrenia have a lower rate of auditory hallucinations compared to younger patients with schizophrenia (Cohen 1995). Moreover, Jeste reported that aging was related to a decrease in psychopathology, even after controlling for chronicity (Jeste et al. 2003).

This encyclopedia entry covers schizophrenia and psychotic disorders in aging and will describe clinical and treatment information and issues that are specific to older adults with these serious mental illnesses.

### Prevalence

There is some evidence that the prevalence of schizophrenia and psychotic disorders is lower in older adult populations versus younger adults. In the United States, the National Institute of

Mental Health reported that the 12-month prevalence rate of schizophrenia only is 1.1% for the adult age population (National Institute of Mental Health 2011). In comparison, Meesters and colleagues reported that the prevalence of all psychotic disorders in persons aged 60 years and older was 0.71%, specifically 0.55% for schizophrenia, 0.14% for schizoaffective disorder, and 0.03% for delusional disorder (Meesters et al. 2012). In another study of 894 older adults aged 70–82 years, they found that the 1-year prevalence of any psychotic symptoms is 0.9% for those aged 70 years and 1.2% among those aged 78–82 years (Sigström et al. 2009). Notably, these rates are higher in the latter study because they measured psychotic symptoms rather than a clinical diagnosis of schizophrenia.

### Late Onset of Schizophrenia

Although it has been estimated that about 85% of older patients were diagnosed before the age of 45 years, there is significant attention and research that focus on late-onset schizophrenia (Cohen 1995; Jeste et al. 2003). Howard et al. wrote a summary about late-onset schizophrenia based on a literature review of related research studies and a meeting by members of the International Late-Onset Schizophrenia Group (Howard et al. 2000). The group reported that about 15% of individuals with schizophrenia have their first psychotic episode after age 40. In late onset, the prevalence is higher in women than in men. They also concluded that symptoms, especially positive symptoms, were similar in early onset (before age 40) versus late onset. But when compared to very late onset (onset after age 60), there was evidence that the very late-onset groups had higher rates of visual hallucinations and lower rates of thought disorder and affective blunting.

The International Late-Onset Schizophrenia Group also concluded that late-onset schizophrenia has somewhat better prognosis compared to early onset (Howard et al. 2000). For instance, persons with late-onset schizophrenia compared to early-onset schizophrenia had less impaired occupational and psychosocial functioning.

They also had better premorbid educational functioning. Nevertheless, late-onset individuals with schizophrenia also often seem to have premorbid schizoid or paranoid personality traits. Cognitively, they have poorer performance in some measures of learning, motor skills, verbal ability, and executive functioning. For the very late-onset patients (onset after 60 years old), the cognitive impairments are more global but not to the same degree as patients with dementia as learning capacity is still not impaired (Howard et al. 2000).

The International Late-Onset Schizophrenia Group also agreed that those with late onset require lower dose amounts of antipsychotics compared to patients with early-onset illness (Howard et al. 2000). Specifically, they concluded that late-onset patients will respond to dose amounts that are about 25–50% of the usual dose for early-onset patients. For the very late-onset patients, they may effectively respond to dosage amounts as low as 10% of the usual dose for early-onset patients (Howard et al. 2000).

### Psychotic Disorders Due To Other Conditions: Dementia

In older adults, psychotic problems can occur secondarily to other conditions such as dementia, now called neurocognitive disorders in the *Diagnostic and Statistical Manual of Mental Disorders 5th Edition* (American Psychiatric Association 2013). In a review of 55 studies by Ropacki and Jeste, they found that psychotic symptoms were reported in 41% of patients with Alzheimer's disease (AD; mean age = 75, range = 68.8–84.6) (Ropacki and Jeste 2005). Specially, 36% of the AD patients experienced delusions and 18% experienced hallucinations. Delusions are more prevalent in the moderate stages (compared to mild stages) of dementia, suggesting that a certain level of neurophysiological functioning and neuroanatomical presence is needed to have delusions. They found that in the first 3 years of the psychotic episode, the incidence of psychosis increased and then plateaued after 3 years. In these patients, the duration of the psychosis varied greatly across patients. However, in their review of the literature, they suggest that

psychotic symptoms seem to persist about several months and rarely extend beyond a year (Ropacki and Jeste 2005).

As for risk factors, Ropacki and Jeste found only weak or mixed evidence of the associations of gender, education, and family history of dementia or psychiatric disorders with psychosis (Ropacki and Jeste 2005). As for the factor of age, whether it be patient's age, age of onset, or chronicity, these age-related factors were also mixed. They found several studies that successfully reported and several others that have failed to find these age effects with the older samples of individuals with schizophrenia (Ropacki and Jeste 2005).

But the authors did mention significant ethnic differences and reported research that found that African Americans with Alzheimer's disease were more likely to experience psychotic symptoms compared to Caucasians (Ropacki and Jeste 2005). They also suggested that incidence of psychosis was related to a faster decline in cognition. Particularly, hallucinations, but not delusions, seem to be associated with accelerated cognitive decline in dementia patients.

### Remission in Older Adults

Remission can be defined as having little or no psychotic symptoms. Many cross-sectional studies have indicated that there is a higher remission rate in older versus younger adults with schizophrenia. For instance, in 2008, the Schizophrenia Group found that 49% of community-dwelling patients with schizophrenia who developed it before age 45 were in remission among a sample of 198 persons aged 55 years and older (Bankole et al. 2008). Meester et al. found a lower remission rate of 29.4% in adults with schizophrenia with a mean age of 68 years old (Meesters et al. 2011). In this study, both positive symptoms (81.9% of patients) and, to a lesser extent, negative symptoms (57.2% of patients) explained non-remission rates in their sample. Remission was also found to be higher in individuals with schizoaffective disorder (47.8%), compared with individuals with schizophrenia (24.4%) (Meesters et al. 2011).

### Mortality Rates

Individuals with schizophrenia have a higher mortality rate than the general population due to a number of contributing factors (Saha et al. 2007). A review of 37 mortalities in schizophrenia studies by Saha, Chant, and McGrath found that the increased rate of death was 2.5 times higher for persons with schizophrenia compared to the general population (Saha et al. 2007). In another study conducted in Finland that examined 66,881 people with schizophrenia, those with schizophrenia were dying on average 25 years earlier than the general Finland population (Tiihonen et al. 2009). Factors impacting mortality in schizophrenia include high rates of suicide, complications secondary to low socioeconomic status, high-risk behaviors, and somatic conditions increasingly caused by the negative effects of second-generation antipsychotic medications (Saha et al. 2007; Tiihonen et al. 2009). Weight gain and metabolic syndrome are also becoming more prominent in the population with schizophrenia leading to higher rates of cardiovascular mortality for this population (Saha et al. 2007). Furthermore, adults with schizophrenia have been reported to exhibit signs of physical aging at an increased rate in comparison to the general population (Jeste et al. 2003).

Research has shown however that long-term antipsychotic medication use leads to overall lower mortality rates in patients with schizophrenia when compared to unmedicated individuals with chronic schizophrenia (Tiihonen et al. 2009). With the exception of some specific second-generation antipsychotics, these medications have been shown to have positive effects on life expectancy, especially when the patient exhibits treatment compliance (Tiihonen et al. 2009). One medication in particular, clozapine, contributed to lower rates of suicide mortality and the possibility of individuals leading a healthier lifestyle to combat the negative cardiometabolic effects of antipsychotic medication (Tiihonen et al. 2009). Though there are drawbacks to the use of clozapine (e.g., frequent blood level monitoring), study results indicating the positive effects on the life span of individuals

with schizophrenia indicate that it should be considered as a first-line treatment (Tiihonen et al. 2009).

## Neurobiology and Cognition

There are relatively few studies that have examined brain structures in older adults with schizophrenia. Frisoni et al. mentioned that previous studies have found various brain abnormalities such as cortical and subcortical volume reduction (Frisoni et al. 2009). It is uncertain how much of these reductions were due to schizophrenia per se versus long-term use of antipsychotic medications or possible comorbid neurocognitive disorders such as Alzheimer's disease. In their review, they describe mixed finding in MRI studies. Some have found significant reductions in brain volume such as in the hippocampus and amygdala in older adults with schizophrenia; others have found no differences, such as one study that compared 45–87-year-old patients with early- versus late-onset schizophrenia compared with healthy controls (Frisoni et al. 2009). Frisoni and colleagues conducted an MRI study of geriatric patients with schizophrenia, Alzheimer's patients, and healthy older adults (Frisoni et al. 2009). They found that the older adults with schizophrenia have 10% less left cortical gray matter volume and 11% less right cortical gray matter volume compared with healthy controls. In contrast the healthy controls were 7% higher in left gray matter volume and 5% higher in right gray matter volume compared with the Alzheimer's disease patients. Furthermore, in a sample of individuals with schizophrenia compared with the healthy controls, other regions with significantly less brain volume included the cingulate gyrus and orbitofrontal cortex. Interestingly, the volumes of these brain areas were not statistically different between the persons with schizophrenia or Alzheimer's disease.

In a more recent study by Prestia et al., older individuals with schizophrenia were compared to older healthy adults (Prestia et al. 2015). These older adults with schizophrenia had significantly smaller left and right hippocampus and amygdala

as well as tissue loss in specific connections with the frontal cortical and limbic structures. Volumes of the hippocampus and the amygdala were positively correlated with the severity of negative psychotic symptoms but not with positive symptoms. For cognitive correlates with brain structures, only one measure of executive functioning and language reproduction (i.e., verbal fluency) was positively associated with the left hippocampus volume. There were no significant correlations between volume of these brain structures with any other measures of cognition, specifically learning and memory, language, constructional abilities, and executive functioning.

Multiple studies have shown that general intelligence is about 5–10 IQ points lower in persons with schizophrenia than comparison samples (Jeste et al. 2011). It is unclear if this cognitive deficit is a prodromal indication of the disorder's neuropathology or if it is a risk factor for developing severe mental illness; however, research has illustrated cognitive deficits in persons with schizophrenia as early as the first grade (Palmer et al. 2009). In adulthood, cognitive functioning has been found to be lower in individuals with schizophrenia in several cognitive domains such as learning and memory, attention, psychomotor skills, and executive functioning compared to healthy controls (Berry and Barrowclough 2009). Interestingly, psychotic symptom severity seemed to be independent of degree of cognitive impairment (Berry and Barrowclough 2009). There is evidence of stability in young and middle-aged adulthood (Friedman et al. 2001). In a 6-year follow-up of cognitive functioning of adults with schizophrenia, they found that cognitive decline was limited to those over age 65 (Friedman et al. 2001).

With these cognitive deficits especially in old age, some research hypothesize that diagnosis of psychotic disorders may increase the risk of dementia. In a study by Harvey and colleagues, cognitive decline and conversion to dementia rates were greater for elderly patients with schizophrenia who spent a majority of their lives institutionalized compared to the general population (Harvey et al. 1999). However, up to 90% of older patients with schizophrenia live in the community.

Though these individuals tend to illustrate mild cognitive impairment throughout their lives, studies have found that the rate of cognitive aging in these patients appears to be comparable to individuals without schizophrenia (Jeste et al. 2011). In other words, these community-dwelling patients with schizophrenia exhibited similar age-expected cognitive decline across neurocognitive domains as the general aging population (Jeste et al. 2011). Perhaps then the risk of dementia in this population is very severe psychopathology that results in institutionalization early in life.

### **Psychosocial Functioning and Quality of Life**

Subjective quality of life is a self-report measure used with persons with schizophrenia to assess overall well-being and satisfaction with life (Meesters et al. 2013). Though positive and negative psychotic symptoms greatly impact a person with schizophrenia's life, it has been shown that general psychopathology such as depression and anxiety have a more significant impact on subjective quality of life, especially in older individuals (Eack and Newhill 2007). Additionally, social cognition factors such as theory of mind largely contribute to an individual's assessment of his or her quality of life, as well as psychosocial factors (Meesters et al. 2013). Elderly patients with schizophrenia are likely to have less impaired psychosocial functioning compared to younger patients (Berry and Barrowclough 2009). This is likely due to successfully managing their symptoms in old age that in turn contributes to the overall higher quality of life rating within this subset of the population of individuals with schizophrenia (Meesters et al. 2013). Still, Berry et al. reported that several studies have found that older adults with schizophrenia compared to same-aged controls were still impaired in "communication, transportation, finance, engagement in activities, forming friendships, looking after the home and shopping" (p. 70) (Berry and Barrowclough 2009). They also reported a similar study of patients with schizophrenic and

schizoaffective disorders over the age of 45 years old who have greater global functional impairment compared to bipolar patients (Berry and Barrowclough 2009).

Research has shown that social cognition has the most significant impact on quality of life for individuals with schizophrenia (Tolman and Kurtz 2012). Furthermore, the domain of theory of mind within social cognition has been shown as more influential to an individual's quality of life than emotion perception (Tolman and Kurtz 2012). Impaired theory of mind negatively impacts quality of life as well as intact theory of mind for a more severely ill patient (Tolman and Kurtz 2012). This influence of theory of mind is in contrast to healthy controls and siblings of people with schizophrenia where neurocognitive factors serve as better predictors for quality of life (Tolman and Kurtz 2012). A patient's ability to perceive his or her impact on the surrounding environment and interpersonal interactions is more likely to improve the individual's quality of life in comparison to simply identifying emotional cues displayed by others (Tolman and Kurtz 2012).

Individuals with schizophrenia have exhibited deficits in community functioning such as obtaining and maintaining employment and living in the community independently (Berry and Barrowclough 2009). These deficits are strongly tied to neurocognitive deficits and continued decline throughout aging (Tolman and Kurtz 2012). Interestingly, a recent study on neuropsychological predictors of objective and subjective quality of life suggests that lower neurocognitive functioning may serve as a protective factor in life satisfaction to some extent in that patients with schizophrenia who also have stronger cognitive abilities report lower satisfaction of life due to increase insight into their level of disability and severe illness (Tolman and Kurtz 2012).

As a person with schizophrenia ages, they are likely to see an improvement in psychosocial functioning due to reduced symptoms and fewer subsequent hospitalizations as well as a better understanding of how to manage the disorder (Jeste et al. 2011). They are likely to subjectively rate their quality of life as better than younger or

middle-aged patients with schizophrenia due to acquiring numerous coping skills and construction of adequate social support to improve overall functionality (Jeste et al. 2011). More specifically, structural changes in the brains of elderly schizophrenia patients have been shown as well as normal age-related reduction in activity of the monoaminergic system that can assist in decreasing positive psychotic symptoms (Jeste et al. 2011). Additional contributing factors to improve quality of life and psychosocial functioning in elderly patients include reduced substance use behaviors, increased medication compliance, and longer exposure to psychotherapeutic interventions (Jeste et al. 2011).

## Treatment

For schizophrenia and other psychotic disorders, the typical treatment especially if the psychotic symptoms are significantly impairing their daily functioning is antipsychotic medications. Specifically, typical (i.e., first generation such as haloperidol, chlorpromazine, molindone) and atypical (i.e., second generation such as olanzapine, risperidone, and clozapine) antipsychotics have been used to successfully treat positive psychotic symptoms. In general, this remains to be true for older patients with schizophrenia, but specific treatment guidelines must include aging considerations for this patient population.

There is relatively sparse research conducted on the effectiveness of antipsychotic medications in older adults. The studies that currently exist have reported somewhat mixed findings. In one study that examined the efficacy and safety of clozapine in 45 older adults with schizophrenia who were treatment resistant, they found that the medication was well tolerated and was not discontinued by any patient and that the rates for rehospitalization were lower with this medication than when they were on other medications in a 5-year comparison period (Pridan et al. 2015). However, in a 2-year longitudinal study reported by Jeste and colleagues, four different second-generation medications, namely, aripiprazole, olanzapine, quetiapine, and risperidone, were

examined in 332 middle-aged and older adult outpatients. No significant improvements in psychiatric symptoms were detected (Jeste and Maglione 2013).

In comparison to younger adult patients, older adults with schizophrenia are at higher risk of the pharmacological side effects of first-generation antipsychotic medications that include Parkinson-like symptoms, falls, and metabolic problems (Jeste and Maglione 2013). These side effects have been found to be as high as 60% in older patients with schizophrenia compared to only 19% for younger patients. This is likely due to the effects of aging that include slower metabolism and greater receptor sensitivity (Berry and Barrowclough 2009). In the 2-year longitudinal study by Jeste and colleagues that examined four atypical antipsychotic medications in middle-aged and older adults, the rates of significant side effects were 50% for nonserious side effects and 23.7% for serious side effects, including 36% incidence of metabolic syndrome (Jeste and Maglione 2013).

Another factor that strongly affects the success of medications is adherence. Unfortunately, similar to younger patients, adherence rates to medications have been found to be poor in older outpatients with schizophrenia. In the same longitudinal study by Jeste and colleagues, more than 50% of the patients discontinued these second-generation (atypical) medications within 6 months (Jeste and Maglione 2013). This is likely due to the relatively high rates of side effects that were reported in their sample.

As for non-medication treatments, psychosocial as well as cognitive interventions have been found to be helpful for older psychotic patients. For example, Jeste and colleagues described a randomized controlled study conducted by Patterson et al. in 2006 that used a manualized treatment called functional adaptation skills training (FAST) in 240 middle-aged and older psychotic adults over a 24-week (session of 2 h per week) treatment period (Jeste and Maglione 2013). This treatment focused on six areas of daily living functioning including: (1) medication management, (2) social skills, (3) communication skills, (4) organization and planning,

(5) transportation, and (6) financial management. They found significant improvements in social and communication skills but no significant improvement in psychotic symptom severity, depression, or quality of well-being (Jeste and Maglione 2013).

In a more recent study of cognitive-behavioral and social skills training (CBSST) treatment, Granholm et al. conducted a randomized control study of 79 older adults with schizophrenia (Granholm et al. 2013). These researchers found that the CBSST significantly improved life satisfaction, motivation, and self-esteem and lowered symptom distress. Encouragingly, retention rates have been found to be as high as 86% in completing psychotherapy interventions as well as that mean attendance (of sessions) rate to be 92% (Berry and Barrowclough 2009).

In sum, the research is somewhat mixed in the benefits of antipsychotic medications in older adults especially when compared to the costs of these medications and their potential long-term side effects. Randomized controlled trials need to be made in this area to get a clearer understanding of the positive and negative effects of antipsychotic medications on older adults with psychotic disorders. Nevertheless, the use of antipsychotics is still generally the first line of defense for psychotic disorders for older adults. According to Jeste and Maglione, the generally accepted protocol for antipsychotic medication is recommended to be a lower initial dose (25–50% lower compared to young adults with schizophrenia) with slow increase in dosage depending on tolerance of side effects and treatment response (i.e., the significant reduction of psychotic symptoms). As for psychosocial and cognitive treatment studies, encouraging results have been found. This is not to suggest that these treatments are better than medication. Rather, in addition to medication, these treatments can significantly improve the quality of life of these older patients.

## Conclusion and Future Directions

As the numbers of geriatric patients with schizophrenia and other psychotic disorders increase in

the United States and all over the world, there is an increased need for continued research in the understanding and treatment of late-life schizophrenia. This entry suggests that while there are many commonalities between younger and older adults with schizophrenia, the differences both qualitatively and quantitatively between these age groups point to the importance of research and clinical investment for geriatric patients with schizophrenia. For these vulnerable groups of patients, they have characteristics of double jeopardy due to old age and severe mental illness. Therefore, more clinical research still needs to be done for tailored and multidisciplinary assessment and treatment of geriatric schizophrenia and psychotic disorders to aid in patient treatment management, reduce economic and family/caregiver burden, and ultimately improve quality of life for these patients.

## Cross-References

- ▶ [Bipolar Disorder in Later Life](#)
- ▶ [Depression in Later Life](#)
- ▶ [Depression and Cognition](#)

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## Second Generation Socioemotional Selectivity Theories

Susan T. Charles and Joanna Hong  
 Department of Psychology and Social Behavior,  
 University of California, Irvine, CA, USA

### Synonyms

Emotion and aging; Emotion regulation; Emotional well-being; Socioemotional functioning

## Definition

Socioemotional selectivity theory has been informing much of the research on emotion and aging for the past 25 years. The theory describes how aging is related to increased importance placed on emotional goals. In the past decade, researchers have developed new theory based on socioemotional selectivity theory, targeting specific aspects of emotional experience. These theories focus on both cognitive aspects involved in processing emotional information (cognitive control hypothesis; positivity effect) and emotion regulation strategies (strength and vulnerability integration).

Socioemotional selectivity theory describes how people's thoughts and behavior change with age as a function of their temporal perspective. According to the theory, as temporal perspective – or how much time people perceive is left in their lives – grows increasingly shorter, people will place more value and importance on emotional goals (refer to the entry on socioemotional selectivity theory for a more expansive description). The importance placed on emotional goals will guide social partner preferences; change how people attend to, appraise, and remember emotional and nonemotional information; and influence emotion regulation strategies and emotional well-being. The wide-ranging applications of socioemotional selectivity theory on social, emotional, health-related, and cognitive processes have been discussed for years (Carstensen et al. 1999). In fact, the continued applications of this theory into new areas of research has resulted in three second-generation theoretical models that articulate age differences observed in specific areas of cognitive and emotional functioning. They include the positivity effect, the cognitive control hypothesis, and strength and vulnerability integration (SAVI).

## Positivity Effect

Socioemotional selectivity theory posits that when perceived time left in the life span is limited, as is normative for older adults and not younger adults, saliency of emotional information increases over

nonemotional information. In an early test of the theory, people read a short passage from novel that included both nonemotional and emotional content; then, less than an hour later, participants were asked to recall the contents of this passage in an incidental memory paradigm (Carstensen and Turk-Charles 1994). Results indicated that each successively older age group recalled a greater proportion of emotional to nonemotional material. This increased saliency of emotional information was also examined in later studies, but importantly, Laura Carstensen and her colleagues examined the importance of the valence in these recollections. When recalling events from participants' lives, for example, the autobiographical memories of older adults were more positive than those of younger adults (Kennedy et al. 2004). When either recalling or recognizing positive, negative, and neutral images that they had previously viewed, older age was related to recalling a greater proportion of positive images relative to negative images; younger age, in contrast, was associated with recognizing and recalling relatively more negative to positive and neutral images (Charles et al. 2003). Likewise, another study in Carstensen's lab studied age difference in attention for positive, negative, and neutral stimuli (Mather and Carstensen 2003). The researchers found that older adults focused their attention on the more positive (when presented with positive and neutral faces) and less negative (when presented with negative and neutral faces) facial stimuli. Younger adults, in contrast, were more likely to focus their attention on more negative faces.

Carstensen and her colleagues termed this cognitive phenomenon the positivity effect, whereby older age is associated with attentional and memory performances that favor more positive, or less negative, information (Carstensen and Mikels 2005; Carstensen et al. 2006). Since publication of the first studies and theoretical papers where the term was first presented, more than 100 studies from multiple laboratories have studied the positivity effect, replicating the important finding – when examining positive compared to neutral stimuli, when comparing negative stimuli versus neutral stimuli, or when comparing cognitive processes in relation to all three valences (positive, negative, and

neutral) together in a study (Reed and Carstensen 2012). Furthermore, a recent meta-analysis examined the conditions under which the positivity effect is likely to be observed in empirical studies (Reed et al. 2014). These conditions included: (1) providing participants with no explicit instructions regarding how to examine the information and (2) studying groups of people that spanned a wide age range. The reasoning behind the first effect is explained by socioemotional selectivity. With no explicit instructions, people process information using their own goals. Older adults, who increasingly prioritize emotional goals, will thereby attend to emotional material more than nonemotional material relative to their younger counterparts. If, however, researchers ask older adults to instead prioritize accuracy or another goal, the performance of older adults will reflect this current goal request, and not their own preferences.

The second aspect is related to socioemotional selectivity theory's position that the age-related change in time perspective is linear and gradual across a normative, long, life span. As a result, age-related changes are very small and will best be detected when comparing across a long age range, or when comparing between groups who vary in age to a great extent.

### **Cognitive Control Hypothesis**

Socioemotional selectivity theory posits that time perspective shapes motivational goals, which in turn shape emotional experiences. Other theories, however, have proposed different factors responsible for age differences in emotional experiences. For example, dynamic integration theory discusses how older age is generally related to declines in the cognitive ability to process complex emotional information (Labouvie-Vief 2003). This theory further contends that positive information is less complex and therefore easier to process than negative information. As a result, dynamic integration theory posits that older adults will compensate for this loss in ability by distorting information in a positively biased direction and by appraising the world in a simpler, yet more positive, manner. The more recently proposed aging-brain model also takes a

loss-based approach, stating that older adults are focusing on and remembering positive information over negative information as a result of age-related declines in the amygdala, which differentially affects attention to negative information more so than positive information (Cacioppo et al. 2011).

In contrast to the loss-based explanations, the cognitive control hypothesis states that high-functioning cognitive control is necessary for older adults to act upon and achieve their emotional goals. Thus, people with the highest levels of executive control will be most successful in their emotional goal pursuits as importance increases with age (Kryla-Lighthall and Mather 2009). Researchers tested this hypothesis by examining the positivity effect for older and younger adults who varied on measures of cognitive control and by examining how performance was affected when people were engaged in a divided attention task, which limits cognitive resources for the emotional task at hand (Mather and Knight 2005; Knight et al. 2007). Results indicated that when dividing the group into high and low performers on the executive control tasks, older adults who scored highest were the ones who displayed the positivity effect, whereas younger adults showed a bias toward negative information regardless of their cognitive performance (Mather and Knight 2005). Older adults who scored low on the executive functioning task remembered more negative than positive or neutral information, showing the same pattern as the younger adults. In addition, when older adults were distracted in studies using divided attention paradigms, they no longer displayed the positivity effect and instead showed biases toward negative information (Mather and Knight 2005; Knight et al. 2007). These studies showed that the positivity effect was not the result of low cognitive functioning, as the loss-models presumed, since lower executive functioning leads to increased negativity. In addition, other studies also showed that superior cognitive performance was required for emotional material to that for nonemotional material (e.g., Mikels et al. 2005). For example, one study confirmed the usual association between older age and worse working memory performance only for nonemotional visual images, but no age differences

were present for visual images with emotional content (Mikels et al. 2005). Moreover, older adults had better performance for positive over negative visual information, whereas younger adults showed the reverse pattern. These findings further support socioemotional selectivity theory, and the cognitive control hypothesis, by showing that older adults invest their cognitive resources in the activities most important to them: those aligned with emotional goals.

The cognitive control hypothesis, then, bolsters SST in two ways: first, the hypothesis has generated findings showing that older adults prioritize emotional goals such that they expend cognitive efforts to display the positivity effect. Thus, the positivity effect is the result of older adults' active goal strivings and not a byproduct of a process over which older adults had no active control, such as a failure to inhibit emotional stimuli. In addition, the findings directly contradict researchers who posit that the positivity effect is the byproduct of cognitive decline.

### **Strength and Vulnerability Integration (SAVI)**

SAVI is the most recent theoretical model developed from SST (for a complete description, see the section on strength and vulnerability integration). Most of the research motivated by socioemotional selectivity theory has demonstrated age-related gains in processing emotional information and in levels of positive affective experience. In addition to the previously recognized strengths of aging, SAVI incorporates age-related decline and focuses on the boundary conditions of age-related increases in functioning (Charles and Piazza 2009; Charles 2010). SAVI examines when older adults are able to focus on and achieve their emotional goals (as have many studies of socioemotional selectivity theory), but adds an emphasis to the situations when older adults are no longer able to maintain high levels of control in sustaining emotional well-being.

SAVI incorporates socioemotional selectivity theory to explain why older adults increasingly focus on and prioritize emotion-related goals and

why, as a result, they are motivated to seek positive emotional experiences and avoid situations that elicit negative distress. Socioemotional selectivity theory, as its name implies, emphasizes selectivity, such that older adults strategically select the situations and environments that promote emotional well-being. This is strength of aging, garnered from time perspective, as described by socioemotional selectivity theory, and also by life experiences and time lived, which provide older adults with information about the situations, social relationships, and experiences that are the most beneficial to their emotional well-being. These strengths promote successful emotion regulation and explain why, in large groups of adults spanning a wide age range, affective well-being shows similar levels if not higher levels among the older adults in the sample.

When older adults cannot select their environments to maintain affective well-being, however, they experience distress. Because older adults' motivational goals are focused on avoiding negative affect, stressful situations are often less frequently experienced with age, even to the extent that healthy older adults in their 80s report fewer daily stressors than those in their 60s and 70s, for example (Charles et al. 2010). When a situation arises that elicits high levels of arousal, however, SAVI posits that the benefits of aging will be attenuated. At this point, age-related physiological vulnerabilities will make regulating high levels of arousal difficult. SAVI posits that the effects of physiological arousal will be harder to modulate in an older and more vulnerable system. In addition, the immediate situation will place demands on the system, similar to the divided attention task situations discussed above (Mather and Knight 2005). In such situations, the current physiological demands make it more difficult to use emotion regulation strategies such as positive appraisals, so age differences in affective reports will be attenuated and sometimes may even not be present in the midst of these distressing situations.

When people are immediately faced with a negative event, they lack the time to appraise the situation, and physiological demands on their system will need to be modulated. As time passes, people will use their appraisals and recall the

emotional experience; these appraisals and memories are posited to become more positive and less negative with age. As a result, age differences will be greatest for events that occurred farther away from the time they were assessed and less pronounced for emotional experiences that are closer to the time they occurred. One study, for example, found that older adults report lower levels of negative affect than younger adults when asked about emotions experienced across various time intervals, such as the current day or the past week (Charles et al. 2015); however, age differences were greater the longer the time recalled (across a month, for example, as opposed to a day).

## Conclusion

All of these theoretical models originated from studies testing socioemotional selectivity theory. Each one – the positivity effect, the cognitive control hypothesis, and SAVI – incorporates the tenets of socioemotional selectivity theory to explain age differences in thoughts and behaviors. These second-generation theories narrow the focus of socioemotional selectivity theory to apply to specific cognitive processes (positivity effect), cognitive conditions necessary for the theory to work (cognitive control hypothesis), and context-specific conditions when emotion regulation benefits from strength and vulnerability integration (SAVI). As researchers apply socioemotional selectivity theory to increasingly diverse aspects of emotional experience, new information will arise, and new terms and theories to explain them. These theories optimally will serve as a guide for future research when investigating the mechanisms behind age differences in social and emotional experiences.

## Cross-References

- ▶ [Age-Related Positivity Effect and Its Implications for Social and Health Gerontology](#)
- ▶ [Aging and Psychological Well-Being](#)
- ▶ [Emotional Development in Old Age](#)
- ▶ [Mental Health and Aging](#)

- ▶ [Positive Emotion Processing, Theoretical Perspectives](#)
- ▶ [Psychosocial Well-Being](#)
- ▶ [Social Cognition and Aging](#)
- ▶ [Socioemotional Selectivity Theory](#)
- ▶ [Strength and Vulnerability Integration](#)

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## Selection, Optimization, and Compensation at Work in Relation to Age

Andreas Müller<sup>1</sup> and Matthias Weigl<sup>2</sup>

<sup>1</sup>Institute for Occupational and Social Medicine, Medical Faculty, Düsseldorf University, Düsseldorf, Germany

<sup>2</sup>Institute and Outpatient Clinic for Occupational, Social, and Environmental Medicine, Ludwig-Maximilians-University, Munich, Germany

### Synonyms

Action regulation; Goal setting; Life management strategy; Resource allocation

### Definition

The model of selection, optimization, and compensation (SOC) encompasses three processes of action regulation in respect to successful aging and life-management: Selection refers to the setting and prioritization of goals, based on personal motives and preferences (elective selection) or due to perceived loss of internal or contextual resources (loss-based selection). Optimization involves the obtainment, improvement, and coordinated use of individual means to pursue important selected goals. Compensation involves the acquisition and application of alternative individual means or the utilization of external or technological aids to substitute lost means.

### The Model of Selection, Optimization, and Compensation

Individual well-being and productivity across the lifespan depend largely on access to resources. In terms of the Conservation of Resources Theory (COR) resources can be considered as internal or external entities that are either valued in their own right (e.g., health) or as means to obtain valued ends (e.g., money) by most people within a given culture in a broad array of situations (Hobfoll 2002). An aging individual faces dwindling intra-individual resources (e.g., physical fitness, health, sensory abilities, and basic cognitive functions) that successively outweigh gains of resources (e.g., knowledge, experience, and social status) (Baltes 1997). In that vein, one of the most essential challenges for aging employees is to maintain well-being, functioning, and productivity over the work lifespan despite this relative loss of resources.

The model of selection, optimization, and compensation (SOC), introduced by Paul and Margret Baltes (Baltes and Baltes 1990), provides a theoretical framework to explain three fundamental action strategies that enable individuals to cope with resource losses and to conserve valuable resources throughout the lifespan (Hobfoll 2002). The SOC model suggests that every developmental process encompasses a combination of

three kinds of adaptive behaviors (Freund and Baltes 2002): Selection refers to the setting and prioritization of goals, based on personal motives and preferences (elective selection) or due to perceived loss of internal or contextual resources (loss-based selection). The SOC model suggests that successful personal development and life management requires a focus on specific goals – in contrast to allocating energy among multiple goals. Selection, therefore, guides and organizes individual behavior, directs personal development, and creates a feeling of purpose in one's life. Optimization involves the obtainment, improvement, and coordinated use of individual means to pursue important goals that were selected individually. Thus, optimization refers to the quality and also persistence of resource allocation. Compensation, like optimization, also refers to means. It specifically addresses the question of how aging individuals who face permanent or temporary loss of resources are still able to maintain a desired level of functioning. Compensation involves the acquisition and application of alternative individual means or the utilization of external or technological aids to substitute lost means.

In sum, the SOC model assumes that available resources can be used more efficiently when individuals focus on fewer, but important goals, pursue these goals in an optimized way, and by doing so, apply adequate compensatory means (Baltes 1997).

## **SOC at Work**

The SOC model has stimulated research in various fields and has received broad empirical support (Riediger et al. 2006). In the last years, a growing number of studies applied the SOC model to the work context in order to explain organizational behavior and coping with age related changes in occupational contexts. The following questions and issues were investigated in particular:

### **The Association Between SOC at Work and Subjective Well-Being**

Studies indicate that high utilization of SOC strategies is related to increased levels of well-being

both in the work and in the family domain (Wiese et al. 2000), and better work-family balance (Baltes and Heydens-Gahir 2003; Young et al. 2007). Moreover, SOC appears to be related to job satisfaction (Schmitt et al. 2012), work engagement (Weigl et al. 2014), and positive expectations about future opportunities at work (Zacher and Frese 2011). In an extension of these cross-sectional findings, first longitudinal studies also demonstrated the prospective impact of SOC on subjective well-being (Wiese et al. 2002).

Beyond the assumption that SOC contributes to a more effective resource allocation and thus enhance personal functioning and well-being, there are complementary explanations for these positive effects of SOC on well-being. SOC can also be considered as a set of behavioral strategies that represent active coping (Dewe et al. 2010). Moreover, SOC is expected to promote goal disengagement and foster goal re-engagement. For instance, loss-based selection refers to the setting of new feasible goals to respond to disadvantageous internal or contextual changes. Thus, SOC might counteract mechanisms of inflexible and rigid organizations of action which might affect mental well-being (Fresco et al. 2006).

### **The Association Between SOC at Work and Job Performance**

Investigations suggest that the use of SOC at work contributes to competency maintenance and job performance (Abraham and Hansson 1995; Yeung and Fung 2009). Moreover, the well-known positive effects of conscientiousness on job performance seem to partly operating through the use of SOC (Bajor and Baltes 2003). In the same vein, generalized optimization strategies appear to be indirectly – i.e., through specific strategies of career planning – linked with various indicators of career success such as increased pay, higher ranked job positions, and career satisfaction (Wiese et al. 2000). However, studies so far failed to demonstrate whether the use of SOC can also predict career success over time (Wiese et al. 2002).

In regard to the single SOC strategies, particularly selection strategies seem to be conducive for

performance (Abraham and Hansson 1995; Yeung and Fung 2009; Bajor and Baltes 2003). However, selection strategies were also shown to enhance the negative impact of burnout on the performance in secondary job tasks, and compensation seems to be most successful strategy in buffering the negative effects of burnout on performance (Demerouti et al. 2014). Thus, the strength and direction of the interrelation between single SOC strategies and performance might be affected by moderating factors as well as the specific performance-dimension under consideration.

### **The Association Between SOC at Work and Work Ability**

A growing body of research particularly in the field of nursing and healthcare work demonstrates that SOC can explain efficient and adaptive resource allocation in terms of maintaining work ability, i.e., the perceived balance between the employees' resources and their job demands (Müller et al. 2012, 2013a; von Bonsdorff et al. 2014; Weigl et al. 2013). Representative findings in older employees in Germany indicate that this association is also true for professions outside of healthcare (Riedel et al. 2015). However, the effects of SOC on work ability seem to be considerably weaker compared to the effects of important job characteristics (Riedel et al. 2015). With respect to the single SOC strategies, optimization, and compensation strategies appear to be the most efficient strategies to maintain work ability (Riedel et al. 2015).

### **The Interaction Between SOC at Work and Work Characteristics**

The application and the consequences of SOC at work are both dependent on the design and characteristics of the task as well of the work environment. It appears that SOC requires job autonomy (Weigl et al. 2013, 2014; Müller et al. 2012). Moreover, research indicates that SOC is related to supportive supervisory behavior (von Bonsdorff et al. 2014), as well as learning and developmental opportunities on the job (Weigl et al. 2014). These findings suggest that in organizations, the development and successful applications of individualized behaviors like SOC

is dependent on sufficient control and latitudes to make own decisions, and requires joint agreements between the supervisor and the employee. In regard to work stressors, role conflicts and role ambiguity have shown to be positively related to selection and compensation strategies (Abraham and Hansson 1995). This indicates that employees apply SOC in response to unfavorable and stressful work conditions.

Beyond that, SOC is presumably intertwined with work characteristics. In other words, the use of SOC seems to reinforce or buffer the effects of work characteristics on individual outcomes. Comparably, work characteristics seem to reinforce or buffer the effects of SOC: Empirical findings indicate that SOC accentuate the positive effects of high job autonomy on work ability (Weigl et al. 2013; Riedel et al. 2015). Thus, taking advantage of SOC seems to add to the mere effects of job autonomy. In contrast, when job autonomy is low, the use of SOC might even have detrimental effects such that SOC can actually be counterproductive if the employee does not have the formal authority to use those (Weigl et al. 2013).

Despite interactions with job autonomy as an important contextual resource and situational enabler, SOC also seem to interact with unfavorable work characteristics: The use of SOC appears to support employees in managing more difficult tasks (Yeung and Fung 2009). Moreover in low-complexity jobs SOC appears to contribute to employees positive expectations about future opportunities at work (Zacher and Frese 2011). Finally, high use of SOC was shown to significantly buffer the relationship between problem solving demands and fatigue (Schmitt et al. 2012).

Studies also revealed that the single SOC strategies have a different effect when quantitative job demands are high, and even detrimental effects are conceivable (Riedel et al. 2015): Employees who apply selection strategies may be able to diminish negative effects of high quantitative job demands, whereas optimization has been shown to strengthen negative effects of high quantitative job demands, and conversely, optimization appeared to compensate for a lack of skill discretion. Thus, from a perspective of resource

allocation (Hobfoll 2002), under condition of high job demands the selection of specific tasks might prevent overload whereas optimization might even increase overload when complying with many job demands. On the other hand, the acquisition of resources through optimization might make up for a lack of environmental resources.

### **Effects of SOC at Work in Relation to Age and Health of Employees**

SOC seems to be particularly effective for older employees (Abraham and Hansson 1995; Yeung and Fung 2009; Müller et al. 2013a; Weigl et al. 2013) which agrees with the assumption that SOC contributes to the more efficient allocation of personal resources. Moreover, SOC strategies turned out to be particularly effective for older employees under specific challenges: SOC seem to maximize the supportive effects of job autonomy particularly in older employees (Müller et al. 2012; Weigl et al. 2013). Again from a resource perspective, older employees may particularly benefit from high job autonomy because it provides opportunities either to balance out age-related losses that hamper the acquisition of SOC at work or to maximize age-related gains, like experience. Likewise, SOC at work was shown to be effective particularly among older employees in low-complexity jobs for focusing on future opportunities at work (Zacher and Frese 2011). However, in difficult task situations employment of SOC strategies seems to support older employees to increase momentary performance, but global performance was only supported by SOC in younger employees (Yeung and Fung 2009). The authors concluded that in the long run older employees might need other strategies than SOC to handle difficult tasks successfully. Accordingly, one recent study pointed to a stronger relationship between SOC and work ability in younger compared to older nurses (von Bonsdorff et al. 2014). These inconsistencies call for further investigations into the interplay of chronological age and SOC at work.

From a resources perspective, recent studies investigated whether the use of SOC contributes to reduce consequential losses of poor health. One study with older employees from 60 to 85 years

indicated that high use of SOC buffered the effects of health status on the intention to remain employed (Müller et al. 2013b). In participants with low use of SOC, there was a weaker intention to remain employed when health status was poor, while this intention was stronger in case of a better health status. Concerning burnout, a prevalent state of diminished health, an investigation showed that compensation was the most effective SOC strategy in buffering the negative effects of burnout on performance, and selection strategies enhanced the negative impact of burnout on performance (Demerouti et al. 2014). Thus, developing and applying compensatory means might be an effective way of coping with limited resources and instrumental in order to maintain performance. Selection strategies potentially reduce the scope of activities into which employees invest their energy which might include detrimental effects (Demerouti et al. 2014).

### **Future Research Directions**

The research on SOC at work has made substantial progress across the past years. Notwithstanding, several limitations in the current evidence base need to be addressed and overcome.

Future studies that explicitly incorporate specific work as well as individual characteristics are needed to further discover the complex interplay of SOC behaviors, individual, and contextual characteristics. Available evidence on the relationship between SOC at work and desirable individual outcomes are respectively based on very few studies. Therefore, replications are needed.

The vast majority of studies on SOC at work have a cross-sectional design which limits insights into cause and effect relationships. It is mainly assumed that the use of SOC at work predicts better well-being, performance, or work ability. Potentially, effects might also be existent in the opposite direction, because SOC is in the short term a resource-demanding strategy. Thus, employees with more personal resources, e.g., high well-being, might thus be able to apply more SOC. Moreover, the long-term effects of SOC at work are not known. SOC behaviors that

are advantageous in the short run might turn out detrimental in the long term (Yeung and Fung 2009). For example, a narrowed scope of selected goals might restrict further development and skill acquisition particularly in early career stages.

In cross-sectional designs a bias due to “healthy worker effects” cannot be ruled out. The existing findings on SOC at work may be valid for professionals with superior well-being because employees with poor health may have already withdrawn from the surveyed workplaces or the active workforce. Although there are first attempts to examine the interaction between health and SOC (Demerouti et al. 2014; Müller et al. 2013b), research is needed to investigate whether employees with poor health are capable to effectively apply SOC behaviors at work or whether SOC strategies work differently.

With one exception (Zacher et al. 2015), there is yet hardly any empirical support for the basic assumption of SOC theory, that the orchestrated use of the three SOC behaviors is the most beneficial strategy. Most of the existing research on SOC at work has either reported the aggregated effects of all three SOC behaviors or their individual effects respectively. Such analyses are not able to disentangle different combinations of SOC strategies and to provide insights into specific behavioral strategies that blend single SOC domains. As an example, the same average SOC score might represent a variety of combination of single SOC strategies, i.e., high selection, low optimization or compensation; or low selection, high optimization or compensation. Hence, the combinations represent totally different regulatory strategies in terms of directions and efforts to enhance or allocate resources. Thus, further investigations of meaningful combinations of SOC behaviors at work might be worthwhile.

Finally, applying self-directed behaviors such as SOC at work almost inevitably affects work procedures, distribution of tasks, responsibilities, and cooperation. As an example, selection behaviors like “delegating tasks to colleagues” or compensation efforts like “asking for help” might be associated with a higher workload for colleagues. Therefore, there is a need for research on the inherent “social aspect” of SOC at work to

account for the complexity and interrelatedness of work systems. Future research might therefore develop designs to investigate the effective organization of SOC on the team level.

## Conclusions and Implications for Practice

An increasing body of research demonstrates that using SOC at work is on average a promising strategy to maintain well-being, performance, and work ability. These effects refer – not exclusively – but particularly to older employees or employees with limited resources. Thus, in accordance with theory, SOC behaviors seem to contribute to the efficient allocation of personal resources, to balance out lack of environmental job resources, and to boost the effects of available job resources. Beyond that, the available empirical evidence on SOC at work also mainly fits the perspective of active coping as well as flexible goal engagement and disengagement on individual well-being.

Since the majority of studies revealed positive effects of SOC at work, it seems advisable to inform employees about the SOC model and to train individuals to deal more effectively with diminished resources. Organizations may offer trainings for employees to craft their work places and jobs so that employees experience engagement and motivation as well as cope successfully with the job demands at hands. Nevertheless, practical measures and interventions based on SOC have to take into account the complexity of sociotechnical work systems. Applying individualized behaviors like SOC at work requires that the employee is allowed to make autonomous decisions about important aspects of its job and has the support of its supervisor and colleagues. As a coordinated strategy SOC at work might balance out detrimental effects of high job demands, low job resources, and booster the effects of high job resources. However, under specific circumstances, SOC use might be detrimental. Detrimental effects of SOC at work can particularly be expected when the work environment does not sufficiently tolerate autonomous

decision making of employees (Weigl et al. 2013), in case of an unbalanced use of effortful optimization strategies under demanding work situations (Riedel et al. 2015), as well as an unbalanced use of selection strategies when individual resources are already depleted presumably by choosing a too narrow range of resource investment that hamper the retrieval of resources (Demerouti et al. 2014). These findings have to be considered when SOC measures are implemented in occupational practice.

Since various studies demonstrated that the effective use of SOC at work is closely related to work and task characteristics, measures that concurrently address individual as well as organizational or task characteristics might be promising. Drawing on available SOC research we assume that top-down approaches that reduce job demands and increase job resources should be aligned with individual bottom-up approaches that foster individual coping or job crafting strategies.

## Cross-References

- ▶ [Age-Related Changes in Abilities](#)
- ▶ [Aging and Psychological Well-Being](#)
- ▶ [Life Span Developmental Psychology](#)
- ▶ [Mental Health and Aging](#)
- ▶ [Psychological Theories of Successful Aging](#)
- ▶ [Work Design and Aging](#)

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## Self-Theories of the Aging Person

Manfred Diehl and Allyson Brothers  
Department of Human Development and Family Studies, Colorado State University, Fort Collins, CO, USA

### Synonyms

Cognitive schema; Self-concept; Self-knowledge; Self-schema; Self-understanding

### Definition

Self-theories of the aging person focus on how a person's self-representations and self-understanding change with age. Self-representations are those attributes that (a) are part of an individual's understanding and knowledge about the own person, (b) are the focus of self-reflection, and (c) can be consciously acknowledged by the person through language and other forms of communication.

### General Framework

Self-theories of the aging person focus on how a person's *self-representations* and *self-understanding* change with age but also how, in turn, self-representations and self-understanding influence individuals' psychological and behavioral aging and related outcomes (Markus and Herzog 1991). Thus, the focus in self-theories of the aging person is on the individual's *self-concept* or *self-representations*. For the purposes of this entry, we will use these two terms interchangeably to refer to those attributes that (a) are part of an individual's understanding of and knowledge about the own person, (b) are the focus of self-reflection, and (c) can be consciously acknowledged by the person through language or other forms of communication (Diehl 2006; Harter 2012).

Contemporary psychological theories conceptualize self-representations as a multidimensional, contextualized, and dynamic *cognitive structure* with important adaptive and self-regulating functions (Brandtstädter and Greve 1994; Higgins 1996). This conceptualization implies that individuals' self-concept is viewed as a *cognitive schema* containing knowledge about personal traits, values, and beliefs, episodic and semantic memories, and knowledge about social roles, positions, and interactions. This cognitive schema is involved when self-relevant information is processed. From a life-span developmental and gerontological perspective, several theorists (Markus and Herzog 1991; Brandtstädter and Greve 1994) have pointed out that the self-concept gives individuals a sense of continuity

and permanence, allows them to distinguish themselves and their developmental history from others, and gives their experiences meaning within a larger life story (Diehl 2006; McAdams 2013). Moreover, self-concept theories also provide an explanatory framework that can account for the fact that human personality is both stable and flexible across the adult life span (Roberts and Mroczek 2008). That is, the notion that self-representations are hierarchically organized makes it meaningful to distinguish between representations that are essential to a person's general identity (i.e., core self-representations) and representations that are linked to specific contexts. Core self-representations tend to be relatively stable across contexts, whereas context-specific self-representations are responsive to the demands of different social roles, life events, or challenges associated with life stage-specific developmental tasks (Markus and Herzog 1991). Thus, self-concept theories provide a suitable framework to account for continuity and discontinuity in adults' development – two processes that are at the heart of the overall aging process. Self-representations are also of critical importance because the biological and psychosocial changes intrinsic to the aging process challenge the self-referential knowledge that constitutes a person's conception of him- or herself (Brandtstädter and Greve 1994).

Self-theories of the aging person are different from other psychological or sociological theories of aging because they put the individual squarely at the center of their theorizing and investigative efforts. Like action-theoretical accounts of psychological aging, self-concept theories emphasize the role of the individual as an *active, self-reflexive agent* who not only passively reacts to internal or external age-related changes and processes but who also intentionally and actively shapes these processes. This view is best illustrated in Brandtstädter and Greve's (1994) model of *accommodative, assimilative, and immunizing processes* that the aging person (more or less consciously) employs to negotiate age-related changes that challenge his or her positive identity. Thus, the main purpose of this triad of processes is the protection of a person's

positive self-representations in different behavioral domains against the potentially negative onslaught of the aging process and to preserve the biological and psychosocial integrity of the person.

Specifically, *assimilative adaptations* involve instrumental and self-corrective activities (e.g., efforts to enhance or maintain a desired ability or level of performance), compensatory activities (e.g., using external aids), and self-confirmatory actions (e.g., choosing environments that conform to a person's self-definition). Brandtstädter and Greve (1994) postulate that assimilative activities should be the preferred mode of adaptation when individuals realize that age-related losses have occurred or are imminent, but when they still believe that these losses may be reversible or can be counteracted through appropriate actions. The authors also postulate that individuals very likely will switch from an assimilative to an accommodative mode if they perceive that assimilative efforts are not effective or become too costly in terms of effort or resources. Consequently, *accommodative adaptations* involve (a) disengagement from blocked goals, (b) adjustment of personal aspirations and self-evaluative standards (e.g., gradual rescaling of self-evaluative standards), (c) self-enhancing comparisons (e.g., downward social comparisons), and (d) palliative interpretations, such as positive reappraisals or the discounting of unattainable goals. In support of the overall model of adaptive behavior, Brandtstädter and Renner (1990) showed that over the course of adulthood (age range 25 to over 75 years), individuals reported an increasing shift from assimilative to accommodative actions (see also (Diehl et al. 2014a)). The authors suggest that this developmental shift may account for the observed stability of self-esteem and subjective well-being in most adults.

Finally, Brandtstädter and Greve (1994) described *immunizing mechanisms* as the third mode of self-concept stabilization. According to the authors, immunizing processes protect self-representations that are highly relevant to a person's self-definition and self-esteem and can be categorized as data-oriented or concept-oriented.

*Data-oriented immunization* is a bottom-up process in which behavioral data (e.g., actual cognitive performance, feedback from the social environment, etc.) fundamentally challenge an individual's self-related beliefs so that he or she engages in a number of immunizing maneuvers to protect his or her self-representations in the respective domain against these data. These maneuvers may include downgrading the diagnostic relevance and validity of the behavioral data (e.g., "My memory is still good even if I forgot a few items on my shopping list") or shifting the temporal focus of self-evaluation so that past accomplishments can be used to stabilize current and/or future self-representations. In contrast, *concept-oriented immunization* is a top-down process in which the person engages in self-stabilizing maneuvers by emphasizing behaviors and attributes that are positively related to age and by de-emphasizing aspects that tend to decline with age. It is important to note that immunizing processes are, by definition, different than defensive mechanisms, because the person can usually acknowledge that the standards for self-definition and self-worth in a certain domain have changed as he or she has grown older (Greve and Wentura 2003). For example, although a good memory may have been a critical self-defining attribute for an individual in young adulthood and midlife, the same attribute or behavior may not be a self-defining feature of cognitive competence anymore in later adulthood.

In summary, Brandtstädter and Greve's (1994) model provides a framework that describes the psychological processes that underlie changes in self-representations across the adult life span. Indeed, there is evidence from numerous studies showing that assimilative, accommodative, and immunizing processes can account for a number of developmental changes in adults' self-representations (Brandtstädter and Renner 1990; Greve and Wentura 2003; Rothermund and Brandtstädter 2003). However, this model is only one approach that tries to explain how individuals' self-representations change over the adult life span. Several other explanations also need to be taken into account.

## Specific Accounts for Changes in Adults' Self-Representations

The other accounts we consider here link adults' self-representations to their *constituent elements*, such as personality traits, social roles, life plans, and normative expectations, as well as individuals' personal memories and their awareness of personal lifetime. The overall argument with regard to these approaches is that changes in these domains give rise to changes in self-representations because they constitute the elements and the content of a person's self-concept and, in particular, of his or her context-specific self-representations.

In terms of *personality traits* such as the Big Five (i.e., agreeableness, conscientiousness, extraversion, openness to experience, and neuroticism/emotional instability), it is well documented that significant changes in mean levels occur across the adult years (Roberts and Mroczek 2008; Helson et al. 2002). For example, over the course of adulthood, men and women tend to become more emotionally stable (i.e., mean-level decline in neuroticism) and more agreeable and conscientious (i.e., mean level increases in these traits), whereas the mean levels of openness to experience and extraversion tend to stay fairly stable, especially in midlife and into old age. Although the exact causes of these changes in key personality traits are not entirely known (see Roberts and Wood 2006), it is logical to conclude that these mean-level changes are also reflected in adults' changing self-representations. For example, mean-level changes in agreeableness are likely to be reflected in adults' self-representations related to getting better along with others, coping with conflict more constructively, and perhaps being more tolerant toward the opinions and attitudes of others. Similarly, mean-level changes in conscientiousness may be represented in the self-concept as having become more serious about personal tasks and responsibilities and having stronger commitments to certain pursuits, such as performance in the workplace or taking better care of one's physical health, financial security, or psychological well-being. Thus, although the connection between changes in personality traits and

self-representations has not been extensively investigated (Diehl 2006), some studies suggest that such a connection exists even into very old age (Troll and Skaff 1997) and, hence, requires more scientific attention.

Changes in self-representations are very likely also the result of changes in *social roles* and changes in role expectations and responsibilities. For example, most societies have normative age-graded expectations with regard to certain social roles, such as family-related roles, work-related roles, or community-related roles (Settersten and Hagestad 2015). Indeed, life-course sociologists have coined the terms “social clock” and “social age” (Hagestad 1990) to indicate that individuals’ lives are structured and evaluated according to certain sociocultural timetables. As such, individuals can be on-time or off-time with regard to these social timetables, and the degree of synchrony or asynchrony with such timetables very likely is reflected in their role-specific self-representations. Also, whereas changes in social roles in young adulthood are primarily characterized by the entry into new social roles (e.g., committed relationship, transition to parenthood, first steady employment, etc.), in midlife and old age, the opposite is primarily the case. That is, changes in social roles in midlife and old age are primarily characterized by *exit events*, such as the last child leaving home, retirement, loss of friends, widowhood, relocation, or the relinquishing of roles in the community, which can greatly challenge a person’s self-concept and sense of self-esteem (see Kling et al. 1997).

Finally, changes in self-representations are also tied to individuals’ *life plans* for and *normative expectations* about the adult years, including the occurrence or nonoccurrence of *life events* and individuals’ perceptions of *personal lifetime*. For example, research by Heckhausen et al. (1989) has shown that adults possess quite well-defined expectations regarding their psychological and social development across the adult life span. These expectations are shared by young, middle-aged, and older adults and are rooted in social and cultural norms that use chronological age as the indicator for having met certain developmental goals (MacMillan 2005). In combination with

the occurrence of expected or unexpected life events (Helson et al. 2009) and personal perceptions of lifetime (Neugarten 1979; Carstensen et al. 1999), these social timetables often motivate individuals to engage in a midlife stock-taking or “*midlife review*” (Stewart and Vandewater 1999), with profound influences on their personality and self-representations (Helson and Soto 2005). In particular, during this process of midlife review, adults may have to come to grips with the fact that certain life plans did not materialize as hoped and that certain goals may have become unattainable. Thus, adults may realize that they have passed what Heckhausen et al. (2001) referred to as *developmental deadlines* or that time for the attainment of a desired goal is running out. Under more favorable circumstances, however, they may realize that the attainment of a certain goal and the realization of a certain life plan may require a “midcourse correction” and reorientation (Stewart and Vandewater 1999). Regardless of what scenario an individual may be confronted with (e.g., in family and personal relationships, at work, and in professional career), in each instance the psychological processes and potential action choices very likely will have an effect on the person’s self-representations and will activate the self-stabilizing processes described by Brandtstädter and Greve (1994). A particular outcome associated with these processes is the person’s increased awareness of his or her own age (Diehl and Wahl 2010) and also a keen awareness of personal lifetime (Carstensen et al. 1999). That is, individuals’ time horizons of past, present, and future selves are likely to shift (Ryff 1991) when they realize that they have less time to live than they have already lived – a realization that usually happens in late middle age or early old age (i.e., approximately between 45 and 60 years). In addition, actual age-related changes in an individual’s behavior, such as physical appearance and health, cognitive functioning, interpersonal relationships, or social-emotional functions, are likely to become noticed by the individual, creating an awareness of his or her own aging. Thus, this increasing awareness of one’s own aging is likely to become a defining feature of the aging self (Diehl and Wahl 2010).

This important developmental process, however, has not been systematically investigated in the context of self-representations, and therefore we are focusing on this aspect in more detail in the following section.

### **Awareness of Aging as a Central Feature of the Aging Self**

The construct of *awareness of aging (AoA)* refers to an individual's perceived experience of growing old(er) and can be assumed to become an integral part of the self-concept. AoA encompasses concepts such as age identity, self-perceptions of aging, and awareness of age-related change (AARC), all of which are concerned with how individuals perceive and interpret their own aging process (Diehl et al. 2014b), that is, how and what kind of self-representations individuals form of their own aging. AoA deserves scientific attention because of its well-documented associations with health and well-being in later life (Westerhof et al. 2014).

To illustrate the connection of AoA with adults' functioning and potential developmental outcomes, we use the example of a single-item question of subjective age, which simply asks adults "How old do you feel?" (Kastenbaum et al. 1972). The difference score between the age a person states in response to this question and the individual's actual chronological age is a robust predictor of a whole host of behavioral outcomes, including functional health and mortality (Hublely and Russell 2009; Westerhof and Barrett 2005). However, what is less known is the exact nature of the "tacit knowledge" that goes into this simple measure of subjective aging, making it such a powerful predictor of late life development. The concept of *awareness of age-related change* (AARC; Diehl and Wahl 2010) was proposed to provide a conceptual framework for investigating the subjective knowledge that forms the foundation for the predictive validity of a number of subjective age ratings.

Diehl and Wahl (2010) define AARC as "... all those experiences that make a person aware that his or her behavior, level of performance, or ways

of experiencing his or her life have changed as a consequence of having grown older" (p. 340). Compared to other AoA constructs, AARC is a new concept because of its focus on the actual behavioral experiences that underlie adults' subjective perceptions of aging. For instance, AARC focuses on age-related changes in five behavioral domains, such as physical health, cognitive functioning, or interpersonal relationships, and addresses both positive and negative changes in these domains. Because of this elaborated structure, the systematic elaboration of the AARC construct provides an opportunity to advance both theoretical and empirical endeavors in the field of subjective aging.

Based on the theoretical model proposed by Diehl and colleagues (2014b), it is possible to postulate certain factors which can be expected to influence the development of AARC. For instance, developmental influences such as early life experiences, lifetime health, and social relationships are likely to shape a person's AARC across the life span. Furthermore, socioeconomic resources (e.g., education, finances, and access to health care), cultural influences (e.g., cultural age norms and expectations, aging-related social policies), and psychological resources (e.g., coping, emotion regulation, and personality) are also theorized to influence the development of AARC. Longitudinal evidence from investigations of other AoA concepts, such as attitudes toward own aging (ATOA), supports expectations of the importance of developmental, socioeconomic, cultural, and psychological resources. For instance, findings from a 12-year study (Miche et al. 2014) showed that a variety of personality, socioeconomic, and health-related factors influenced ATOA in middle-aged individuals (early 1940s to mid-1950s), whereas health and physical functioning were more relevant predictors among young-old adults (early 1960s to mid-1970s).

Understanding the role of AARC as part of adults' self-representations is also important in the context of behaviors that individuals may or may not engage in to promote their own health and well-being across the adult years. A large body of research suggests that most individuals

hold negative views of aging (Hummert 2011), and these negative views can and often do undermine individuals' efforts to engage in behaviors that promote healthy and successful aging (Levy and Myers 2004). There have been some investigations so far into the specific pathways (Levy 2009) by which attitudes interfere with engagement in health-promoting behaviors. For instance, a psychological pathway may manifest as a low degree of *perceived control* over the environment (Lachman et al. 2011) or as the *misattribution* of a health problem to the inevitable process of "getting old" (Sarkisian et al. 2007). Such pathways involving AoA are consequential because they limit and undermine individuals' participation in health-promoting behaviors. Given the well-documented connection between AoA and health behaviors, researchers have also begun to ask whether targeting AoA and the associated self-representations may be a fruitful way to promote healthy and successful aging (Kotter-Grühn 2015). In recent years, there have been several attempts to change negative views on aging with such a goal in mind (Sarkisian et al. 2007; Wolff et al. 2014).

In summary, AoA represents a central aspect of adults' self-concept, and a growing body of evidence suggests that it is associated with a number of important outcomes in late life (Diehl and Wahl 2015). Because AoA is not a fixed state, but rather a process that unfolds over time as a result of many different life experiences, it also holds promise with regard to intervention and prevention. Specifically, research on AoA holds the promise to open new views and to lead to new approaches on how adult development and aging can be optimized. The long-term goal of these endeavors is the improvement of adults' health and well-being and the delay of age-related disease and impairment.

## Conclusions and Outlook

As this entry shows, a self-theoretical approach to adult development and aging has a number of unique features that are not represented in other theoretical approaches. First, a focus on

self-representations is concerned with individuals as active agents and as producers of their own development, including the dialectics that are inherent in the related psychological, social, and interpersonal processes (Diehl 2006). In particular, self-theoretical approaches can theoretically and empirically account for key processes of adult development and aging such as continuity and discontinuity.

Second, a self-theoretical approach can enhance the explanation of certain phenomena that have puzzled aging researchers for quite a while. Among these puzzles is the "paradox of well-being," which refers to the fact that despite an increasingly negative ratio between gains and losses across the adult life span and despite objective losses, older adults tend to show fairly high levels of psychological well-being. Brandtstädter and Greve's (1994) model of assimilative, accommodative, and immunizing processes, for example, can describe and explain how "strategic" adjustments to self-representations and personal goals stabilize a person's sense of self-worth when it is threatened by the challenges and losses associated with growing old(er).

Finally, recent theoretical developments that view awareness of aging as a central component of middle-aged and older adults' self-concept (Diehl et al. 2014b) also open new vistas for intervention and prevention efforts. In particular, by focusing on adults' negative views on aging, and drawing on motivational approaches to improve these negative views, new intervention programs are being designed to promote behaviors that are known to promote healthy and successful aging. One of the big challenges of the ongoing global population aging is how to get individuals to take greater responsibility for their own adult development and aging and how to delay the onset of age-related diseases. Essentially, the delay of disease onset or disease-related loss often requires that individuals need to embrace and engage in behavior change for the long run. Self-theoretical approaches may provide some of the key elements to achieve such long-term behavior change and to optimize current and future generations' aging experience.

## Cross-References

- ▶ [Age, Self, and Identity: Structure, Stability, and Adaptive Function](#)
- ▶ [Age Stereotyping and Views of Aging, Theories of](#)
- ▶ [Self-Theories of the Aging Person](#)

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## Semantic Dementia

Nathan Hantke<sup>1,2</sup>, Nicholas T. Bott<sup>1,3</sup> and Viktoriya Samarina<sup>4</sup>

<sup>1</sup>Sierra Pacific Mental Illness Research, Education, and Clinical Centers (MIRECC), VA Palo Alto Health Care System, Palo Alto, CA, USA

<sup>2</sup>Department of Psychiatry and Behavioral Sciences, Stanford University School of Medicine, Stanford, CA, USA

<sup>3</sup>Pacific Graduate School of Psychology—Stanford PsyD Consortium, Stanford, CA, USA

<sup>4</sup>Barrow Neurological Institute, Phoenix, AZ, USA

## Synonyms

Primary progressive aphasia semantic; Semantic variant primary progress aphasia (svPPA); Temporal variant frontotemporal dementia

## Definition

Semantic dementia (SD) is a progressive neurodegenerative syndrome characterized by a gradual

decline in semantic processing and related language abilities. SD patients typically show difficulty with the comprehension and expression of words and a deterioration of semantic knowledge about places, people, objects, and general information (Murre et al. 2001). While the ability to produce speech remains unchanged, individuals with SD often struggle finding the correct word during conversation, first for less commonly used words and then for more rudimentary ones. These symptoms progress until the ability to understand the basic components of language and semantic relationships is lost, resulting in impaired ability to read, write, and partake in conversation (Kertesz et al. 2010).

## What Is Semantic Dementia

Semantic dementia is one of several clinical syndromes within the broad construct of frontotemporal dementia (FTD). FTD is still sometimes referred to as Pick's disease after Dr. Arnold Pick, the eighteenth-century physician who first described a patient with the collection of behavioral and language symptoms now associated with FTD (Bott et al. 2014). The nosological classification of FTD and its associated syndromes have been debated ever since Dr. Pick's description at the turn of the century. Dr. David Neary and colleagues (Neary et al. 1998) created a consensus study group, proposing a broad construct called frontotemporal lobar degeneration (FTLD), which encompasses several syndromes that selectively affect the frontal and temporal cortex. FTLD consists of three clinical syndromes: FTD, progressive nonfluent aphasia, and progressive fluent aphasia.

Updated since 1998, a revised conceptualization of FTLD is generally broken down in to clinical subtypes characterized by changes in behavior (behavioral variant FTD or bvFTD) or changes in language (primary progressive aphasia or PPA). PPA is further divided in to semantic dementia (also known as semantic variant PPA), nonfluent variant PPA, and logopenic variant PPA (Bott et al. 2014; Gorno-Tempini et al. 2011).

The cognitive profile now associated with SD was first described by Dr. Elizabeth Warrington in her seminal 1975 publication (Warrington 1975).

She presented the case study of three patients, all of whom demonstrated a pronounced loss in semantic memory and associated language processes, coupled with preserved speech production and solid performance in other areas of cognition (Warrington 1975; McCarthy and Warrington 2015). However, the emphasis of the paper was primarily on understanding semantic memory deficits, as compared to describing a unifying disorder. The term semantic dementia was first presented in 1989 by Dr. Julie Snowden and colleagues and then further refined by Dr. John Hodges and colleagues in 1992, providing a label for the collection of cognitive impairments presented by Dr. Warrington (Hodges et al. 1992; Snowden et al. 1989).

## Diagnostic Criteria

The most recent international consortium criteria for SD were established in 2011 (Gorno-Tempini et al. 2011). Inclusion criteria for SD requires the presence of three core features: language difficulty as the most prominent clinical feature, language difficulty as the cause of impaired ability to perform daily living activities, and the presence of aphasia as the most significant deficit at symptom onset and during the initial phase of the disease. Exclusion criteria include the presence of prominent initial behavioral disturbances, episodic or visual memory impairments, or visuoperceptual difficulties, and the symptoms cannot be better accounted for by psychiatric or nondegenerative nervous system or medical disorders.

The 2011 consortium criteria also provide three levels of diagnostic certainty for a diagnosis of SD: clinical diagnosis, neuroimaging-supported diagnosis, and definite (Gorno-Tempini et al. 2011). A clinical diagnosis of SD requires impairments on tasks of confrontation naming and single-word comprehension, with at least three out of four additional core features, including (1) impaired object knowledge, (2) surface dyslexia or dysgraphia, (3) spared repetition, and (4) spared speech production. Neuroimaging findings consistent with SD are required for an imaging-supported diagnosis of the syndrome and must show either predominant anterior

temporal lobe atrophy or predominant anterior temporal hypoperfusion or hypometabolism on SPECT or PET imaging. The presence of genetic or pathological confirmation of FTLN is required for a definitive diagnosis of SD.

## Pathology and Genetics

Pathological studies suggest that SD is a tauopathy and is thus best classified within the category of FTLN, instead of a variant of amyloid-associated dementias, such as Alzheimer's disease (Rossi and Tagliavini 2015). SD appears to often be associated with Pick bodies, in which a protein called tau clumps together inside nerve cells, inhibiting function and eventually resulting in the death of the cell. However, neuropathological findings are varied, and other studies suggest that SD is associated more with ubiquitin-positive, tau-negative intraneural inclusions typical of motor neuron disease; some patients even show atypical distribution of Alzheimer's disease pathology (Davies et al. 2005; Rossor et al. 2000).

Semantic dementia is characterized by focal atrophy and dysfunction of the anterior and posterior inferior temporal lobe, including the inferior and middle temporal gyri (Mummery et al. 1999). The temporal atrophy is typically left sided, but may also be bilateral. The hippocampus is believed to be spared although findings are somewhat mixed, as studies have found SD-related pathology in the dentate gyrus (Hodges et al. 2010). This selective atrophy of the polar and infero-lateral temporal regions is a unique characteristic of SD and is not seen in Alzheimer's disease (Murre et al. 2001).

An estimated 40% of all FTD cases include a family history of dementia, with approximately 10% of patients being autosomal dominant, affecting first-degree relatives across two generations (Bott et al. 2014). Of autosomal dominant cases, *MAPT*, *GRN*, and *C9ORF72* are the most common genes responsible for the inheritance of FTD. Of FTD syndromes, SD is the least likely to be hereditary, with a predicted familial rate between 2% and 7%, although a mutation in the

*MAPT* gene has been reported in a case of SD (Hodges et al. 2010; Goldman et al. 2005; Bessi et al. 2010).

## Clinical Presentation and Cognitive Deficits

As defined in the diagnostic criteria, the common complaint by individuals with SD is difficulty with aspects of expressive and receptive language, as language dysfunction is often the main symptom during the first 2 years of the disease (Bang et al. 2015). This is due to the disease's selective targeting of the left temporal lobe, a region of the brain critical for language abilities (Kertesz et al. 2010). Importantly, the ability to produce speech is preserved and remains fluent, but words start to lose meaning. Patients with SD may start substituting words in conversation, such as saying "that thing" in place of a noun, or progress from using more specific words to terms representative of broader concepts (e.g., from penguin to bird to thing). The progressive loss from specific to broad word categories may reflect the relative strength and frequency of use for each concept or word within the semantic network. More familiar, common items are associated with deeper, richer, and more robust semantic networks. This robustness results in a higher probability of a term or concept being resilient and remaining preserved despite initial degradation of semantic networks (Lambon Ralph et al. 1998).

Semantic dementia-associated language deficits are present across multiple modalities, not just for words, suggesting the disease represents a breakdown in networks important in conceptual knowledge (Bozeat et al. 2000). This breakdown in semantic networks in turn results in the more clinically evident deficits in language associated with the disease (Lambon Ralph et al. 1998). As such, patients with SD not only experience difficulty with word finding but also in the ability to recall the meaning of words and related concepts. Patients may ask "What does that word mean?" even for vocabulary commonly used in the past, as well as lose the ability to understand how concepts are related across semantic constructs (e.g., how a

giraffe and a tiger are related). This deficit results in difficulty with comprehension and expression during conversations, as patients rely on related yet incorrect words to communicate a message. SD-related deficits in verbal comprehension have profound effects on patient's daily activities. Tasks that involve spoken or written language, such as holding a conversation or watching television, become very difficult to undertake. The loss of word comprehension and related word concept is fairly unique to SD, as word knowledge is largely preserved across the aging process. Patients may also decline in other abilities that rely upon semantic processing, such as the ability to spell, comprehend written material, and remember names.

SD is associated with deficits across a variety of neuropsychological measures. Along with word comprehension and word finding difficulties, individuals with SD demonstrate impaired performance on other tests that rely upon semantic knowledge, including confrontational picture naming, matching words based on their semantic relationship, producing words within a semantic category (e.g., provide the names for as many types of animals as possible), and providing the name of an item based on its description (Murre et al. 2001).

While language-related abilities decline in patients with SD, other cognitive abilities not mediated by anterolateral temporal lobes remain preserved. Whereas episodic memory declines in other neurodegenerative diseases, such as Alzheimer's disease, this ability may remain largely untouched in SD. Interestingly, patients with SD are better able to remember more recent as compared to remote information, although may struggle when asked to provide more detail (Hodges and Graham 1998). This pattern is a reversal of the temporal gradient typically seen in other dementias and is likely due to the selective atrophy of the neocortex of the temporal lobes, combined with the largely spared hippocampal integrity frequently seen in SD (Hodges and Graham 1998). Executive functioning, performing math, visuospatial skills, nonverbal reasoning, and daily activities such as driving are largely preserved until later in the course of

the disease. This intact ability to perform daily tasks creates an odd juxtaposition. For example, patients may be able to use a hammer, but may be unable to provide the name or understand the word for the object.

SD is primarily described in terms of language deficits, as the syndrome typically presents with left greater than right atrophy of the anterior temporal lobes. In left variant SD, functions pertaining to the right hemisphere are sometimes "released." In such cases, patients can develop visual-based compulsions, including painting, puzzle work, jewelry beading, and collecting items (e.g., coins, brightly colored objects) (Bang et al. 2015).

Twenty-five percent of cases present with right greater than left atrophy (Thompson et al. 2003). When SD starts in the right temporal lobe, patients may have difficulty recognizing faces and experience changes in behavior. Typical behavioral symptoms include a lack of empathy and engagement, an increase in compulsive behaviors such as writing notes, rigid thinking, awkward social interactions, loss of insight into behavior, difficulty with theory of mind, and restricted food preferences (Bott et al. 2014; Bang et al. 2015). Regardless of the side of onset, SD usually spreads to involve the contralateral side as the disease progresses.

## Daily Functioning

Patients diagnosed with semantic dementia, unlike the behavioral variant of frontotemporal dementia, often do not display significant behavioral changes at the onset of the disease. However, as the disease progresses and begins to impact regions beyond the temporal lobes, a variety of behavioral changes more typical of FTD may occur that impact daily functioning and interpersonal relationships. Individuals in later stages of SD may present as disinhibited, engaging in socially inappropriate behavior with little insight in to how they are perceived by others, including a lack of embarrassment. Individuals may also show disregard for the feelings of others and display a general social coldness that includes a lack

of empathy (Bang et al. 2015). Individuals with SD may also neglect basic aspects of self-care, such as bathing regularly, due to general apathy and difficulty with initiation.

Symptoms of depression are seen in 44% of individuals with SD and occur regardless of side of disease onset (Bang et al. 2015). However, symptom presentation varies, as right-sided SD is associated with anxiety, atypical depression, and denial of symptoms, while patients with left-sided SD are more likely to report anhedonia and other classic depressive symptoms (Edwards-Lee et al. 1997). Individuals may also demonstrate exaggerated emotional responses to situations, such as extreme happiness or sadness and generally increased lability. This lability may be correlated with events or tasks that pertain to the patient's self-interests or clash with the patient's increased mental rigidity. Patients with a predominately right-sided disease focus may be prone to violent outburst and be argumentative, while patients with left-sided disease may become more "mellow" (Edwards-Lee et al. 1997).

The obsessions and compulsions of individuals diagnosed with SD can take many forms and may increase in intensity to the point of interfering with daily activities. Individuals may become focused on watching clocks, eating only select foods, or fixating on certain games or puzzles. The obsessions of individuals with predominately left-sided temporal lobe disease tend to focus on visual compulsions, such as painting or collecting objects. In contrast, right-sided SD often manifest in verbal compulsions (Bang et al. 2015).

These changes in empathy and personality can be very trying and difficult for the family members of individuals with SD, as the patient's behavior and disposition are often in stark contrast to how he or she was prior to disease onset. The lack of emotional reciprocity and awareness of social etiquette can be especially difficult, straining interpersonal relationships and making social outings challenging.

### Course of Disease

Semantic dementia is estimated to represent 20–25% of all FTD cases and 3% of all dementia

cases (Kertesz et al. 2010). The age of disease onset is often earlier than what is seen in Alzheimer's disease and similar to other forms of frontotemporal dementia, usually ranging from 45 to 65 years old, although late-onset SD does sometimes occur in the elderly (Shimizu et al. 2011). The mean age of symptom onset is age 60 with diagnosis occurring 4 years later on average (Hodges et al. 2010). Postmortem studies reveal a median survival rate of approximately 8 years with a range of 3–15 years (Hodges et al. 2003). However, this finding was based on a relatively small sample size ( $n \leq 20$ ) and may have "been biased by the restriction to patients reaching autopsy." (Hodges et al. 2010) Another study by the several of the same authors utilizing a larger sample size reported a variable survival rate, as patients may pass away anywhere from 2 to 3 years after diagnosis to 17 years, with a 50% survival rate of 12 years (Hodges et al. 2010).

### Conclusions

Semantic dementia (SD) is a neurodegenerative disorder characterized by a decline in semantic processing and language abilities, while the ability to produce speech and other cognitive abilities remain initially largely untouched. Couched within broad construct of frontotemporal dementia, SD has been characterized through a rich history of the case studies and only more recently is being studied empirically with larger sample sizes. SD often initially presents as difficulty with word finding and then transitions to problems with language comprehension and a breakdown in larger semantic memory-dependent tasks. As the disease progress, individuals with SD may begin to show changes in personality and behavior. The age of disease onset ranges from 45 to 65 years old, with a 50% survival rate of 12 years.

### Cross-References

- ▶ [Aphasia in Later Life](#)
- ▶ [Behavioral and Psychological Symptoms of Dementia](#)

- ▶ Dementia and Neurocognitive Disorders
- ▶ Frontotemporal Dementia (FTD)
- ▶ Language, Comprehension
- ▶ Language, Naming
- ▶ Semantic Dementia

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## Sensory Effects on Cognition in Later Life

Karen Z.H. Li, Halina Bruce and  
Victoria Nieborowska  
Department of Psychology, Center for Research in  
Human Development, Concordia University,  
Montréal, QC, Canada

## Synonyms

Audition; Cognition; Movement; Vision

## Definition

This entry reviews the interacting relationships between sensory (audition, vision) and

sensorimotor (gross and fine motor) aging and cognitive aging. Evidence from experimental age-simulation, clinical, intervention, and neuroimaging approaches is summarized, along with major theories linking sensory/sensorimotor aging to cognition.

## Background

The impact of sensory aging on cognitive status is a growing focus of research (Salthouse 2010; Scialfa 2002; Schneider and Pichora-Fuller 2000). On this topic, the visual and auditory systems have been most closely examined given that these are the two predominant sources of environmental input for further perceptual and cognitive analysis. For instance, the integrity of signals entering the cognitive system via auditory or visual channels, if compromised or degraded by aging, have been shown to impede efficient cognitive processing of that information due to a need to engage in top-down processing (e.g., contextual knowledge) to “fill in the blanks.” A less commonly considered influence on cognitive functioning is the age-related decline of sensorimotor processes. This domain of functioning, which encompasses gross and fine motor tasks, requires the integration of multiple sensory inputs (tactile, visual, vestibular, proprioceptive). As such, sensorimotor aging has more recently been considered in terms of its indirect effects on cognitive processing efficiency. For example, motor tasks such as postural control and object manipulation appear to enlist more cognitive capacity in old age, consequently detracting from ongoing cognitive tasks such as memory retrieval, language processing, or navigation.

Within each domain (auditory, visual, motoric, cognitive), there is well-established evidence of gradual age-related degeneration that can be observed at anatomical, neuronal, and behavioral levels. What is currently less well established is our understanding of how, across domains, multiple age-related declines influence one another. The extant research has focused on theoretical questions concerning the directionality of influence (unidirectional, reciprocal, indirect) and

whether other more general factors can account for correlated declines in sensory/sensorimotor and cognitive domains. On a more applied level, another topic of interest is whether the accurate assessment of cognitive abilities is hampered or biased when individual differences in sensory impairments remain uncorrected or when cognitive assessment tools are not optimally designed for individuals with subclinical sensory declines.

Much of the contemporary research linking sensory/sensorimotor aging and cognitive aging stems from a large-scale longitudinal study known as the Berlin Aging Study (BASE), which began with a sample of old-old (aged  $\geq 70$  years) community-dwelling individuals recruited using German city registry information. Multiple indices of physical, psychological, intellectual, and social functioning were collected at regular intervals. Using the early cross-sectional data, it was found that the age-related variance in general intellectual functioning was well accounted for by standard clinical tests of visual acuity (64.5%), auditory acuity (74.5%), and balance and walking speed (82.6%). Markedly lower correlational values were observed in a comparison group of young and middle-aged adults (Baltes and Lindenberger 1997), suggesting an increasingly strong connection between sensory/sensorimotor abilities and intellectual functioning with aging. Subsequent large-scale multivariate studies indicate broad agreement, although the identification of a singular “common cause” underlying sensory/sensorimotor and cognitive aging has been challenged by other efforts such as the Australian Longitudinal Study of Aging (ALSA). Follow-up longitudinal analyses of the BASE sample indicate weaker support for a single-factor model linking sensory and cognitive aging than the original cross-sectional report, leaving open the possibility of co-occurring factors such as cognitive compensation for sensory aging.

What follows is a review of the three main areas of research linking auditory, visual, and sensorimotor aging with cognitive functioning. Highlighted are key methodological approaches such as experimental age simulations of sensory decline, structural and functional neuroimaging,

and sensory remediation. Current theoretical views and future research directions are then presented in an effort to integrate and reconcile findings generated from three areas that have advanced in relative isolation from one another.

### Effects of Aging Audition on Cognition

The most prevalent type of auditory impairment in old age is presbycusis or loss of sensitivity to high frequency sounds. However, hearing is also impacted by other age-normative changes including both peripheral and cognitive factors (Schneider and Pichora-Fuller 2000; Schneider et al. 2010). Although hearing loss may account for speech-recognition difficulties in quiet conditions, peripheral changes in the auditory system can only account for a portion of the difficulties experienced by older adults in noisy and multi-speaker situations. To this end, to fully comprehend an auditory scene, listeners must locate and perceptually segregate the sound sources in their environment in order to focus their attention on target sources and ignore the processing of information from irrelevant sources. In addition to locating speakers in space and focusing attention on relevant information, speech comprehension is affected by temporal processing, partly under the control of the central auditory nervous system. With age, processing speed and interaural timing are affected, with the auditory system becoming slower and more asynchronous, respectively. However, cognitive theorists have suggested that in addition to signal degradation from a deteriorating peripheral auditory system, older adults may be more vulnerable to intrusions from irrelevant or distracting stimuli than younger adults due to age-related changes in cognitive functioning such as changes in working memory, slowed speed of processing, and a deficit in inhibition. In tandem, older adults also utilize cognitive resources (e.g., working memory) to compensate for age-related hearing loss.

Epidemiological studies have revealed a correlation between hearing loss and cognitive function that remains even after correcting for individual differences in comorbid conditions, chronological

age, and cognitive status. Furthermore, the prevalence of hearing loss is greater in demented than non-demented groups (Schneider et al. 2010). While the auditory-cognitive link is well replicated in such approaches, explorations of underlying causes require more experimental designs.

One such research strategy is to simulate aspects of age-related hearing loss by degrading the auditory speech signal to mimic a specific feature of the auditory system that is hypothesized to decline and affect cognitive performance. Examples of such experimental manipulations include presenting speech in noise, increasing the rate of speech, or adding temporal jitter, to mimic age-related declines in perceptual segregation, processing speed, and temporal processing, respectively. In studies of speech perception, older adults derive more benefit from informative sentence context than young adults (Pichora-Fuller et al. 1995; Schneider and Pichora-Fuller 2000), and performance is influenced by the predictive context of the stimulus (Burke and Shafto 2008). However, this utilization of top-down resources has been thought to detract from other cognitive processes: When auditory memory stimuli are presented in background noise such as multi-talker babble, age and noise have similar negative effects on long-term memory but not immediate memory, presumably because the auditory challenge interferes with capacity-limited memory encoding processes. Similarly, when speech rate is manipulated, the effects of age, hearing loss, and accelerated speech are more detrimental in syntactically complex sentences than in simple ones (Schneider et al. 2010). Therefore, age-related changes in hearing ability may be compensated for by recruiting cognitive resources, but at a cost to other ongoing cognitive activity. An implication of such findings is that when a listening task is simple or provides adequate environmental support, the older listener may successfully perform the task but expend more cognitive effort or capacity to do so. Effortful listening is a common complaint of older adults even when auditory acuity is within the normal range.

The interpretation of top-down cognitive compensation has been further explored using

dual-task methodology. In this approach, participants are administered an auditory task and a nonauditory task separately (i.e., single-task conditions) and simultaneously (i.e., the dual-task condition). This approach assumes that if older adults recruit more cognitive capacity to perform listening tasks, they should show larger dual-task costs than young adults. Dual-task costs are typically defined as a drop in performance from single-task to dual-task conditions, as expressed by absolute or proportional difference scores. Accordingly, compared to their age-matched peers, individuals with hearing loss show greater dual-task costs on a nonauditory secondary task while maintaining good auditory task performance under dual-task conditions. Notably, this pattern holds even after hearing loss is corrected by increasing the signal intensity or by improving the signal-to-noise ratio. This pattern is consistent with the view that more cognitive resources are needed to compensate for sensory deficits (McDaniel et al. 2008). Very new work using structural and functional magnetic resonance imaging (MRI) shows global decreases in brain volume in hearing-impaired older adults as compared to their age-matched peers and increased involvement of prefrontal cortical regions in older adults while performing listening tasks.

Others have investigated the impact of correcting for auditory impairments on cognitive functioning. In those older adults with diagnosed hearing impairment, sensory remediation (i.e., hearing aid use) has resulted in significant improvement on cognitive measures administered within the same modality as the intervention. This finding supports the importance of assessing hearing acuity in both research and clinical assessments of cognition. Furthermore, cognitive scores (working memory, general intelligence) correlate with measures of speech perception, even after amplification with hearing aids. Finally, individual differences in cognitive capacity are predictive of the degree to which individuals can benefit from more complex, cognitively demanding hearing aid models (Schneider et al. 2010), suggesting a reciprocal relationship between auditory and cognitive aging.

## Effects of Aging Vision on Cognition

As with the aging auditory system, there are multiple anatomical changes to the visual system that occur gradually during the normal course of aging. Normative age-related transformations of the eye structures (e.g., decreased pupil size, increased lens density, yellowing, and opacity) result in reduced accommodation to near objects (presbyopia) and less light reaching the retina. Older adults show reductions in light sensitivity, contrast sensitivity, retinal illumination, and color vision, which affect more complex visual processes (Schneider and Pichora-Fuller 2000). Age-related slowing of visual processing has implications for older adults' ability to detect, identify, and track visual stimuli. These visual functions are fundamental precursors to many upstream cognitive processes. There is considerable evidence for age-related decline in visual tests of inhibition, selective attention, task switching, multitask processing, and processing speed (Burke and Shafto 2008; Kramer and Madden 2008). Older adults exhibit a slowdown in visual target detection, recognition, and identification of visual objects which adversely affects top-down processes that are typical of cognitive aging, including working memory. As demonstrated in the hearing-cognition literature, longitudinal and cross-sectional research has shown strong correlations between visual acuity and fluid cognitive abilities such as memory and attention (Scialfa 2002).

Age-simulation techniques have also been used in the visual domain to examine the interplay between age changes in cognition and sensory function. For instance, partial occlusion filters were used to simulate reduced visual acuity in middle-aged adults who were given standard tests of intelligence. However, this manipulation did not cause significant decreases in cognitive performance as compared to control participants wearing clear goggles. By contrast, subsequent work using similar simulation methods revealed worsened cognitive performance in samples of older adults, whose cognitive capacity is more limited than that of middle-aged adults. Possibly, the earlier findings did not yield significant effects

because there is sufficient spare cognitive capacity to compensate for the occlusion effects in midlife. In other age-simulation work concerning visual search tasks, older adults show slower and more effortful search compared to young adults. Manipulations that reduce luminance or duration of the visual presentation, to mimic lens opacity and slowed processing respectively, cause younger adults' pattern of visual search performance to resemble that of older adults (Scialfa 2002).

Other age-simulation work has shown larger age effects in visual processing speed when attentional load and background visual noise are increased. In the useful field of view (UFOV) task, the examinee is instructed to indicate the location of a peripheral target which may be embedded among an array of distractors. It is shown that older adults' UFOV is worsened when performed with a simultaneous cognitive task (Owsley 2011). Taken together, given a sufficiently demanding task, older adults' performance is disproportionately worsened in comparison to younger adults when either the visual demands of a cognitive task are increased or when the cognitive demands of a visual task are increased.

Further evidence of age-related cognitive recruitment comes from neuroimaging studies in which there are age-related differences in the pattern of brain activation during a cognitive task. For example, in selective attention tasks, older adults show greater activation of frontoparietal regions and reduced activity in visual cortices during visual search compared to younger adults. Sensory aging is also found to be associated with age-related decline in visual cortex activation during word recognition (Kramer and Madden 2008). Studies of visual language processing (dependent on visual acuity and contrast sensitivity) show that increments in word length differentially increased the lexical decision latency in older adults compared to younger adults, and this was linked to less activation of visual cortex. Similarly, in a fMRI study of lexical decision, older but not younger adults showed improved performance when word frequency increased. This frequency-related benefit was linked to increased activation of anterior and posterior regions of the occipitotemporal pathway.

The interpretation given was that older adults utilize higher-order functions as a compensatory mechanism for declines in sensory processes (Burke and Shafto 2008), similar to what has been shown in the auditory aging research.

Intervention studies have shown that practice may improve cognition through the utilization of top-down mechanisms that outweigh the use of bottom-up sensory processes (Scialfa 2002). For example, visual processing speed and the ability to perform multiple attention tasks can be enhanced through a training program in which older adults practice the detection and discrimination of visual stimuli (Owsley 2011). Surgical intervention in the form of cataract surgery has yielded improvements to cognitive performance to some degree, although the clinical significance of the observed improvements has been called into question (Jefferis et al. 2011).

There is support for the notion that visual deficits produce age-related changes in cognition that may cause difficulty for older adults to process test material (Scialfa 2002). Therefore, cognitive tests are possibly biased against individuals with poor vision who attain poor cognitive performance scores. For example, seniors show larger Stroop interference effects which are commonly understood as a decline in selective attention. However, it has been shown that age-related deterioration in color vision might be responsible for an increase in the interference effect (defined as the difference between color naming and reading color-neutral stimulus latency) in seniors (Ben-David and Schneider 2009). Consistent with this finding, researchers have examined the Montreal Cognitive Assessment (MoCA), a widely used screening test for mild cognitive impairment (MCI), in terms of its suitability for older individuals with low vision. When four visual items were removed from the global score, test specificity increased, but the sensitivity to detect MCI in visually impaired older adults was reduced, suggesting that visual impairment may be a harbinger of cognitive impairment (Wittich et al. 2010).

Importantly, one should consider the role of sensory function in experimental design to diminish the effect of sensory loss on cognitive

performance. For instance, participants should be screened for visual health (near and far acuity, contrast sensitivity, UFOV) as appropriate for the experimental tests in question. Furthermore, visual test stimuli should be presented in consistently optimal conditions by avoiding low luminance and contrast, high spatial and temporal frequency, or short wavelengths (Scialfa 2002).

### **Effects of Sensorimotor Aging on Cognition**

Following from the early correlational findings generated by the BASE and ALSA projects, a growing body of research has concerned the link between sensorimotor aging and cognition (Seidler et al. 2010; Woollacott and Shumway-Cook 2002; Yogev-Seligmann et al. 2008). Age-related loss of muscle mass leads to slowed contraction speed, loss of receptors in the joints reduces proprioceptive input, and degeneration in the basal ganglia, cerebellum, and motor cortex results in disruptions in movement onset, timing, and coordination of movement, respectively. Further age-related changes in sensorimotor integration affect movement velocity and correction (Ketcham and Stelmach 2001). Apart from such age-normative changes, conditions such as rheumatoid arthritis or Parkinson's disease affect the ease and control of movement.

Early models of gross motor control assumed that standing balance and locomotion were primarily driven by spinal and not cerebral circuits. Only recently has there been broad acceptance of the role of cognition in these motor tasks. This conceptual shift was, to a large degree, initiated by a clinical observation of dementia patients who, when asked a question, either stopped walking to answer or continued to walk while answering. Patients who stopped fell more frequently in the subsequent 6-month period than those who managed to dual task, suggesting that individual differences in cognitive capacity might be related to motor control. Indeed, measures of walking correlate positively with measures of executive functioning and processing speed, suggesting that there is shared neural circuitry underlying both

domains of functioning. A large body of research has since been generated using experimental dual-task methods borrowed from cognitive psychology.

In much of this work, the emphasis has been on the dual-task costs that arise when a cognitive task is performed simultaneously with gross motor tasks such as walking or balancing. As much of this research has stemmed from the medical and movement sciences, the physical outcomes have been of greater interest than the cognitive. However, one can also consider the detrimental effects on cognitive performance that occur when the motor system is challenged by arthritis or tremor or when fear of falling is at issue and cognitive capacity is allocated to motor control instead of a concurrent cognitive task.

In keeping with other age-simulation work, reduced sensory inputs have been examined in the context of balance control in which the individual is instructed to stand upright without movement for a short period of time (e.g., 30 s). For example, altering proprioceptive input by balancing on a compliant foam surface or restricting vision while balancing is more detrimental to older adults' balance than young adults', and these effects are further exacerbated by the addition of a cognitive load. Similarly, in postural recovery studies involving unpredictable platform movements, older adults commonly show greater dual-task costs than young adults, both in terms of cognitive performance and in the efficiency of postural recovery, again suggesting that sensorimotor and cognitive systems compete for common capacity.

In dual-task studies of walking, it has been shown that older adults have a tendency to allocate more attention to walking than to the concurrent cognitive task, owing to the instinctive desire to prioritize physical safety over cognitive performance. Similar to the auditory and visual age-simulation work, higher-order cognitive processes such as memory encoding and language production have been shown to suffer under dual-task conditions as compared to single-task cognitive conditions. Conversely, dual-task costs in the sensorimotor domain seem less affected by age, suggesting that older adults are less willing to

relinquish cognitive capacity and truly divide their attention between cognitive and locomotor tasks compared to younger adults. This pattern supports the “posture-first principle” or postural prioritization hypothesis. Postural prioritization is commonly expressed by showing greater dual-task costs in the cognitive than in the sensorimotor domain, despite instructions to treat each task with equal importance. Not surprisingly, this prioritization behavior emerges more frequently when testing older fallers and those with self-reported fear of falling or when walking is restricted to a narrow or elevated path that induces fear of falling. In sum, postural prioritization may be seen as an indirect way in which sensorimotor aging can have a negative impact on cognitive performance.

Unlike the dual-task research on visual and auditory perception, in some instances the addition of a concurrent cognitive task is facilitative: Particularly for older adults, balancing or walking paired with a simple cognitive task may improve motor performance compared to single-task conditions, but these benefits turn into costs as the cognitive task increases in complexity (Frazier and Mitra 2008). One interpretation of this nonlinear pattern is that directing full attention to walking or balancing is unnatural and detracts from motor coordination; hence, a simple cognitive task helps by providing an external attentional focus. However, once cognitive complexity exceeds one’s available capacity, performance costs are commonly observed.

Fine motor performance has been examined using finger sequencing and reach-to-grasp protocols measured under single- and dual-task conditions. These investigations reveal similar patterns of age-related increases in dual-task costs. As well, functional neuroimaging studies of older and younger adults performing hand or foot movements, finger sequencing, or tapping commonly show patterns of greater neural activation with age in prefrontal and sensorimotor cortical areas. In contrast to functional neuroimaging studies of visual and auditory tasks, in motor performance studies, it is less common to observe under-activation of regions more associated with peripheral processing that are more typically recruited in young adults.

More recently, portable neuroimaging (functional near-infrared spectroscopy) of walking has revealed that prefrontal brain regions are more involved in walking while talking compared to walking alone and that older adults underutilize the prefrontal cortex to coordinate dual-task performance. Findings from clinical populations provide convergent evidence for the link between cognition and mobility: Patients with Parkinson’s and Alzheimer’s disease exhibit more gait abnormalities when performing a simultaneous cognitive and walking task compared to healthy controls. Intervention studies targeting cognitive attentional training have led to improved gait speed, standing balance, and dual-task walking and balancing (Seidler et al. 2010; Yogeve-Seligmann et al. 2008).

## Theoretical Perspectives

Based upon the variety of findings reviewed, a number of explanatory models have been entertained (Schneider and Pichora-Fuller 2000, for an overview). Perhaps the simplest model, *sensory deprivation*, proposes that long-term decline in the sense organs leads to deterioration and atrophy of higher-level cognitive structures. The strong view of this model (irreversible deterioration) has been disconfirmed in studies showing improved cognitive performance following treatment to correct peripheral deficits, although these findings are mixed. A future aim would be to correct for more than one aspect of aging sensory functioning at a time. Further, the sensory deprivation view appears more applicable to the aging of vision and hearing than to motor processes, at least in its strictest form. A more parsimonious but indirect possibility is that declining hearing, vision, and mobility may lead to social withdrawal as activities become more effortful. This in turn might lead to cognitive under-stimulation and eventual cognitive deterioration.

A second major view is the *common-cause hypothesis*, stemming from the original BASE correlational findings. This view states that a third general factor underlies multiple domains of age-related decline. Candidate common factors

include: global neural degeneration, dopaminergic transmission efficiency, behavioral slowing, and genotypic variation. This perspective holds appeal in light of correlations between sensory measures and cognitive measures that have no obvious sensory requirement (e.g., letter fluency). However, as Schneider and Pichora-Fuller (2000) have noted, the third-factor explanation assumes that there is modularity or functional independence of sensory and cognitive systems, which is a debatable assumption.

Quite different from a modular view is the *shared resource* or *integrated system* view, which states that perceptual and cognitive systems share neural structures and resources. Within this perspective, cognitive decline could influence performance on perceptual tasks, and conversely, increased perceptual or motoric challenge would draw more resources from cognitive networks. Age-simulation designs, in which increasing sensory load results in reductions to cognitive performance, support the shared resource view. Similarly, studies in which cognitive load is increased by adding task complexity or by adding a concurrent task frequently result in costs to perceptual or motor performance.

Related to this is the *cognitive compensation* perspective, as illustrated in functional neuroimaging studies showing supplementary brain activation in prefrontal or contralateral regions more so in older than in younger adults and in behavioral studies of word perception in which older adults benefit more from the presence of semantic context as compared to young adults. Across auditory, visual, and motor aging literatures, the strict criterion for cognitive compensation is the observation of age-equivalent performance levels. However, age equivalence may not be attainable when cognitive resources are not sufficient to both compensate for sensory/sensorimotor declines and address the cognitive demands of the task at hand (Seidler et al. 2010), for example, when auditory memory encoding processes are disrupted by presenting stimuli in noise (Schneider et al. 2010).

## Future Directions

The work on sensory/sensorimotor aging and its effects on cognition are moving toward further consideration of cross-domain and reciprocal interactions. For example, epidemiological work links hearing acuity and mobility, showing that older adults with hearing impairment are at greater risk of falling than their normal-hearing peers. Also on the topic of age-related hearing loss, combined audiovisual presentation shows promise in improving performance on comprehension and working memory tasks. In future work, longitudinal designs will be essential for the elucidation of lead-lag relationships among domains of functioning and should move beyond the aim to identify candidate common factors, taking into consideration the possibility of cognitive compensation. Currently these aims have been examined using distinct methodological approaches. The emerging research also calls for a closer examination of the sensory and motoric requirements inherent in standard neurocognitive assessment tools and adaptations to improve measurement sensitivity and specificity. Further work on the implications of combined sensory and cognitive impairments for everyday functioning would complement existing work showing that cognitive status plays a significant role in how well those with sensory impairments fare with activities of daily living (Heyl and Wahl 2012). Lastly, elucidation of the limits of sensory correction (e.g., hearing aid use) within complex real-world environments with multisensory and cognitive demands (postural control, multitasking) will better inform clinicians, end users, and industry.

## Cross-References

- ▶ [Australian Longitudinal Study of Aging \(ALSA\)](#)
- ▶ [Common Cause Theory in Aging](#)
- ▶ [Dual Sensory Loss](#)

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## Sexuality and Aging

Catherine Connaughton and Marita McCabe  
Institute for Health and Ageing, Australian  
Catholic University, Melbourne, VIC, Australia

## Synonyms

Attitudes toward sexuality and aging; Geriatric sexuality; Sexual behavior; Sexual dysfunction; Sexual expression in older persons

## Definition

Sexuality and aging are a complex field, with attitudes toward sex and sexual expression characterized by factors such as historical context, cultural, and societal expectations as well as

shaped by numerous biological, psychological, and relationship factors.

## Introduction

People have increased longevity, and with this comes the notion that they are sexually active for a longer period of time. Biomedical interventions have enabled older people to maintain an active sex life as well as vitality in the bedroom. However, it has only been within the last few years that research has investigated the sexual behavior of older adults, rather than relying on the stereotype that as people age, the need and desire for sexual activity may be less prominent (Marshall 2012). Over the past decade, clinicians and researchers in this field have acknowledged some of the factors associated with sexual functioning in older people, such as the availability of a partner as well as good physical health. It is only recently that the expression of sexuality and sexual behavior in people over the age of 50 years has been explored. This entry presents an overview of the history to sexuality and aging followed by the contemporary view of sexuality, including current attitudes, cultural differences, and sexual expression, in addition to differences between generations on marriage, cohabitation, and dating. It also considers the factors associated with sexual functioning and treatment in older people, with implications for clinical practice and future directions.

## From Historical to Contemporary Views of Sexuality

Before the medicalization of sexual dysfunctions, loss of interest in sex as well as ability to function sexually was generally viewed as part of the natural aging process. If individuals experiencing sexual difficulties were to seek treatment, they may have been offered counseling to assist them to adjust to the changes in their bodies, rather than receiving interventions to address the problem. Pioneers in the sex research field, Masters and Johnson (1966) suggested that sexual activity

was still possible among older people and that although some adjustments should be made in accommodating physical and health changes, sex could be enjoyed into older life by placing an emphasis on intimacy, rather than sexual performance. Although the nature and frequency of sexual activity may vary for individuals, there was little evidence available to suggest what was “normal” in regard to sexuality and sexual expression in older people.

The availability of medications to improve sexual functioning, such as the release of Viagra in 1998, has driven the more recent view that older people can maintain a healthy and active sex life. In addition, more is now known about effective therapies for the treatment of sexual dysfunction. Despite this, there is a poor understanding of the factors associated with the continuation and maintenance of sexuality for older people as well as what healthy aging in regard to sexual expression may encompass. There is limited research available on people over the age of 50 to suggest what they are currently experiencing and what they would like to experience in regard to their sexual expression. Given the health and lifestyle factors associated with aging, it is likely that the expression of sexuality will differ from when they were younger. For example, some older people may feel relieved, as they may not want to be as sexually active as they were previously, perhaps due to physical frailty or that they do not perceive sex to be important in the relationship. For others, it may be that sex is critical, and sexual expression will continue into older age, including kissing, touching, and hand-holding. Thus, numerous factors including cultural standards, societal expectations, and individual features may influence sexual behaviors in older age people.

## Contemporary Views of Sex

In general, the population has lower mortality rates and an increasing aging population. The focus on physical illness and disease in aging has shifted to the maintenance of good health, with continued sexual functioning being viewed as a positive aspect of the aging process.

Specifically, the “baby boomers” have experienced the sexual revolution of the 1960s and other social changes such as the feminist and gay rights movements. This indicates that there may be a changing of societal norms, values, and trends in relation to sexual attitudes and sexual behavior, and what is socially acceptable may differ for this generation in comparison to previous cohorts of older people. It is highly likely that people within the “baby boomer” era will have very different views and expectations of sexuality. Therefore, previous data on sexual behaviors and expectations in the aging population may no longer be relevant to present-day aging.

### Attitudes to Sex and Sexual Expression

To date, there have only been a few studies that have examined the sexual attitudes and behaviors of men and women above the age of 50. The National Social Life, Health, and Aging Project (NSHAP) (Waite et al. 2009), the National Survey of Sexual Health and Behavior (Herbenick et al. 2010), and the American Association of Retired Persons (AARP) study (Fisher 2010) provide some important insights into the attitudes and sexual practices of people aged over 45 years.

### Sex and Sexual Behavior

Studies have demonstrated gender differences in attitudes toward sex as well as differences between age cohorts within the aging population. In a study of 1,670 adults over the age of 45, Fisher (2010) found that of the 1,487 people who completed the survey aged over 40 years, 80% of all men and 62% of women under the age of 70 years rated a “satisfying sexual relationship” as important to their quality of life. Only 8% of women over the age of 70 years reported that they agreed with the statement that “sex is only for younger people.” Gender differences have also been found in the literature, with men of all ages rating themselves as more positive about sex and sexual expression than women, regardless of the circumstances (i.e., whether married, dating, or single). Among women, 71% believed there was too much emphasis on sex today, compared to 58% of men.

On the other hand, 67% of men agreed that sex is critical in a good relationship, compared with 50% of women in the sample.

In another study, of men aged 57–64 years, 68% agreed with the statement “Sexual ability decreases with age” (Waite et al. 2009). This increased to 72% of those aged between 65 and 74 years and 78.5% of men aged between 75 and 85 years. For women, the findings were 71%, 83%, and 89%, respectively. Nevertheless, conservative attitudes remain among the older cohort, with many asserting that “religious beliefs guide their sexual behavior” (Waite et al. 2009). In a review of the literature, DeLamater (2012) concluded that a substantial proportion of older people are more likely to believe that sex declines in importance as they age. Moreover, further analyses of the AARP data conducted by DeLamater and Sill (2005) found that men and women who agreed that sex was important also reported significantly greater levels of sexual desire compared to those who did not rate sex as important. Thus, positive attitudes toward sexuality appear to be important for the maintenance of sexual activity in older people. It is also critical to consider the factors that may influence the importance that people place on sexual activity as they age. For example, the burden associated with becoming a caregiver for aging parents, looking after grandchildren, or transitioning into the role of the carer for a partner with declining health may impact on the desire or importance of sex in the relationship.

It has been demonstrated that healthy and physically active individuals over the age of 45 years report greater satisfaction with their sex lives than those who report health problems or increasing physical frailty. Indeed sexual satisfaction decreases sharply with age. Fisher (2010) reported that 12% of the respondents were more satisfied with their sex lives at present than they were 10 years ago, but 46% were currently less satisfied. In a study of sexual activity in adults aged 57 years and older, Waite et al. (2009) found that the most commonly cited reason men gave for not engaging in sex was the health of their partner. Supporting this, the most common response from women was that their own health limitations interfered with sexual activity. Also critical is the

importance of maintaining a sexual relationship for a couple and whether the level and nature of sexual activity throughout their lives is related to a decline in sexual activity in older age.

### Sex and Sexual Expression

It has been suggested that older people may consider the use of other forms of sexual activity, such as oral sex and self- or mutual masturbation, when vaginal sex cannot be part of their repertoire. However, one study has shown that 62% of men and 53% of women aged 57–64 reported they had “any” oral sex in the preceding year, which compares with only 28% of men and 36% of women in the 75–85 year age range (Waite et al. 2009). Moreover, studies have shown that a large proportion of older people still engage in vaginal sex in their later years. Herbenick et al. (2010) found that vaginal intercourse was reported by 58% of men and 51% of women aged 50–59. This declined to 43% among men over the age of 70 and more sharply to 22% among women 70 years and older. Similarly, of people aged 57–64 years, 87% of women and 91% of men stated that vaginal intercourse is “usually” or “always” part of sexual activity (Waite et al. 2009). In older cohorts this diminished to 75% of women and 84% of men who indicated that vaginal sex was usually or always part of sexual activity. Thus, people aged above 75 years may not consider the use of oral sex as a substitute for vaginal sex. This may change over time in aging baby boomers, who have more liberal attitudes toward sex and sexuality and who may continue to engage in higher rates of oral and vaginal sex than current cohorts of older people.

DeLamater (2012) found that solo masturbation was common among the older cohort (70+ years), with 46% of men and 33% of women indicating they engaged in this behavior. Interestingly, men with partners were less likely to engage in solo masturbation, whereas for women, solo masturbation was unrelated to partner status. However, some caution in regard to sexual behaviors such as masturbation is advised, given the possibility of a “cohort” effect influencing women who came of age after sexual revolution of the 1960s rather than an effect driven by biological age (Waite et al. 2009).

### Marriage, Dating, and Cohabitation

Fisher (2010) found that the number of people aged over 45 years who believe that unmarried people should not have a sexual relationship dropped from 41% 10 years ago to 22% in 2009. This suggests that people in this generational cohort may be more accepting of different forms of relationship and that more people over the age of 45 may be willing to seek a sexual partner if they are widowed or divorced. In particular, the baby boomers have demonstrated more accepting attitudes toward divorce and remarriage as well as cohabitating without marriage. In the study by Fisher (2010), 54% of the participants stated that they were married, and 15% stated that they were dating or engaged, which included those who were single, divorced, and widowed and those who were separated and dating. Interestingly, those who were married reported less sexual satisfaction than those who were currently dating (52% compared to 60%).

Overall, significant gender differences have been found in the research, in that generally men report higher levels of sexual activity and place a greater level of importance on sex in the relationship than women. However, caution is warranted as men are more likely to be partnered, particularly in the older cohort studied (i.e., over 75 years), when compared to women. Women tend to live longer than men and are unlikely to re-partner in older age, explaining to some extent why there is a sharp decline in reported sexual expression in older women (Herbenick et al. 2010). Moreover, Waite et al. (2009) found that among women without a current partner, disinterest in sexual activity increased with age, suggesting either that the lack of a partner in itself lowered sexual interest or that no longer seeking out a partner might have lowered sexual desire. This is in contrast to older men without a partner who still expressed interest in finding a partner (Waite et al. 2009).

### Cultural Perspectives

The limited research investigating attitudes toward sexuality and sexual expression in older people has predominantly involved Westernized cultures. Therefore, there is relatively little

information available regarding cross-cultural perspectives of sexuality and aging. However, the few studies that have been conducted in non-Westernized cultures have demonstrated substantial differences between the Western and Asian cultures. A study of 26,000 people aged between 40 and 80 years found that both women and men from China, Japan, and Thailand reported that sex was significantly less important than their Western counterparts (Laumann et al. 2006). Moreover, their sexual satisfaction was significantly lower than men and women from Western countries. People from Asian countries also reported lower levels of satisfaction with their relationships. Nevertheless, gender differences in beliefs about the importance of sex in the relationship and sexual satisfaction remained consistent across the countries; with men reporting higher rates of sexual satisfaction and importance on sex than women (Laumann et al. 2006), a finding that is also reflected across Westernized cultures.

A study by Yan and colleagues (2011) also found gender differences when they investigated the meaning of sexuality for Chinese men and women aged 61–85 years. Specifically, women who were interviewed reported that sex was part of their responsibility to procreate as well as to fulfill their husband's sexual needs, and men reported that sex was important for fulfilling their physical drive. Both genders though agreed that kissing, hugging, and caressing were not "sexual" activities. Interestingly, both felt that sex was neither pleasurable for women nor that it was needed in a similar manner to men (Yan et al. 2011). The differences in sexual expression and attitudes expressed by Western or non-Western cultures highlight the importance of considering the cultural context of sexuality, both in regard to assessment for people who present within the clinical setting and directions for further research. These studies demonstrate some of the complexities in understanding factors associated with sexuality and aging.

## Aging and Sexual Functioning

It has been widely accepted that with increasing age, there is deterioration in sexual activity and

functioning. This is based largely on the research findings showing strong links between aging and a decrease in sexual functioning. However, the findings are varied in more recent studies. For instance, research shows that erectile dysfunction, but not premature ejaculation or low desire, was found to be associated with age (Waite et al. 2009). It was also found that with the exception of lubrication issues, there were no major differences in the level of sexual dysfunction among women in younger (i.e., 57–64) and older (i.e., 75–85) age groups (Waite et al. 2009). It has also been suggested that sexual desire and frequency of orgasm decrease with age. However, this does not appear to be the case, with research showing that for partnered women and men, it is the decline of physical vitality rather than a decline in sexual interest that impacts most on their sexual functioning (Waite et al. 2009).

## Factors Associated with Sexual Functioning

There are many factors that may have an impact on sexual functioning as we age – related to biology, psychology, and relationships. It is important to recognize that sexual functioning may not decrease as a direct result of the aging process, but that older individuals have increased risk of developing health concerns, which may impact on sexual functioning.

*Biological Factors.* There has been extensive research on the associations between aging, medical conditions, and medication as factors associated with male sexual dysfunction. Aging has been found to be a strong predictor for erectile dysfunction. In particular, Laumann et al. (2007) reported a several-fold increase in moderate to severe dysfunction with age, particularly between the ages of 40–49 years. A lack of interest in sex has also been demonstrated to be associated with age and the aging process. However, it has been found that age does not appear to increase the risk of all sexual dysfunctions for men. For instance, one study has shown that while age was a significant factor in predicting erectile dysfunction and problems with low sexual desire, it did not predict problems with delayed ejaculation or premature ejaculation (McCabe and Connaughton 2013).

Although there is less research on the biological factors associated with female sexual functioning, the influence of hormonal, neurological, vascular, and anatomical factors is recognized (McCabe et al. 2010). For women, life stage changes – such as pregnancy, childbirth, and in particular, menopause – have been shown to impact on sexual functioning. Lubrication problems with age have been well documented (McCabe et al. 2010). Hormone level changes are not restricted to women, but in both genders; it tends to be associated with a reduction in sexual functioning.

The reduction in sexual functioning in the course of aging may have several explanations. With a growing aging population, the risks of medical conditions such as diabetes mellitus, hyperthyroidism, high cholesterol, lower urinary tract problems, prostate disease, and cardiovascular disease also increase. All these conditions have been found to be associated with sexual dysfunction (Laumann et al. 2007). Of note are medical conditions such as vascular and endocrine difficulties that may lead to decreased penile blood pressure, which, in turn, exacerbates the difficulty developing and maintaining an erection. Other conditions such as arthritis may cause sexual activity to be very painful and therefore restrictive. Neurological conditions such as dementia and Parkinson's disease may act as both precipitating and maintaining factors for both male and female sexual dysfunction. Moreover, not only does the risk of complex medical conditions increase with age, but the use of medications, such as antihypertensives and antidepressants (McCabe and Connaughton 2013), as well as the hormonal contraceptive pill has become more prevalent, which have also shown to impact sexual functioning.

*Psychological Factors.* There are a number of psychological factors known to influence sexual functioning in men and women. Studies of women have found that low levels of sexual desire tend to be associated with negative attitudes toward sex in the family of origin (Giles and McCabe 2009). Other research has found that more severe problems in arousal and orgasm are related to negative current attitudes toward sex for both men and

women (McCabe and Connaughton 2013; Giles and McCabe 2009). An individual's level of general anxiety has been associated with poorer sexual functioning irrespective of gender, as is depression and stress and comorbid anxiety and mood disorders.

Negative beliefs and thoughts related to poor body image have been identified as factors that may predispose, precipitate, and maintain sexual difficulties and low sexual satisfaction in men and women, leading to distraction during sexual activity and increased sexual avoidance. Research shows that men with erectile problems are not only distracted during sexual activity by thoughts of sexual performance (i.e., the maintenance of their erection) but also with concerns of body dissatisfaction and sexual undesirability (McCabe and Connaughton 2013). This has implications for the aging male and female, in that negative appraisal of age-related physical changes may lead to a higher level of risk for the development of sexual problems.

*Relationship and Social Factors.* Relationship factors may be both a cause and consequence of sexual dysfunction in both men and women. In particular, a lack of intimacy, communication difficulties, and poor relationship satisfaction have all been associated with poorer sexual functioning in both men and women (Althof et al. 2005; Basson 2000). It has also been found that the longer the relationship duration, the greater the risk of sexual dysfunction and that sexual dysfunction in one partner may precipitate sexual dysfunction in the other. Particularly salient for older adults is the impact of life transitions on sexual functioning. The experience of children moving out of home, retirement, the emergence of grandchildren, diminished income, and moving into an aged care facility can all have negative implications for levels of sexual desire as well as opportunity for sexual expression.

### **Treatment of Sexual Dysfunction**

*Psychopharmacology.* The focus on biological causes of sexual problems and subsequent ready availability of medication such as sildenafil (Viagra), in the late 1990s, resulted in a shift in the medicalization of sexual dysfunction. There is

a substantial body of literature showing that these medications can be effective in the treatment of erectile dysfunction. Moreover, medications for the treatment of other male sexual dysfunctions, such as premature ejaculation, have also been shown to be effective. In contrast, pharmacotherapy for female sexual dysfunction has been of limited benefit. Since the approval of sildenafil for male erectile dysfunction, there has been a search for a similar treatment for women in the form of a “pink Viagra.” However, study findings are inconclusive, and currently there is only one drug for female sexual dysfunction approved in Europe and none approved in Australia or the United States. Hormone treatments for female sexual problems have focussed on the delivery of estrogen and testosterone, both of which play key roles in female sexual response (Wylie and Malik 2009). Estrogen therapy is commonly used for sexual dysfunctions in women undergoing hormonal changes due to menopause and target symptoms such as diminished levels of lubrication and decreased vulvar sensation (Wylie and Malik 2009). To date though, there is no direct evidence that estrogen therapy is efficacious in the treatment of female sexual dysfunction, and this is in the context of considerable negative side effects of estrogen therapy that include increased risk of endometrial cancer, gallbladder disease, and venous thromboembolic events (Wylie and Malik 2009). Overall, there is a greater likelihood that men and women in their 50s and 60s have the expectation that sexual expression will continue as they age. Thus, despite the relative ineffectiveness of pharmacotherapy for women, it is nevertheless likely that there will be greater acceptance and use of medications to assist with sexual functioning in the future.

*Behavior Therapy.* The primary focus of Master and Johnson’s (1970) behavioral sex therapy is to assist the couple to re-experience sexual pleasure without the anxiety of performing intercourse. Sensate focus begins by focusing on the pleasure of nongenital touching, followed by sessions involving self-exploration of the genitals, shared genital exploration with partners, intercourse, and finally orgasm. While participating in these tasks, men and women are instructed to

focus on the sensations that accompany the experience with an absence of performance demand or excessive self-monitoring, which interfere with sexual functioning. Studies have demonstrated the effectiveness of behavioral techniques to treat sexual dysfunction in both men and women (Berner and Gunzler 2012).

*Cognitive-Behavioral Therapy.* The cognitive-behavioral therapy (CBT) treatment for sexual dysfunction aims to modify attitudes, beliefs, and expectations underlying the sexual dysfunction. In a review of the literature on couples with sexual dysfunction, Berner and Gunzler (2012) found that CBT successfully improved the sexual functioning of men, particularly those with erectile dysfunction. In women, CBT also was found to be effective for the treatment of hypoactive sexual desire disorder and was somewhat effective for the treatment of vaginismus (Berner and Gunzler 2012). Couple therapy using CBT has also resulted in significantly improved overall sexual functioning for women.

Although age is associated with an increased risk of sexual dysfunction, it is also the case that such dysfunction is not an inevitable outcome of the aging process. All the above data needs to be considered in light of large numbers of men and women above the age of 65 years reporting good sexual functioning well into their 80s and 90s (Waite et al. 2009; Herbenick et al. 2010; Fisher 2010).

## Challenges, Considerations, and Future Directions

Given only a few studies have investigated the prevalence of sexual activity in later life, it is difficult to generalize from these findings about what may constitute a “healthy, sexual relationship” in people aged over 50 years. Further research is required in order to obtain a good understanding and awareness of how to provide adequate support and accurate information for older people who want to remain sexually active. It would also be useful to gain a deeper understanding of the meaning of sexuality in older age persons by utilizing qualitative research methods.

In this way we can better understand not only what older people are currently experiencing in their sexual lives but also what they would like to experience. This information would not only enhance understanding but could be used to facilitate the development of interventions to assist older people to achieve their goals.

### **Training for Medical Practitioners**

Research has shown that older people tend not to seek assistance from their medical practitioner, largely due to the assumption that the sexual difficulties are a “normal” part of aging. This would be better managed were medical practitioners, health-care nurses, and psychologists given additional training to enhance screening, assessment, and evidence-based treatments for sexual difficulties in this population. Most importantly, providing basic training and awareness to practitioners to inquire about sexual health and sexuality in older clients is imperative (Hinchliff and Gott 2011). Given the high level of shame and embarrassment of sexual dysfunctions, previous research has suggested that people were more likely to seek help for sexual dysfunctions if their doctor had asked about their sexual functioning in a routine visit during the previous 3 years (Hinchliff and Gott 2011).

Clinicians also need to utilize appropriate assessment strategies across a range of biological, psychological, and relationship factors to formulate suitable treatment recommendations for older men and women who are challenged by difficulties in sexual function. For example, research has shown that erectile difficulties are one of the most common reasons why men seek medical assistance. Screening for possible causes – whether medical, pharmacological, psychological, or relationship based – is important when men present to their medical practitioner for treatment. Moreover, there may also be a lack of education in regard to sexual expectations in older people. For example, DeLamater (2012) suggested that some people with heart conditions may fail to initiate sexual activity with their partner because of fears that it may lead to negative consequences. This demonstrates that clinicians have an important role in the education of men and women

regarding their sexual health as well as appropriate strategies to address sexual dysfunction (see chapter “► [Training Psychologists in Aging](#)”).

### **The Use of the Internet to Facilitate Understanding and Treatment**

The use of online technologies as a way of accessing information, communicating with health professionals and groups, as well as Internet-based therapies is also worthy of consideration for this particular age group. Using Web-based programs and apps on mobiles is becoming increasingly common. This has important implications for the accessibility of information, communication with others via chat rooms, as well as the use of social media to form new friendships, seek social support, and maintain connections with others. In particular, given the embarrassment and shame surrounding seeking advice from medical professionals in regard to sexual functioning and the limited training and awareness by medical professionals to ask about sex lives, Internet-based treatments (also called e-therapy, Web-based therapy, and cybertherapy) for sexual dysfunction are likely to grow in popularity. Either group or individually based therapy provides privacy, is convenient to clients, and is accessible to geographically isolated members of the community, as well as people who find it difficult to leave the house due to limited mobility. The anonymity inherent in Internet-based therapy may be especially helpful in attracting older clients with sexual difficulties, who may otherwise delay or avoid treatment opportunities due to misconceptions with sexual dysfunction, such as sexual difficulties resulting from the “normal” aging process.

Over the past decade, clinicians and researchers in this field have begun to investigate the effectiveness of Internet-based sex therapy for a variety of male and female sexual difficulties. However, given the complexities with medication use and health factors associated with aging, Internet-based programs must also recommend screening for health concerns and biologically based factors commonly associated with sexual dysfunction by a medical practitioner. Another consideration in regard to the use of the Internet

is that given research on sexuality and aging is relatively limited, sexual information on the Internet may not necessarily be correct or relevant for older populations. Therefore, it is imperative that clinicians can provide information that is accurate, evidence based, and tailored to the needs of this particular demographic to clients.

### Nursing Homes and Sexuality

It is expected that the number of people in the population above the age of 70 will increase substantially over the coming decades. The implication is that more people may need to access nursing homes and other support accommodation facilities which may not be conducive to the changing view of sexuality and positive aging. It may become difficult for married couples living apart to continue a sexual relationship. Living conditions in nursing homes and supported accommodation tend to lack of privacy, have few separate rooms, and poor staff education in regard to the importance of sexual activity for older adults – all of which curtail sexual expression between partners (Roach 2004). Moreover, sexual behavior in the nursing home may be viewed as an inappropriate behavior by staff and family members, who may resort to seeking medical interventions to alleviate shame and embarrassment of reports of sexual behaviors from their family members. In addition, although people who identify as gay, lesbian, bisexual, and transgender orientation are increasingly accepted in society, they may face discrimination when they require access to aged care facilities and wish to share accommodation with their partners. This highlights the need for education and support to nursing staff as well as a better understanding of the sexual needs of those in residential care (see “► Retirement Villages” for a more comprehensive review).

### Conclusion

The importance of maintaining a healthy level of sexual activity will likely increase as more people live longer and live in better health than previous generations. More liberal attitudes

toward sexuality and sexual expression are likely as the expectations of being sexual continue throughout the aging process. While a shift has occurred in the definition and awareness of what constitutes “normal” sexual functioning for the aging population, these perceptions and expectations may be based on a society that highly values medication and antiaging products. However, further research needs to investigate narratives of the meaning and understanding of aging and sexuality. Although societal and cultural factors are important in shaping expectations of sexuality, ongoing sex and sexual expression is a process that is highly individual and is based on the physical, psychological, and social health of the couple.

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## Sleep Effects on Cognition with Aging

Michael K. Scullin  
Department of Psychology and Neuroscience,  
Baylor University, Waco, TX, USA

### Synonyms

Aging; Attention; Circadian rhythms; Longevity; Memory; Older adults

## Definition

Sleep is important to optimizing memory and cognitive functioning in young adults. With increasing age, sleep becomes fragmented and decreases in quality. Evidence suggests that getting good sleep quantity and quality can predict how well cognitive functioning is preserved in older age.

## Introduction to Sleep

Sleep has historically been conceptualized as a period of time in which the body restores itself. It is perhaps surprising then that many individuals sacrifice sleep on a nightly basis. According to Gallup polls, the percentage of Americans sleeping for 6 or fewer hours per night has risen from 11% in 1942 to 40% in 2013. Rather than validating the propensity to cut back on sleep, current research suggests that sleep serves multiple functions and could be most important for the brain. Consider, for example, the last time you only slept for 3 or 4 h. You likely experienced an inability to focus and to learn in class, as well as feeling a relentless internal drive to fall asleep.

Like hunger and thirst, the internal drive to sleep persists until the need is met, and there are serious consequences to not sleeping. When rodents are kept awake for two weeks, they die (Rechtschaffen et al. 1989). In rare cases, humans have stayed awake for several consecutive days (the longest confirmed case was 11 days), and in such cases these individuals experienced cognitive deficits and hallucinations. Thus, the functions of sleep are vital and likely more diverse than a simple shut-down-to-restore mechanism.

To understand the functions of sleep, one needs first to understand normal sleep physiology in adults. The most common approach is to use *polysomnography* (PSG), which refers to the electrophysiological recordings of brain waves (EEG), muscle activities, eye movements, breathing rates, and heart beat rhythms. PSG recordings have revealed that adults cycle through stages of sleep throughout the night. Therefore, “sleep” is actually an umbrella term that encompasses

physiologically distinct rapid eye movement (REM) stages and non-REM stages. A full cycle of the sleep stages takes approximately 90 min and most adults will have five to six cycles per night.

Adults first enter Stage 1 of non-REM sleep, which is considered to be a transitional state between sleeping and waking. Participants who are awoken during Stage 1 sleep will sometimes contend that they were not truly asleep (though they often cannot describe what was on their mind prior to the awakening). Stage 2 of non-REM is considered to be “true” sleep (Martin et al. 2000) and is represented by slower EEG activity (<8 Hz) interleaved with bursts of thalamocortical sleep spindles. Individuals next enter into non-REM Stages 3 and 4, which are characterized by even slower EEG oscillations (<4 Hz) and are therefore collectively referred to as *slow wave sleep* (SWS). Slow EEG oscillations are generated in the neocortex (particularly in frontal regions) (Massimini et al. 2004) and are believed to orchestrate the firing of both sleep spindles and hippocampal-cortical sharp wave ripples (Buzsáki 1998). Subcortical and sensory systems are largely suppressed during SWS, thus leaving a quiet background for the aforementioned neural activity (Buzsáki and Peyrache 2013; Logothetis et al. 2012). Following these non-REM stages, the sleeping brain enters into REM sleep, which is distinguished by vivid dreaming and increased cerebral blood flow in several regions such as the amygdala (Maquet et al. 1996). Humans spend the majority of the first half of the night in SWS, whereas the second half of the night is dominated by REM sleep and Stage 2 sleep.

Contemporary sleep science has capitalized on the advanced understanding of sleep physiology to link how sleeping “well” (i.e., minimal fragmentation, high levels of REM and SWS) benefits mood, body weight control, cardiovascular function, immune system function, and other aspects of health (Kryger et al. 2011). One of the most active contemporary areas of study concerns how sleep impacts cognitive functioning. Anyone who has pulled an “all-nighter” knows that their ability to maintain attention over a long period of time is

greatly diminished. Even more interesting, however, is sleep’s role in *memory consolidation*, which refers to the brain’s ability to transfer information from short-term storage (e.g., hippocampus) and preserve it in long-term storage (e.g., neocortex).

## Sleep and Memory Consolidation

Though scholars have long suspected that SWS and REM sleep actively benefit memory (e.g., Jackson 1884), scientists have only recently been able to experimentally demonstrate this effect. Initial evidence for memory consolidation during sleep arose from animal studies. In the 1990s, researchers recorded the firing rates of single cells to identify how the rodent’s hippocampus learned to run a maze. These studies typically showed that particular hippocampal neurons would fire in particular locations in the maze during learning (termed place cells). A turning point for the sleep field came in 1994 when Matt Wilson and Bruce McNaughton (1994) continued to record the hippocampal firing patterns during sleep and discovered that memories (i.e., represented by hippocampal firing patterns) were replayed during sleep. Subsequent work showed that this memory replay was causally associated with memory benefits the following day (Bendor and Wilson 2012).

Since Wilson and McNaughton’s (1994) seminal study, psychologists and neuroscientists have conducted hundreds of experiments to translate this research to humans (Rasch and Born 2013). For example, to mimic the paradigm used in animal studies, Peigneux et al. (2004) had participants undergo neuroimaging while learning a virtual maze and then undergo neuroimaging again while sleeping that night. The researchers found that to the extent that the hippocampus showed reactivation during sleep, participants were better at the virtual maze task the next day. Early PSG studies suggested that consolidation of episodic memories (i.e., explicit memory for events) occurs during SWS, and consolidation of procedural memories (implicit, motor, or skill memory) occurs during REM sleep (Plihal and

Born 1997). However, this sleep stage by memory-type distinction remains an area of active debate (Scullin and Bliwise 2015a).

One approach to linking sleep physiology to memory is to attempt to experimentally control memory consolidation during sleep. For example, studies that have directly manipulated features of SWS using transcranial direct current stimulation (tDCS) have demonstrated a causal role for SWS density in episodic memory consolidation. Marshall et al. (2004) had subjects learn word pairs and then tested them 3 h later after SWS or a wake-only interval. They applied tDCS or a placebo stimulation during sleep to affect the density of SWS. Relative to placebo stimulation and wake conditions, tDCS stimulation during SWS led to significantly greater SWS density and greater word retention (i.e., memory consolidation).

Similar evidence for a causal role of SWS in memory consolidation arises from the targeted memory reactivation procedure (Oudiette and Paller 2013). In this approach, participants learn a series of card pair locations on a grid (e.g., try to remember the grid locations of matching cards such as two pictures of a cat). Every time a card is studied (e.g., picture of a cat), it is paired with an associated sound (e.g., “meow” sound). Participants are tested on their memory of the card locations following a sleep or wake interval, but critically, during the sleep or wake retention interval, the experimenter plays half of the sounds that were previously studied. The central finding of this literature is that reactivating memories (via replaying the associated sounds) is more likely to improve later memory when reactivated during sleep than during wake, and especially if the episodic memories are reactivated during SWS (Rasch et al. 2007). Thus, there is strong evidence for sleep being conducive to episodic memory consolidation. One noticeable feature of this literature, however, is that the preponderance of evidence has emanated from studies of healthy young adults (ages 18–30). The remainder of this chapter focuses on how age-related changes in sleep quality, quantity, and physiology affect cognitive functioning, memory consolidation, and may even increase risk for dementia.

## Changes in Sleep in Advancing Age

Of all the changes in behavior and physiology that are observed with advancing age, changes in sleep are one of the earliest and most pronounced (Bliwise 1993). These age effects on sleep are summarized in Table 1. First consider subjective evaluations (i.e., complaints) about sleeping. Individuals can fall asleep as easily as young adults, but they typically fall asleep earlier in the evening. Many older adults complain of frequent nighttime awakenings as well as waking up too early and not being able to fall back asleep. Individuals often introspect that the cause of their sleep fragmentation is due to nocturia, or the need to use the bathroom in the middle of the night. However, there exists a debate as to whether a full bladder causes awakenings from sleep or if instead individuals wake up due to other causes (e.g., sleep apnea) but simply attribute the awakening to their bladder. Regardless of mechanisms, because sleep is more fragmented in older adults, *nocturnal* sleep duration is typically shortened. Total sleep time over a 24-h period may however be preserved due to an increased frequency of napping with increasing age.

Next consider physiological studies of sleep (PSG). Several age-related changes to sleep stages are consistently observed (Table 1). Older adults spend more time in the “light” stages of sleep (Stages 1 and 2 of non-REM sleep) than young adults, which may contribute to their sleep fragmentation because one is easily awoken during Stages 1 and 2 of sleep. REM sleep may also demonstrate some changes with normal aging (and particularly with Alzheimer’s disease) such as decreased density of REM burst activity. The most profound age-related change in sleep physiology appears to be to SWS. Older adults show about half the amount of SWS as young adults, and there even exist studies in which *zero* minutes of SWS were observed at night in *any* of the older adults who participated. Such observations are most likely to occur in very old men, because on average females display more SWS than males. Almost every EEG aspect of a slow wave is affected in older adults: slow waves are smaller (lower amplitude), faster

**Sleep Effects on Cognition with Aging, Table 1** Changes in sleep behavior and physiology with increasing age

Sleep issue	Effect of aging	Description
Subjective (self-report) observations		
Sleep onset latency (falling asleep)	None or minimal	Older adults can usually fall asleep as easily as young adults
Nighttime awakenings (fragmented sleep)	↑ with aging	Increased nighttime awakenings indicate fragmented sleep and can affect perceived sleep quality
Nocturia (waking up to void)	↑ with aging	Need to use the bathroom in the middle of the night may fragment sleep
Early morning awakening	↑ with aging	Waking too early may decrease total sleep time
Phase advance (timing of sleep/wake cycle)	↑ with aging	Older adults fall asleep earlier in the evening, which may contribute to early morning awakenings
Physiological (polysomnography) data		
Stage 1 NREM sleep	↑ with aging	Increased time in these “light” sleep stages may contribute to sleep fragmentation
Stage 2 NREM sleep	↑ with aging	
REM sleep	↓ with aging	Density of REM burst activity decreases and may precede development of dementia
Slow wave sleep (SWS)	↓ with aging	Decreased SWS may impair episodic memory consolidation during sleep
Sleep apnea	↑ with aging	Sleep apneas cause sleep fragmentation and hypoxia and impair memory consolidation

(i.e., higher frequency), less continuous (i.e., lower density), and are altered in morphology (e.g., the slope of the slow wave is affected) relative to young adults.

Beyond sleep stages, PSG studies show that older adults are at increased risk for developing several sleep disorders, for example, sleep apnea, which is a condition in which individuals may stop breathing for  $\geq 10$  s and, in particularly severe cases, for over a minute. Apneas may repeat hundreds of times every night and go unrecognized for years, but they are problematic because they cause sleep fragmentation and deprive the brain of oxygen (hypoxia).

The causes of poor sleep with advancing age are still being studied, but several factors such as a sedentary lifestyle, physical pain, depression and anxiety, reduced exposure to zeitgebers (e.g., sunlight), nocturia, use of medications that disrupt sleep architecture, and atrophy in regions that are important to sleep maintenance (e.g., ventrolateral preoptic area, suprachiasmatic nucleus) (Kryger et al. 2011). The take-home message from sleep and aging studies is that most indicators of good sleep quality in young adults are impaired in older adults.

### Cognitive Consequences of Diminished Sleep Quality with Aging

If sleep is critical to cognitive functioning in young adulthood (Rasch and Born 2013), but is diminished in quantity and quality with increasing age (Bliwise 1993), then poor sleep may contribute to cognitive aging. The approaches toward addressing sleep’s role in cognitive aging have ranged from basic science experiments in animal models to experimental cognitive psychology studies to population-based epidemiological studies (Scullin and Bliwise 2015a).

### Self-Report, Population-Based Studies

In many epidemiological studies, individuals self-report how much sleep they are getting, how much they are waking in the middle of the night, and how sleepy they feel during the day. There are now approximately 50 papers that have evaluated subjective sleep quality in relation to objective measures of cognitive functioning in aging adults. These studies often have very impressive sample sizes ( $N > 100,000$  in ref (Sternberg et al. 2013)



that are generalizable to the population. In cross-sectional studies of middle-aged adults (40s and 50s), short sleep and fragmented sleep were frequently associated with poorer cognitive performance on a range of memory and attention tasks (Scullin and Bliwise 2015a). In older age, these correlations were more sporadic. For example, Miller et al. (2014) examined the association between episodic memory and short sleep duration in middle-aged (50–64 years) and older-aged (65+ years) adults and found that short sleep in middle age, but not older age, was associated with poor episodic memory performance.

An interesting theme that has emerged from longitudinal epidemiological studies is that short sleep and fragmented sleep in middle age might accelerate cognitive decline observed by the time one reaches their 60s, 70s, or 80s. There are at least six longitudinal studies that have found that short sleep in one's 40s, 50s, or 60s predicts faster cognitive decline as much as two decades later (e.g., Kulmala et al. 2013; Virta et al. 2013), even after controlling for many demographic and comorbidity variables. The implication is that investing in sleeping well when one is relatively young may have cumulative benefits as one ages.

### Polysomnography Correlational Studies

As informative as epidemiological studies have been to showing that sleep complaints are associated with – and can even predict – cognitive decline, such studies are limited by their lack of precision. Using PSG, researchers have attempted to identify the sleep physiological correlate of cognitive decline. Though a few PSG studies suggest that short sleep per se is important to cognitive decline, the majority of the literature suggests that fragmented sleep and REM sleep dysfunction are markers (or potential causes) of cognitive decline (Scullin and Bliwise 2015b). The evidence for poor REM sleep (e.g., low duration or density) exacerbating age-related cognitive decline spans nearly 50 years (Feinberg et al. 1967) and was recently supported by the large-scale Osteoporotic Fractures in Men (MrOS) sleep study. In the MrOS study (Song et al. 2015), 2,601 older adults underwent PSG and cognitive testing (MMSE and Trail Making B) at Time 1 and then

repeated cognitive testing 3–4 years later. They found that individuals with low REM sleep and high Stage 1 sleep (i.e., a marker of light, fragmented sleep) showed a twofold increased rate of cognitive decline.

### Memory Consolidation Studies

A quickly developing area of research concerns how sleep benefits memory consolidation. Though some of the more exciting recent advances in this area have arisen from the tDCS and targeted memory reactivation approach (Oudiette and Paller 2013), such approaches have yet to be successfully applied in older adults (Eggert et al. 2013). The more common approach to testing for memory consolidation is to teach individuals a memory task in the evening and then retest them following sleeping. Relative to wake-only control groups (i.e., learning in the morning and testing in the evening), this sleep condition is typically associated with better memory. Circadian factors (e.g., morning versus evening testing) tend not to strongly influence consolidation effects (Scullin and Bliwise 2015a), and though reduced daytime interference during sleep has some impact on memory (Jenkins and Dallenbach 1924), qualitative changes in memory traces with sleep suggest active consolidation mechanisms (e.g., Ellenbogen et al. 2006; Payne et al. 2008; Scullin and McDaniel 2010).

If sleep benefits memory consolidation in young adults and if sleep quantity and quality are impacted detrimentally by aging, then one would predict that memory consolidation should also decline with aging. Animal studies support the view that memory consolidation declines with aging. When applying the same hippocampal memory replay procedure used in the classic Wilson and McNaughton (1994) work, researchers have found that memory replay is absent in older rodents (Gerrard et al. 2008). Similar patterns of decreased memory plasticity during sleep have even been observed in *Drosophila melanogaster* (fruit fly) models (Donlea et al. 2014).

In human subject research, most studies have also suggested that memory consolidation declines with aging. Most memory consolidation

and aging studies have used either procedural memory tests or verbal episodic memory tests. Nearly all of the experimental studies (seven of eight) that compared procedural memory (i.e., skill memory or motor memory) consolidation across sleep and wake intervals in middle-aged or older adults have suggested that there is a gradual loss of procedural memory consolidation with increasing age (Scullin and Bliwise 2015a). For example, Wilson et al. (2012) compared 24 healthy young adults, 32 healthy middle-aged adults, and 31 healthy older adults on a motor sequence learning task following wake-only and sleep intervals (within-subject manipulation). They found that the benefit due to sleep on procedural memory improvements was large in the young adults, reduced but present in middle-aged adults, and absent in older adults.

Identifying the PSG correlate of reduced procedural memory consolidation in aging adults has been difficult. In young adults, prospective memory consolidation is typically associated with REM sleep (Plihal and Born 1997) or sleep spindle density (Fogel and Smith 2011). However, attempts to experimentally increase REM sleep or spindles in older adults have had inconsistent effects on procedural memory (Hornung et al. 2007). Other studies have investigated brain activity during sleep *after* learning a procedural memory versus no learning. The idea here is that recently learned tasks should be replayed during sleep and that such replay will be evidenced by greater hemodynamic (fMRI) or electrophysiological (EEG spindles) activity. Using neuroimaging, Fogel et al. (2014) found post-training increases in activation in several frontal, parietal, and hippocampal regions in healthy young adults. No such post-training increases in activation were observed in older adults, suggesting that these older adults were not “replaying” the trained procedural memory task.

Similar age effects emerge for consolidation of episodic memories (explicit memory for events). Scullin (2013) compared the retention of paired word associates across sleep and wake intervals in 57 healthy young adults and 41 healthy older adults. The young adults demonstrated greater

episodic memory retention following the sleep interval than the wake interval, as well as a strong positive correlation between retention and amount of SWS. The older adults showed low SWS overall and no sleep benefit to episodic memory retention. This age-related decline in episodic memory consolidation seems to begin well before older age. Backhaus et al. (2007, 2006) found that episodic memory consolidation was impaired in a group of adults in their 40s and 50s, particularly for middle-aged adults who showed very little SWS.

Some of the age-related declines in episodic memory consolidation may be due to declining SWS, but other factors such as age-related atrophy of prefrontal regions and hippocampal regions and diminished prefrontal–hippocampal connectivity likely contribute (Mander et al. 2013). Memory consolidation may even depend on the amount of oxygen saturation levels in the prefrontal cortex during sleep. Most young adults show an increase in oxygen saturation levels from wakefulness to SWS (measured via cerebral oximetry), but most older adults show the reverse pattern (i.e., reduced prefrontal oxygen saturation levels during SWS (Carlson et al. 2008). However, older adults who showed increased prefrontal oxygen saturation levels during SWS performed better on episodic memory tasks (Carlson et al. 2011). Furthermore, Scullin et al. (2012) observed that individuals whose oxygen saturation levels dropped below 90% for 5 or more minutes (measured via pulse oximetry) during sleep showed no sleep-dependent memory consolidation.

## Can Sleep Disorders Cause Dementia?

If poor sleep is associated with poor cognitive functioning, then one might wonder whether sleep disorders could increase risk for dementia.

One sleep disorder that is consistently linked to the later development of dementia is REM sleep behavior disorder (RBD). In normal REM sleep, there is muscle atonia (i.e., individuals are paralyzed). The function of this muscle atonia is to prevent individuals from acting out dreams and

hurting themselves or their bed partners. RBD patients, however, will commonly act out violent dreams including fighting pirates, hunting and stabbing deer, and defending oneself against home intruders. There are even dramatic cases of suicide or homicide during sleep. For example, in July 2008, Brian Thomas was dreaming that he was fighting an intruder and woke up to find that he had strangled to death his wife of nearly 40 years. The charges against him were dropped, in part due to his history of sleepwalking, but also due to irregularities in his REM sleep that were observed during a PSG test.

Not only can dream enactment be dangerous, but RBD is often a sign of neuropathology. RBD is associated with dopamine dysfunction and brainstem pathology (including alpha-synuclein deposition and Lewy bodies). Individuals diagnosed with RBD – typically older men – have a 30% chance of developing Parkinson's disease within 3 years and a 66% chance within 8 years (Postuma et al. 2015). In one documented case, RBD symptoms predated the development of Parkinson's disease by 50 years. RBD patients tend to show deficits in episodic memory, executive function, and visuospatial processing and an increased risk for clinical dementia (Vendette et al. 2007).

Though the association between RBD and later Parkinson's disease and dementia is strong, the RBD sleep disorder per se is unlikely to be the cause of the dementia (i.e., the Lewy body neuropathology is presumed to be the cause of both RBD and dementia). The causal link between dementia and sleep may be more direct in Alzheimer's disease. Several PSG studies have found that sleep architecture differs between patients with Alzheimer's disease relative to healthy controls (Bliwise 1993), with the largest deficit being to REM sleep (but also sleep fragmentation and SWS). Moreover, epidemiological studies have found that subjective reports of short and fragmented sleep in middle age are longitudinal predictors of Alzheimer's disease decades later (Benedict et al. 2014). Several studies have also connected poor sleep to the hallmark pathology of Alzheimer's disease – amyloid plaques and neurofibrillary tangles (tau) – by using Pittsburgh

Compound B neuroimaging and cerebrospinal fluid (CSF) measures (Ju et al. 2013; Spira et al. 2013). Highly controlled animal studies have experimentally demonstrated that depriving a rodent of sleep leads to a buildup of amyloid plaques and tau deposition (e.g., Kang et al. 2009). Perhaps the most interesting recent advance in this literature is that one of the functions of sleep may be to clear the brain of harmful metabolites. Xie et al. (2013) found that CSF flow increased by up to 60% during sleep and this increase in CSF flow was instrumental in clearing amyloid out of the brain. Thus, losing out on sleep may cause a buildup of amyloid deposition whereas gaining normal sleep may help clear the brain of amyloid. Whether treating sleep disturbances in young and middle-aged adults reduces the risk of Alzheimer's disease or slows general cognitive decline remains a provocative question for future research.

## Conclusions

One of sleep's normal functions appears to be bolstering memory consolidation and cognitive functioning. With increasing age, sleep becomes shortened, fragmented, and changed in architecture (e.g., less SWS). These changes are paralleled by declines in cognitive functioning, such as a reduction in memory consolidation. Whether improving sleep in older adults could help ameliorate or reverse cognitive declines is an open question; however, there is now ample evidence that the quality of sleep in youth and middle age has predictive value for how rapidly cognitive functioning will decline years into the future. The practical implication is that people should invest in their sleep throughout the lifespan and, at the very least, during youth and middle age, to promote health, well-being, and graceful aging.

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## Cross-References

- ▶ Individual Differences in Adult Cognition and Cognitive Development
- ▶ Memory, Episodic
- ▶ Memory, Procedural
- ▶ Prospective Memory, New Perspectives for Geropsychological Research
- ▶ Psychological Theories of Successful Aging

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## Small-Scale Homelike Care in Nursing Homes

Hilde Verbeek

Department of Health Services Research, Faculty of Health, Medicine and Life Science, CAPHRI School for Public Health and Primary Care, Maastricht University, Maastricht, The Netherlands

## Synonyms

Autonomy; Group living; Person-centered care; Small-house nursing homes; Small-scale living facilities

## Definition

Small-scale, homelike nursing homes are an innovative example of long-term institutional care for people with dementia. They reflect a common psychosocial care concept, focusing on residents' autonomy and opportunity for choice, and aim to sustain a sense of self and control. A small number of residents (usually six to eight) live together in a homelike environment, and nursing staff is part of the household. Residents are encouraged to participate in daily household activities, emphasizing normalization of daily life with person-centered care. The physical environment resembles an archetypal home.

## Cultural Change

Small-scale, homelike nursing homes are the result of a changing care concept that has been developed during the past decennia's in health and dementia care, in which quality of life and well-being have a prominent place (White-Chu et al. 2009). In dementia care, there is a trend toward deinstitutionalization. Older people want to live at home for as long as possible (also referred to as aging in place), although this is not always feasible as care needs increase. Dementia in particular has a large impact on the ability to live within the local community, and approximately one third lives in long-term institutional care. Long-term institutional care for people with dementia has shifted in terms of philosophy and practice from a medically oriented care environment toward a resident-centered, individualized care environment (Verbeek et al. 2009a). Traditionally, nursing homes for people with dementia were based on a medical-somatic model of care, emphasizing illness and treatment of underlying pathology. Nursing homes were institutions, protected settings in which basic nursing and medical care services were provided aimed at keeping residents safe. Physically, they would resemble hospitals, with long corridors, a nurses' station, and staff uniforms. Their rules and routines governing daily life permit little individualization.

Nowadays, person-centered models of care are prominent in dementia care and emphasize strengthening residents' autonomy and overall well-being. Older people should be enabled to continue their lifestyle as before admission to a nursing home. Program design ensures that residents are known as people. Families are an important part of the care process in small-scale, homelike settings and prepare, for example, biographies for staff (Verbeek et al. 2009a). Furthermore, they not only focus on their own relative in the home but look after other residents as well. Adopting a homelike, person-centered care approach has proven to be very difficult in existing traditional large-scale nursing homes. The care environment often does not match with the therapeutic goals, which is perceived as an important barrier. As a result, new initiatives have been developed in the world that provide health, social, and nursing care in a small-scale and homelike environment. Radical alterations have been made in comparison with traditional nursing homes, implementing changes in the organizational, physical, and social environment of settings.

Worldwide, several small-scale, homelike concepts have been implemented, such as group living in Sweden, group homes in Japan, shared housing arrangements in Germany, the Green House concept in the United States, and small-scale living arrangements in the Netherlands. Some of these have become regular dementia care settings, such as group living in Sweden and small-scale living arrangements in the Netherlands (Verbeek et al. 2009b).

## Environmental Characteristics

There is a wide variation of small-scale, homelike care environments for people with dementia across and within countries. The location varies from units in a larger nursing home, toward purpose-built stand-alone facilities in the community. Some small-scale, homelike facilities are situated on the area of a larger nursing home. Stand-alone facilities prevent institutional characteristics to reappear in small-scale, homelike

settings, and being built in the community aims to maintain residents' social network. However, such facilities are often not feasible due to financial constraints and organization of (mental) health care. Physical characteristics of buildings resemble an archetypal home, including a kitchen, laundry area, dining room, and living room (Verbeek et al. 2009b). The vast majority of small-scale, homelike settings have private bedrooms, and some have also private bathrooms. The care environment can be considered as an active component in the dementia care process. Current theories stress that a match is needed between the person's needs, his/her abilities, and environmental demands to elicit adequate behavior in people with dementia, also referred to as person/environment fit (Lawton and Nahemow 1970; Cohen-Mansfield 2000). If environmental demands exceed patients' ability to cope, they have more difficulty to maintain adequate behavior, which decreases their quality of life. These principles have important implications for care environments, especially for people with dementia, as they experience diminished physical and/or mental disabilities due to their illness, increasing the environments' influence on their behavior. Several guidelines have been established on how to design dementia care environments. Most evidence exists for unobtrusive safety measures such as camouflaging exit doors; varying the ambience, size, and shape of space; private bedrooms, big enough for a reasonable amount of personal belongings; and control of stimuli such as noise and lighting (Fleming and Purandare 2010; Calkins 2001). Less evidence exists about the use of signage of various sorts (e.g., colors, objects).

However, to create a homelike environment, changing the physical setting alone is not sufficient as it can only facilitate (Judd 1998). Social and organizational aspects of the environment are necessary components in the development of a small, homelike therapeutic setting. The number of residents usually is between six and ten residents per unit in small-scale nursing homes. The main aim of a small group is to promote social activities and create a family-like structure, although in practice group, size may also be

determined by practical considerations such as available space, staffing, and financial issues. A small and fixed team of nursing staff takes care of the residents, which allows for close contact and communication. As nursing staff, residents, and family caregivers form a group, there is opportunity to become familiar with each other. The organizational environment in small-scale, homelike nursing homes is very different from traditional institutional care. In small-scale, homelike nursing homes, residents and their caregivers mainly determine daily life. They can decide, for example, when they want to get up in the morning and have their meals. On the contrary, in traditional nursing homes, the routines of the organization mainly determine daily life. Furthermore, nursing staff has integrated tasks in small-scale, homelike nursing homes, meaning that they are not only responsible for personal and medical care but also organize activities and do domestic chores such as cooking. In traditional large-scale nursing homes, tasks are highly differentiated with separate personnel to assist meals, do activities, and provide nursing care.

### Target Population

In general, small-scale homelike care facilities provide 24 h of nursing care to residents with dementia. In practice, characteristics of residents are heterogeneous across settings. Some small-scale, homelike nursing homes are designed for people with dementia in the earlier stages of their disease. Admission criteria to these settings may apply then, such as sufficient mobility and being ambulatory, being able to participate in social activities, or having communication skills. These settings manifest themselves as intermediate care facilities between home care and institutional nursing care. Residents may be transferred when criteria are no longer met. Challenging behavior, such as aggression, is perceived as especially problematic in small groups and that is often seen as a reason to relocate residents in larger nursing homes. Other small-scale, homelike care settings, however, are aimed to provide a home for life and are seen as an alternative to traditional

large-scale nursing homes providing all necessary health and social care services. Despite a similar level of care needs, residents in small-scale, homelike care settings appear to have a better cognitive and functional status compared with residents living in traditional nursing homes.

## Experiences

Residents with dementia, their family caregivers, and nursing staff have mainly positive experiences with small-scale, homelike care settings. Research shows that residents with dementia expressed feeling at home because they could maintain their personal characteristics and experience being connected and united within the household. Providing small-scale, homelike care in nursing homes creates structural opportunities for individualized care and attention to the residents' personal needs. The extent to which a nursing home has small-scale and homelike characteristics positively influences occupation of residents with their preferred and diverse activities.

Family caregivers highly appreciate personal contact and attention from nursing staff, not only with the residents but also with family caregivers themselves. They feel a strong sense of involvement and welcome the freedom that small-scale, homelike care puts on making one's own choices. This makes it easier for them in accepting that their relative can no longer live at home, since the environment is adapted to support residents in their autonomy. Furthermore, nursing staff appreciated the broadening of their tasks and had the feeling that they could spend more time with residents. They not only interact with residents during standard nursing care moments but also encourage residents to participate in daily activities. These household chores may serve as a handle for undertaking meaningful activities and provide opportunity for reciprocity. Negative aspects were mentioned as well. Family caregivers indicated a lack of amenities and general facilities such as a restaurant in some small-scale, homelike care settings. Furthermore, nursing staff worked alone a lot, and some missed a team to discuss difficulties and share responsibility.

## Effectiveness

Despite the fact that experiences with small-scale, homelike care environments are mainly positive, effects on residents, family caregivers, and nursing staff are limited. Several studies have been conducted in various countries comparing small-scale, homelike care settings with traditional large-scale nursing homes showing mixed results. The most consistent evidence suggests that residents living in small-scale, homelike care environments have more social interaction (de Rooij et al. 2012; Verbeek et al. 2014). Small-scale, homelike settings seem to offer a more attractive environment for people with dementia to encounter meaningful stimuli, thereby enhancing social engagement. Environmental stimuli can influence social engagement, especially when related to real-world tasks (Cohen-Mansfield et al. 2010). This may be due to a lifetime exposure, and, for example, household activities have meaning in themselves, which is an important characteristic fulfilling residents' desire to make oneself useful. Additionally, it is of great importance to individualize activities to residents' self-identity roles by tapping into past experiences, hobbies, and interests as this also increased engagement. Furthermore, less physical restraints are used in small-scale, homelike care settings. This may reflect the difference in care philosophy and organizational context in comparison with traditional nursing homes. For other resident-related outcomes, such as quality of life and neuropsychiatric symptoms, no evidence was found (Verbeek et al. 2010; te Boekhorst et al. 2009; Wolf-Ostermann et al. 2012). Neuropsychiatric symptoms appear similar for residents in small-scale, homelike care settings and traditional nursing homes, although residents in small-scale, homelike care may express sometimes more agitated behavior (e.g., restlessness). Family involvement is similar for both settings. Family caregivers visit equally frequent and perform similar activities. Furthermore, indications for less perceived caregiver burden were found, although more research is needed. In general, higher satisfaction is found among family caregivers in small-scale, homelike nursing homes (Verbeek et al. 2012).

When nursing staff members become more involved with family caregivers and keep open lines of communication as they do in small-scale, homelike nursing homes, family caregivers' satisfaction increases. This may improve their feeling of confidence that their loved one is well being cared for.

### **Implications for Staff**

Nursing staff who work in small-scale, homelike care settings have different roles and tasks compared with staff employed in more traditional facilities. Overall, staff working in small-scale living facilities inclines more toward integrated care: nursing staff members are part of the household and have integrated tasks, including personal and medical care, organizing activities, and daily household chores. For example, in small-scale homelike care environments, daily nursing activities are characterized by working all around and independently, whereas nursing staff in traditional wards collaborate with each other and have differentiated tasks. This affects their job characteristics, such as perceived autonomy, social support, workload, and demands. Nursing staff report a higher perceived autonomy and more social support and experience a lower workload compared with staff working in traditional large-scale settings (Willemse et al. 2014). Furthermore, staff in small-scale, homelike nursing homes encourage residents in their autonomy instead of focusing on disabilities and taking over tasks from residents. Therefore, a culture change within formal care is necessary, as staff should focus on the remaining functional capacities of people with dementia and to encourage their autonomy. The organizational policy of small-scale, homelike nursing homes is important in establishing meaningful social interactions with residents, developing a sense of community, and preserving community roles, thereby creating a supportive environment. Staffing patterns focus on meaningful activities and integrated tasks in a nonhierarchical structure (Smit et al. 2012).

For staff working in small-scale, homelike nursing homes, there might be a tension between the focus on everyday life and the medical needs

of older people with complex chronic diseases such as dementia. When normalization of living for older people with dementia is the main focus of interest, there is a risk that professionalism in dementia care may be lost. Social care aspects and the creation of a homelike environment are integral to residents' quality of life and quality of care. However, an exclusive social model of care is inadequate to meet the needs of vulnerable older nursing home residents with dementia (Tolson et al. 2013). Skilled staff with adequate training and education is essential for future dementia care. In small-scale, homelike nursing homes, this is especially relevant as nursing staff work alone during a great extent of the day. They have a large responsibility for residents' care and require skills such as being able to observe, being alert for changes, and being able to respond adequately. Training (both in educational models as training on the job) should focus on dementia and consequences of the disease for caregiving, taking into account the whole residents' system. Since multimorbidity is present in many residents, more knowledge of other chronic diseases highly prevalent in older people (such as cardiovascular diseases or diabetes) and the interplay among diseases are essential. Nursing staff need to know the consequences of the disease for daily functioning and how to support this, taking into account what residents themselves are still able to do.

### **Future Directions**

Small-scale, homelike nursing homes have promoted a continuation of self and normality: knowing the person, welcoming the family, providing meaningful activities, being in a personalized environment, and experiencing flexibility and continuity. This development has encouraged changes in institutional care for people with dementia in a positive way, both in regular nursing homes as well as in the development of new dementia care facilities. The key question in realizing dementia care facilities should focus on how to reach optimal well-being for residents, their family caregivers, and nursing staff in the actual

care provided. This provides opportunities for residents and their family caregivers to make a choice on which care facility suits their wishes and beliefs best.

The working mechanisms of small-scale, homelike care environments and how they exert an effect remain unclear. As a result, changes are implemented in daily practice without knowledge on which components in the physical, social, or organizational environment should be altered and are most effective. The main focus in research and practice has often been on physical aspects of the environment, such as location, design features of an archetypical home (e.g., doorbell, kitchen, and bringing own furniture), and (group) size. This is understandable, since physical aspects are visible, relatively easy to measure, and therefore provide a clear distinction with traditional nursing homes. However, it is the interplay among physical, organizational, and social aspects of the care environment that should be taken into account to realize timely, effective care tailored to the needs of people with dementia.

## Cross-References

- ▶ [Assisted Living](#)
- ▶ [Environmental Influences on Aging and Behavior, Theories of](#)
- ▶ [Housing Solutions for Older Adults](#)

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## Social Cognition and Aging

Elise K. Kalokerinos<sup>1</sup>, William von Hippel<sup>2</sup> and Julie D. Henry<sup>2</sup>

<sup>1</sup>Department of Psychology and Educational Sciences, KU Leuven, Leuven, Flemish Brabant, Belgium

<sup>2</sup>School of Psychology, The University of Queensland, Brisbane, QLD, Australia

### Definition

Social cognition refers to the processes through which people make sense of themselves and others to engage with their social context (Fiske and Taylor 2013). Social-cognitive research draws from models developed in cognitive psychology as a tool for understanding social functioning. A social-cognitive perspective is useful for enhancing our understanding of the aging process, particularly because of the extensive research literature documenting age-related changes in cognition (Salthouse 2012). The cognitive changes that emerge with age paint a complex picture of loss and gain, as some losses in cognitive functioning interact with some gains in knowledge or ability in other domains. Social-cognitive changes with age are made even more complex by the fact that motivational and emotional changes brought about by changes in life goals (Charles and Carstensen 2010) interact with changes in cognitive function to produce diverse patterns of responding.

### Determinants of age-related social-cognitive change

Two broad determinants of social-cognitive change with age are investigated in this entry. First, research on cognitive function generally paints a picture of loss as the norm with aging, with older adults typically showing a decline in areas that tap the “mechanics of the mind” such as processing speed, memory, executive function, and complex reasoning (Salthouse 2012). These deficits in cognitive processing often co-occur with other age-related losses, such as reduced physical and perceptual functioning, suggesting an underlying general physical decline. Despite these losses, however, there are also important areas of preserved and even enhanced function in late life. These are usually in domains that tap “experience of the mind” such as vocabulary and general knowledge (Salthouse 2012). In these domains, smaller age differences emerge, and older adults often outperform younger adults. Thus, the first key determinant of social-cognitive change with age is whether the task relies more on mechanics or experience.

Social cognition involves dual processes, with automatic and controlled processes each contributing to, or competing for, social outcomes (Smith and DeCoster 2000). Although aging disrupts processing speed and other factors that play a role in automatic processes, the primary impact of age is on controlled processes (von Hippel and Henry 2012). Because controlled processes are sometimes recruited to inhibit automatic ones, as the influence of controlled processes declines with age, the influence of automatic processes can become more apparent. This interaction between controlled and automatic processes is also influenced by the fact that the two processes appear to operate in a compensatory fashion, such that some automatic processes peak when controlled processes are at their weakest. Thus, a second important determinant of social-cognitive change with age is whether the task at hand relies more on automatic or controlled processing and whether the two tend to work together or in opposition. This entry will outline the broad categories of social-cognitive change with age and the role

that mechanics, experience, and automatic and controlled processes have in determining these changes.

## Emotional and Motivational Changes

One group of age-related changes occurs in emotional goals and functioning (Charles and Carstensen 2010). These changes have an important impact on the ways in which older adults process social and emotional information. One marked change in older adults, compared with those who are younger and in middle age, is in the processing of positive and negative information. Many studies have demonstrated an “age-related positivity effect” whereby older adults preferentially attend to and remember positive over negative information (Charles and Carstensen 2010). Interestingly, several studies find that cognitive control resources are recruited to maintain the positivity effect: The positivity effect does not occur when cognitive resources are diverted to a secondary task. In addition, older adults recruit medial prefrontal regions, which have been implicated in top-down emotion regulation processes, when processing negative but not positive stimuli, indicating controlled downregulation of negative emotion (Reed and Carstensen 2012). It has also been demonstrated that older adults with better executive function, that is, older adults who demonstrate greater cognitive control on tasks demonstrated to require top-down, controlled processing, show a greater positivity effect (Reed and Carstensen 2012). This possibility is currently debated, but it suggests that older adults may recruit their limited cognitive resources in an attempt to maintain a positive outlook, a step that is indicative of the potential importance of positivity to older adults.

Emotion regulation is the process by which emotions are increased, decreased, or sustained. When compared with younger adults, older adults also show maintained or even improved emotion regulation (Charles and Carstensen 2009). They are able to implement emotion regulation strategies both before and after the onset of the emotional response with similar effectiveness to

younger adults. In some areas, older adults even show better emotion regulatory functioning than younger adults. For example, some studies have demonstrated that older adults are better able to suppress the expression of emotion than younger adults. This strategy is usually cognitively costly; however, other research has demonstrated that emotion suppression incurs fewer cognitive costs for older than younger adults: After suppressing their emotions, younger adults showed reduced working memory performance, but older adults did not. Research examining emotion in daily life has also found that older adults may be better at emotion regulation: after an experience of negative effect, older adults returned to a neutral or positive state more quickly than younger adults. Finally, older adults appear to rely on more effective emotion regulation strategies (e.g., cognitive reappraisal) than younger adults (e.g., expressive suppression). Taken together, this work suggests that older adults rely on the emotion knowledge accrued during their lifetime to implement emotion regulation strategies in a more emotionally intelligent and perhaps less cognitively demanding way.

## Cognitive Changes

Executive functions are a group of mental processes responsible for initiating, planning, and coordinating basic cognitive processes. Executive functions include task switching, working memory, and inhibition of thought and behavior. As such, executive functions are not a single ability, but a group of higher-order processes that permit the regulation of cognition. Executive functions recruit frontal brain regions, and these areas are among those affected by age-related deterioration. As a result, aging is associated with declines in executive functioning (Salthouse 2012). These declines in executive function are associated with a wide range of outcomes, which we will briefly discuss below.

**Behavioral restraint.** Age-related declines in executive function have been linked to a broad range of cognitive deficits, such as disruptions in attention and memory. The consequences of a

decline in executive function, however, are broader than just these cognitive deficits. Executive functions play a central role in social processes, and as a result, the age-related deficits observed in executive function have been found to lead to problems with social behavior across a variety of domains (von Hippel 2007). In particular, deficits in inhibitory processes have been linked to socially disinhibited behavior with age. As a result of decreased inhibitory ability, older adults are more likely than younger adults to talk excessively about topics that are irrelevant to the conversation, to inquire about private issues in public settings, and to engage in a variety of socially inappropriate behaviors than younger adults (von Hippel 2007). Importantly, this effect of executive decline appears to be independent of the effect of general cognitive decline, suggesting that executive deficits have an important unique effect on social appropriateness.

***Stereotyping and prejudice.*** Devine (1989) proposed that our environment is filled with stereotypes, and as a result, these stereotypes are automatically activated upon encountering a stereotyped group member. She suggested that this automatic activation of stereotypes occurs among both prejudiced and non-prejudiced people, but that non-prejudiced people reject and inhibit these stereotyped thoughts, whereas prejudiced people do not. Older adults are less capable of inhibiting their automatically activated thoughts than younger adults, and thus, one implication of this model is that older adults may be more prejudiced. Several lines of research now support this idea (von Hippel and Henry 2012; von Hippel 2007). Older adults show greater prejudice on self-report scales and are rated by their peers as being more prejudiced than younger adults, and these age differences in prejudice appear to arise through executive function decline. Older adults do not seem to show greater automatic bias when compared with younger adults; they are just less successful at inhibiting this bias. These findings suggest that age differences in prejudice emerge in response to executive function decline and are not simply the result of a greater willingness among older adults to express their prejudices.

***Understanding others.*** As outlined earlier, older adults tend to prioritize emotional and social goals. One implication is that aging might lead to improvements in social understanding. In contrast to this suggestion, however, research finds important losses in understanding others' emotions, intentions, and mental states with age. Broadly, there seems to be an age-related decline across all modalities of emotion recognition, although there is some evidence that unconscious emotion recognition may be better preserved than conscious emotion recognition (von Hippel and Henry 2012). Additionally, in some contexts, older adults seem to use more sophisticated heuristics than younger adults in forming social judgments, suggesting that the accumulation of social experience across the adult life span can lead to some benefits in understanding others (Peters et al. 2007).

***Emotion recognition and empathy.*** Emotion recognition is an important skill for social interaction, and indeed, emotion misrecognition in older adults is associated with reduced social and interpersonal functioning, poor communication, and inappropriate social behavior (von Hippel and Henry 2012). Across most emotions the pattern is of age-related decline, and the recognition of anger and sadness is particularly impaired (Ruffman et al. 2008). This specific decline in recognition of negative emotions may be a function of the tendency for older adults to focus on positive over negative information in processing, as inattention to negative expressions may make their identification more difficult.

Older adults also show deficits in cognitive empathy, that is, they have a poorer understanding of others' complex emotions and mental states (von Hippel and Henry 2012). As with social dysfunction, deficits in cognitive empathy appear to emerge as a result of age-related decline in executive function, with older adults showing greater impairment on measures where greater executive control is required. Relatively less research has been conducted examining older adults' emotional empathy or their emotional responses to the cognitive or emotional state of another. The research in this area so far has examined mimicry and found that although

subconscious mimicry seems to be spared in later adulthood, later stages of mimicry may be interrupted by difficulties in emotion recognition.

**Attribution and social inference.** The processes covered earlier in this section rely primarily on the mechanics of the mind and thus are negatively affected by brain atrophy. There are, however, some aspects of social inference that rely more clearly on the experience of the mind, and in these areas, age has the potential to result in improved function. Indeed, across some domains of social inference, older adults are able to use more adaptive strategies (Peters et al. 2007; Blanchard-Fields 2007). For example, older adults require fewer cues than younger adults to form clear impressions of others, perhaps because they can rely on their greater social experience. Older adults are also more skilled at making trait inferences about others and are more able to use important diagnostic trait information in making social judgments. Finally, older and middle-aged adults are more sensitive to social context than younger adults, which can provide helpful information for understanding others.

**Attitudes and persuasion.** Attitude change involves a number of cognitive and motivational processes that change in older adulthood, suggesting that there are likely to be corresponding changes in persuasibility, that is, the degree that one is able to be persuaded of an idea, with age. Consistent with this possibility, attitude change follows a U-shaped curve with age, with younger and older adults being the most susceptible to attitude change (Visser and Krosnick 1998). This effect seems to emerge in part because younger and older adults also report lower attitude certainty, attitude importance, and attitude-relevant knowledge than middle-aged adults. One source of these changes may be cognitive losses with aging, which limit older adults' ability to counterargue against persuasive messages. Two other noncognitive mechanisms may also underlie age-related susceptibility to attitude change: reduced social support for attitudes and role changes with age that bring about attitude changes. That is, older adults may find that there is no longer social support for the attitudes they used to hold and so change their attitude

accordingly. They are also less likely to have a social role involving power: Powerful roles call for a resolute approach in the face of persuasion attempts, and because older adults do not usually hold these roles, they are likely to be more persuasible. At this point we do not know the degree to which these factors may underlie changes in persuasibility among older adults.

**Decision-making.** Decision-making is affected by both age-related gains and losses. As with other domains, the general cognitive decline observed with aging is often associated with poorer decisions. It is also the case, however, that older adults make better use of cognitive shortcuts in decision-making and benefit from their greater life experience, and emotional and motivational changes mean that they are often happier with their choices (Peters et al. 2007). Broadly, the research literature shows age-related deficits in the decisions necessary for everyday life (Thornton and Dumke 2005). This effect is robust across most markers of decision quality, with the exception that older adults' self-ratings suggest either preserved decision-making or even better everyday decision-making than younger adults. These findings suggest that older adults perceive themselves as making better decisions despite actually making worse decisions. Because older adults tend to focus on the positive, it is possible that older adults are simply happier with their decision outcomes than younger adults and thus rate themselves as better decision-makers despite their objective deficits.

Although older adults show decline in most domains of decision-making, they show preserved ability and even improvements in interpersonal decisions (Blanchard-Fields 2007). Older adults may outperform younger adults in interpersonal domains because of their accumulated life experience, but they also have some additional advantages. First, they tend to take a long-term perspective and focus more on preserving interpersonal relationships than on solving personal problems (Blanchard-Fields 2007). Second, they do not overweight negative information, which may be helpful in some interpersonal decision-making domains (Charles and Carstensen 2010). Third, they are strategic about when they use

controlled processing strategies, correctly perceiving cognitive control as a limited resource (Peters et al. 2007).

Various types of decision processes are also impacted by the age-related pattern of deficits in cognitive control processes but preservation of automatic processes. For example, controlled processes are often required to correct for possible sources of bias in decision-making, and as a result, older adults are less able to correct for biases (Peters et al. 2007). Cognitive control processes are also required in generating counterfactual simulations of possible alternative outcomes to decisions, and as a result, older adults are less able to create detailed simulations of the future. Naturally, this deficit has the potential to negatively impact their decision-making.

In contrast, the relative preservation of automatic processes in older adults allows them to make use of a number of automatic heuristics, which are fast, effortless, and generally accurate enough for most everyday purposes (Peters et al. 2007). The use of these heuristics may be helpful in allowing older adults to make rapid decisions while relying less on controlled processes. It is also the case, however, that older adults may be less able to suspend their reliance on automatic heuristics by implementing cognitive control processes when it is necessary to do so.

### Individual Differences in Loss

In assessing cognitive loss with age, it is also important to consider whether these losses can be prevented and whether there are traits that may buffer age-related deficits in social-cognitive functioning.

**Age stereotypes.** There are number of stereotypes about cognitive loss with age, and these stereotypes are widely endorsed by older adults themselves (Levy 2003). Not surprisingly, research suggests that age stereotypes can have a causal effect on cognitive outcomes. For example, older adults who are led to think about aging and wisdom perform better on a memory test than older adults who are led to think about aging and

senility. These acute stereotype effects may be induced through stereotype threat (or the concern that one may be judged on the basis of negative stereotypes about one's group), which has been shown to lead to performance deficits in a wide variety of domains. The more chronic consequences of age-related stereotypes are likely to be induced through a combination of stereotype threat and self-stereotyping (Levy 2003). That is, to the degree that older adults expect to show stereotypic age-related losses, they are likely to do so. This has been demonstrated across many domains, but perhaps the most striking is research demonstrating that negative stereotypes of aging measured early in life predict poorer health and earlier mortality in late adulthood. Overall, the data suggest that negative stereotypes about aging are likely to exacerbate age-related cognitive decline. They also suggest, however, that promoting positive stereotypes of aging may be an important intervention tool.

**Mental activity.** Mental activity levels may also play an important protective role in the cognitive aging process. Complexity in education, work, and in everyday life all delay the onset of cognitive decline (Valenzuela and Sachdev 2006). The facilitating effect of mental activity may be analogous to that of physical exercise. Even short-term mental activity may have beneficial effects, and thus, it may be possible that older adults could benefit from acute cognitive training (Lustig et al. 2009). A systematic review concluded that cognitive training in healthy older adults produces strong and persistent protective effects on cognitive performance, particularly in the domains that were the major focus of the intervention (Valenzuela and Sachdev 2009). That is, cognitive training seems to be most helpful when it is targeted: For example, training in attention enhances attention but does not always enhance memory, and training in memory enhances memory but does not always enhance attention.

Mental activity does not just delay the onset of cognitive aging; it can also compensate for it. One important example of compensation shown by older adults is neural "over-activation," in which additional brain regions are recruited by older adults to solve the same problems as

younger adults (Reuter-Lorenz and Cappell 2008). Although there is no single explanation for over-activation, it appears to be at least in part a compensatory process to attempt to address declines in cognitive function.

## Conclusions

It is clear from the phenomena discussed in this entry that social-cognitive aging is a complex process, influenced by a variety of different sources. Age-related decline in cognitive control processes can sometimes be offset by preservation of automatic processes, but sometimes the inability to inhibit automatic processes can itself lead to poorer performance in older adults. In contrast, age-related changes in experience and knowledge accumulated throughout life can enhance social-cognitive function in some domains, and it is important to understand these experiential changes that occur in tandem with cognitive decline. Finally, motivational and emotional changes with age also play an important role in any attempt to understand social-cognitive outcomes, and the interactions between cognitive, experiential, and motivational changes can create complex patterns of behavior. It is clear that social cognition changes in many important ways with advanced age, and research is only just beginning to understand this complexity.

## Cross-References

- ▶ [Attitudes and Self-Perceptions of Aging](#)
- ▶ [Cognitive Control and Self-Regulation](#)
- ▶ [Emotional Development in Old Age](#)
- ▶ [Positive Emotion Processing, Theoretical Perspectives](#)
- ▶ [Socioemotional Selectivity Theory](#)

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## Social Connectedness and Health

Catherine Haslam, Tegan Cruwys, S. Alexander Haslam and Jolanda Jetten  
School of Psychology, The University of Queensland, Brisbane, QLD, Australia

### Synonyms

Social capital; Social integration; Social networks; Social participation; Social support

### Definitions

The above synonyms are often used interchangeably to imply social connectedness, but they do not fully capture the breadth of the construct. Social network refers to the structure of relationships and their interconnections. Social support is typically derived from social relationships and is broadly defined as the care that is either provided or perceived to be readily available in times of need. These are all interrelated concepts. For instance, you are more likely to receive social support from those with whom you are socially networked. Other synonyms, notably social integration and social capital, while intended to capture wider dimensions of connectedness, can be vague and are often used inconsistently. Social integration encompasses the behavioral (or participatory) and cognitive (a sense of belongingness) elements of social relationships. Social capital is typically defined as the network of relationships between people who live and work in a society or community that support

their effective functioning. These constructs imply, but do not fully capture, what it means to be socially connected. In this entry, social connectedness is defined as the sense of belonging and subjective psychological bond that people feel in relation to individuals and groups of others. This definition also captures the idea that identification with others is the basis for social connectedness – something that we explore further in this entry as a possible mechanism for the health-enhancing effects of social relationships.

## Social Relationships and Health

It has long been recognized that mortality and morbidity rates vary dramatically as a function of the social conditions in which we are born and raised, live, work, and age. The extent of these is considerable, with life expectancy 48 years lower in the least advantaged nations (e.g., Sierra Leone) and 20 years shorter among the most disadvantaged within the same nation (Marmot 2005). Many have argued that such disparity in life expectancy should not be inevitable, particularly as there is nothing fundamental in our biological makeup that should make this so. Rather, the cause of such disparity is fundamentally *social*, created through inequality in opportunities for stable education, work, housing, and wealth. These upstream factors not only affect our exposure to, and experience of, illness, but they also affect our response to illness – which is driven primarily by our knowledge, attitudes, beliefs, and behaviors around health. Clearly, then, when it comes to managing health, interventions that target these social determinants are as vital as those that target the medical.

Various strategies and policies have been proposed at national and international levels to overcome these health disparities. However, there is also recognition of the importance of understanding the social conditions that reduce such inequality at more local, or community, levels. Explanations for the presence of health disparity at this level tend to be framed in terms of social capital, which tends to be represented by a range of indices (e.g., number of social ties, whether one

lives alone or with others, trust, engagement with civic associations) measured at both individual and community levels. However, researchers have questioned the extent to which this captures the subjective and experiential aspects of social relationships that are integral to one's sense of social connectedness, which is lacking or markedly reduced among members of disadvantaged groups in unequal societies. Addressing this point, researchers have incorporated concepts such as social engagement, participation, social support, and influence into their analysis, in addition to documenting the number of objective social resources that a person or group has. Increasingly, the contribution of social *identification* – defined as the sense of self that people derive from their membership with various social groups (e.g., family, work team, church) – is also gaining prominence, due to its capacity to explain why not all relationships are beneficial for health and why we seek engagement and support from particular people but not others. Other developments have focused on the types of relationships (spousal versus friendship and one-to-one versus group-based relationships) that might be more beneficial for health.

We address these developments in this entry as mechanisms proposed to account for the benefits that arise from social connectedness, after considering the evidence of the impact that social relationships have on the health of older adults in domains of life expectancy, mental health, and cognitive health.

### **Social Connectedness and Life Expectancy**

The relationship between social engagement and mortality was first identified in a pioneering study conducted by Berkman and Syme in 1979 (Berkman and Syme 1979). This research focused on Californians aged between 30 and 69 years and found that those who lacked social contacts were more likely to die earlier than those who were well connected. This relationship held after statistically controlling for physical health, health behaviors (e.g., smoking), health practice, and use of health

services. Further analysis of these mortality data, following people over a period of 17 years, found that social connectedness was particularly important for the life expectancy of people aged over 70 years (Seeman et al. 1987). Indeed, those with the lowest social network index scores (based on ratings of marital status, perceived isolation, contacts with friends and relatives, and membership of church and other groups combined) had a 50% greater risk of mortality than those with the highest scores.

Findings from these studies were later replicated in longitudinal investigations involving American (Glass et al. 1999), Australian (Giles et al. 2005), and European (Bennett 2002) populations. Other studies also show that it is not just the leisure or physical activity, but rather productive engagement with others in the process of participating in these activities that confers a survival advantage (Maier and Klumb 2005). Findings also show that these relationships hold over the age span with social networks predicting longevity among the older-old (Giles et al. 2012). In the study conducted by Giles et al. (2012), relationships with friends were found to be more beneficial for survival than those with children and relatives, though this is not always the case. Other studies that include wider social networks (e.g., community and other group activities) also find evidence of increased life expectancy (Glei et al. 2005).

### **Social Connectedness and Mental Health**

The findings from the life expectancy literature extend to the mental health literature. It has been shown that older people with integrated social support networks (comprising family, friends, neighbors, and community groups) are generally less depressed and report greater well-being (Wenger 1997). While the impact that social relationships have on mental health is seen across all age groups, older adults are particularly vulnerable to mental health problems arising from social isolation due to their increased risk of physical disability and illness. Loneliness is a specific risk factor for depression in older adults (Cacioppo

et al. 2006), with Golden and colleagues (2009) reporting that where loneliness is experienced among people over 65 living in the community, 35% present with an associated depression.

However, not all relationships are created equal, and some can be more supportive of mental health than others. Speaking to this point, Litwin (2001) found that intensive family ties were more restrictive for older adults in Israel and generally less supportive of health than diffuse network ties that were characterized by large and diverse networks with variety in potential sources of social support. These data highlight the importance of multiple resources for health, combining notions of both relationship quantity and relationship quality.

Further studies have indicated that these findings are robust and generalizable to other populations, including older people living in the United States (Fiori et al. 2006). Here again, it was found that people with diverse networks (typically involving interaction with family, friendship, and religious and other informal group memberships) reported fewer depressive symptoms. Those with restrictive networks, whether confined largely to family or through having very limited social ties, had worse outcomes – all consistent with earlier findings. This suggested that network diversity is important to mental health in many different cultural contexts.

An important implication of these findings is that particular types of relationship may be more important for mental health. Taking this a step further, Cruwys et al. (2013) investigated the contribution that social group memberships made to depression outcomes in older adults. This study drew on data from the English Longitudinal Study of Ageing and found that participation in social group activity was not only protective against the development of depression in healthy participants but also preceded recovery and reduced the risk of relapse among those with a history of depression. Of particular interest was the fact that risk of relapse reduced incrementally as a function of the number of groups to which people belonged. Specifically, an increase in one group membership reduced the risk of relapse by 24%, but an increase of three group memberships reduced the risk of

relapse by 63%. As the authors conclude, these data show that one's connectedness to social groups can both protect against the development of depression and provide a "social cure" (p. 185) (Cruwys et al. 2013) for existing depression.

## Social Connectedness and Cognitive Health

There is equally strong evidence of the role that social relationships play in protecting against cognitive decline. Most studies in this area are longitudinal and involve older adults living independently in the community. The majority draw the same general conclusion: that people with greater social connectedness enjoy better cognitive health and are less vulnerable to progressive decline (Haslam et al. 2014a).

The size of these effects is considerable. To illustrate, Barnes and colleagues (2004) found that the rate of cognitive decline was reduced by 39% for those in their sample of older people who had the greatest social network size. This was reduced even further, by 91%, where people actively participated with others in those networks – confirming the point made earlier that quantity alone fails to capture fully the protective benefits of social connectedness. There is also evidence that the rate of memory decline is halved among those who are most socially connected (Ertel et al. 2008).

Data from Bennett et al. (2006) provide an interesting biological perspective on the role of connectedness. These researchers followed healthy older people who, on first contact, showed no signs of Alzheimer's disease pathology. Yet, at postmortem examination years later, they found greater evidence of tangle density (a marker of such disease) among those who were least socially connected. Clearly, as Cohen (2004) suggests, social relationships have the capacity to get "under our skin" in ways that shape the biological processes that are detrimental to health.

There are questions, though, about causality in the cognitive health literature. This is because the correlational nature of much of this research limits the conclusions that can be drawn – in particular,

due to the possibility of reverse causality. That is, it may be the case that people who are in better cognitive health have greater capacity to engage actively with their social networks, rather than the other way around. In support of this argument, there are a few studies that observe a positive association between social connectedness and cognitive health cross-sectionally, but not longitudinally. Other studies have directly addressed this issue by focusing only on higher-functioning seniors with low likelihood of existing cognitive impairment or by analyzing subgroups of respondents whose abilities were preserved at the start of data collection (Bennett et al. 2006; Ertel et al. 2008). While findings from these latter studies support the conclusion that social connectedness influences cognitive integrity and reserve, only experimental studies can definitively establish causality.

A parallel debate concerns the types of relationships that are particularly advantageous for cognitive health. As noted earlier, having more connections with friends in particular is associated with increased life expectancy (Giles et al. 2012). However, in the cognitive domain, researchers have tended to base their analyses on a social network index that combines information about one's relationships and activities both with significant others (i.e., spouse, children, friend, relative) and with other social groups (e.g., church, voluntary, recreational clubs). This makes it difficult to establish whether any particular type of relationship is especially protective. This is exacerbated by the tendency for researchers intuitively to place greater emphasis on one-to-one relationships with significant others than on group-based relationships. In an attempt to disentangle these influences on cognitive health, Haslam et al. (2014b) examined the separate contribution that group and one-on-one social interaction made to cognitive integrity over time. Drawing on three waves of data from the English Longitudinal Survey of Ageing, they found that group activities were especially protective against cognitive decline and that this effect was more impactful with increasing age. More specifically, above-average group engagement was of moderate importance for the youngest respondents, such that those aged

50 years functioned cognitively at the level of a person aged 46 years. However, the functional savings were more substantial at the older end of the age spectrum, with the more socially engaged 80-year-olds performing cognitively like the 70-year-olds. These data are also consistent with those of Gleib et al. (2005) and Sugisawa et al. (1994), who found that relationships with significant others, such as a relative or friend, did not reduce the risk of cognitive decline and mortality, respectively. Instead, Gleib found that those who participated in one or two group activities displayed 13% fewer cognitive deficiencies 3 years later and that those who participated in three or more groups had 33% fewer deficiencies. Individual relationships were not associated with the same positive cognitive outcomes. Such data suggest that there may be particular value in targeting and developing group-based relationships when it comes to preserving cognitive health.

## Mechanisms Underlying Social Connectedness

In most of the above studies, enhanced health outcomes were independent of sociodemographic factors, physical and psychological health status, and baseline physical and cognitive abilities. So, when we control for these factors, how exactly does social connectedness enhance the health of older people? A number of mechanisms have been proposed across these domains of health that can be broadly conceptualized as physiological and psychological. Although we describe these separately below, it is clear that these factors do not operate independently. The psychological experience of stress, for example, produces physiological changes, and these changes will feedback into our appraisal and response to that stress. Thus, the pathways through which social connectedness enhances health are multiple and interactive.

### Physiological Mechanisms

One means through which social isolation might influence mortality is through its action on the biological pathways of stress. In the wider context

of the social determinants of health, social disadvantage (whether due to financial hardship, social stigma, or discrimination) is only one of the many recognized causes of ongoing stress (that include loss of one's spouse, being diagnosed with illness) – all of which can have damaging effects on the body. Stress triggers the release of cortisol, cytokines, and other substances that put pressure on immune and other physiological systems. The hypothalamic-pituitary-adrenal axis is particularly important in this regard as it is responsible for adapting to stressful circumstances and environments. In the absence of factors, such as social support, to buffer against the stress response, there is slower adrenocortical recovery which, when cumulative, can accelerate physiological decline. Supportive networks are believed to buffer these effects, controlling the body's response to heightened arousal and stress (Uchino 2006) and, through this, providing protection against damaging neurodegenerative outcomes.

Additionally, neuroendocrine and immune function regulation appears to be enhanced among people who are more socially connected. It has been argued and found that social networks provide a basis to suppress neuroendocrine responses, which reduces vulnerability to disease development. Lower overall cortisol (Turner-Cobb et al. 2000) and higher oxytocin levels (Knox and Uvnas-Moberg 1998) have been found among those with greater social support from their network ties.

An alternative perspective argues that it is the damaging effects of social isolation, rather than the protective effects of social connectedness, that is the cause of these findings. Social isolation is a stressor in its own right, increasing neuroendocrine responses and cardiovascular reactivity, which has the effect of suppressing immune function (Cohen 2004). In line with this proposition, in studies of patients with HIV, those who were more disconnected socially were found to have fewer helper T cells over time to combat the disease (Theorell et al. 1995). More diversity in social networks has also been found to reduce vulnerability to developing the common cold after exposure to the virus (Cohen

et al. 1997). Greater cardiovascular reactivity in response to stress is associated with higher blood pressure, which can be reduced in the presence of a significant other or friend (Kamarck et al. 1990). Moreover, there is evidence that blood pressure is lowered in general among people who are more socially connected (Steptoe et al. 2000).

The physiological effects of social connectedness appear to go further to protect against the development of carotid artery atherosclerosis and progression of cardiovascular disease. Like the above studies, these examined the impact of social connectedness via perceptions of social support – highlighting again the dynamic relationship between physiological and psychological processes in protecting against health decline.

### Psychological Mechanisms

Social connectedness increases access to the psychological and material resources that buffer against stress, thereby reducing its impact on physiological processes that are associated with disease. Of these resources, *social support* is recognized as pivotal and comes in various forms – emotional, instrumental, and informational. Social support has been shown to offer some protection against the damaging physiological effects of stress and is associated with more functional, or adaptive, coping styles (Cohen and Wills 1985). Emotional support, in particular, appears to reduce the impact of stressful life events and has been repeatedly linked with greater longevity.

Interestingly, though, not all forms of support seem to lead to positive outcomes. Penninx et al. (1997) found that receiving high levels of instrumental support, that can arguably promote greater dependency, is associated with greater risk of early death. Moreover, *perceived* support appears to be key, with evidence showing that it is not the receipt of support that is critical, but the belief that it is (or will be) available when needed.

*Self-efficacy*, defined as the confidence with which we perform particular behaviors, is another psychological resource believed to carry protective properties. It has been argued that greater self-efficacy enhances one's sense of control and purpose in life which, in turn, reduces the impact

of age-related changes and disease processes. Indeed, research suggests that having purpose in life confers a survival advantage, mediating relationships between social networks and health outcomes in depression and exercise. Among older adults in particular, a reduction in social contact is associated with a decline in self-efficacy, which can impact further on one's engagement in health-productive behaviors (McAvay et al. 1996). There is also a relationship between social support and perceived efficacy. Where social support is perceived positively, it can enhance one's sense of control and efficacy, but where it reinforces dependence and is disabling, it can erode self-efficacy and self-esteem.

Berkman, (Cohen et al. 2004; Berkman et al. 2000) also recognize the important role of social influence, arguing that active participation in social networks makes people open to the influence and control of others. When our social networks encourage positive health norms, such as good eating habits and regular exercise, then they are likely to rub off, increasing our openness to engaging in these same productive behaviors. But we are also likely to be guided by those in our social networks who set negative examples. For example, we engage in more smoking and drinking when we are in the company, or the influence, of network ties for whom this behavior is normative. As these examples illustrate, our social relationships have a major influence on our attitudes to health (e.g., about the benefits of exercise and a healthy diet) and how we respond when health might be compromised (e.g., by seeking health services and adhering to treatment adherence). Notably, greater exposure to these effects, as you might expect with age, does not make us less susceptible to social influence. However, the one advantage of longevity is that with increasing age, the physiological effects of social support appear to be cumulative, with evidence of lower resting blood pressure among older adults who have greater perceived access to support (Uchino et al. 1999).

Missing from this discussion of psychological mechanism is an explanation of *why* only particular networks influence our attitudes about health behavior, impact on our self-esteem and

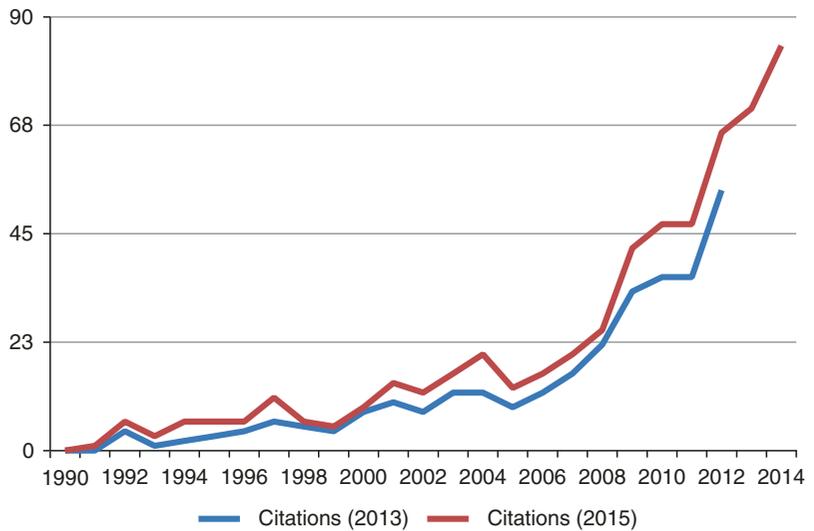
self-efficacy, and provide a basis for giving and receiving support. Researchers from the social identity tradition argue that *identification* with significant individuals and groups of others is what makes social participation possible. This is because social engagement does not occur in a psychological vacuum. There must be a basis, reason, and motivation to participate, and this is more likely to be present when people perceive themselves as sharing a common bond or connection with others (as members of the same family, neighborhood, or a community group).

This reasoning has driven recent development of the Social Identity Approach to Health (Haslam et al. 2009; Jetten et al. 2012). This framework draws on social identity theorizing to account for the conditions in which social connectedness enhances health. It has recently been applied to account for the beneficial effects of social relationships for cognitive (Haslam et al. 2014b) and mental (Cruwys et al. 2013) health, with a particular focus on the value of our connectedness with social groups. Fundamental to this framework is the idea that social groups (whether they comprise family, friendship, religious groups, or community groups) provide an important and distinctive basis for self-understanding and self-definition. Groups frame and inform our beliefs and values, drive our thoughts, influence our emotions, and shape our behavior only when, and to the extent that, they are internalized as part of our self-concept.

Importantly, this sense of social identification with others also influences the dynamics of social support. Here, it is often assumed that social support will have positive implications for health, but, as intimated above, research shows this is not always the case. Indeed, speaking to this point, meta-analyses indicate that the effects of across-the-board support on mortality and health are close to zero – explained largely by these data combining both positive and negative perceptions of support (Schwarzer and Leppin 1991). So what is it that makes support more (or less) beneficial for health? The social identity approach helps to answer this question, explaining the dynamics of support with reference to two key ideas. First, when people define themselves in terms of a

### Social Connectedness and Health,

**Fig. 1** Number of journal articles on social identity and health cited from 1990 to 2014 (Data abstracted from Web of Science, March, 2015 and updated from that reported in (Haslam 2014))



given social identity (as an older adult, a member of the Taylor family), they will see other ingroup members as *part of the self* (rather than as external to self). Second, this sense of shared identity then provides a basis and motivation for people not only to promote their own health and well-being but also to advance the interests of other ingroup members (other seniors and Taylor's) through the provision of useful forms of help. At the same time, this shared social identity also provides a basis for interpreting the helping behavior of others in positive ways – so it is seen as constructive (e.g., as an act of kindness or in their best interests) rather than regarded with suspicion.

Drawing on these ideas, we can make several predictions about the health benefits that our connectedness to these groups makes possible. Because social identification underpins positive forms of influence and support, groups will tend only to enhance health when (and to the extent that) their members identify strongly with them. Accordingly, I am more likely to benefit from my connectedness with other seniors when they are a group that is particularly important to me and one with whom I share strong bonds. When this is the case, group membership and group connections will serve as a psychological resource from which we can draw strength and positive support, particularly when facing challenges that threaten health. Yet, in the absence of such identification,

proffered support and social contact are more likely to be perceived as unnecessary or undesirable and indeed may only impose further strain – and hence may actually be detrimental to health.

Put simply, this theorizing suggests that the active ingredient in social relationships is social identification. This can account for the helpful and harmful effects of social group relationships, the dynamics of support and influence, and the particularly beneficial effects of group-based relationships. While this index of connectedness has yet to be incorporated into the broader literatures on social capital and social determinants of health, it is gaining momentum. This is also true of the Social Identity Approach to Health more generally – as the growth in research on social identity and health attests (see Fig. 1 (Haslam 2014)).

### Conclusion

There is no doubt that social relationships matter for health, whatever our age, and that some relationships are more protective than others. Our knowledge of the mechanisms through which social connectedness protects health is growing, with increasing evidence of the interrelationships between psychological and

physiological processes. There is also growing recognition in the literature of the need to clarify the vital ingredient through which social connectedness builds key psychological resources, such as support and influence. To this end, there is increasing evidence of the important role that social identification plays in health, not least through its capacity to provide a basis for meaningful forms of social connectedness. Targeting these social processes in intervention is as important as targeting medical factors when seeking to protect and enhance health. Aging is inevitable, but its impact on increasing vulnerability to health disparities that hinder social connectedness need not be – particularly when we have the means to develop the social interventions, needed to promote social cure, at our disposal.

## Cross-References

- ▶ [Aging, Inequalities, and Health](#)
- ▶ [Loneliness and Social Embeddedness in Old Age](#)
- ▶ [Mental Health and Aging](#)
- ▶ [Social Cognition and Aging](#)
- ▶ [Social Group Interventions for Older Adults](#)

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## Social Exchange Theory and Aging

Wylie H. Wan<sup>1</sup> and Toni C. Antonucci<sup>2</sup>

<sup>1</sup>Oregon Health and Science University, Portland, OR, USA

<sup>2</sup>University of Michigan, Ann Arbor, MI, USA

### Synonyms

Lifespan; Relationship development; Social network

### Definition

Social exchange and aging is defined as the change and stability of exchanges among individuals across the lifespan.

### Introduction

Social exchange theory proposes that social behavior and interactions among individuals are a result of an exchange process. This perspective suggests that the relationship between individuals is generated by the pursuit of rewards and benefits and the avoidance of costs and punishment. In this entry, social exchange theory is defined and discussed as it applies to the aging process.

First, social exchange theory, which is rooted in economic, psychological, and sociological foundations, is introduced, followed by a description of how social exchanges change and develop as individuals age, why they are important, and innovative perspectives on social exchanges. Next, major psychosocial and sociodemographic factors that can influence the development of social exchanges over the life course are considered. Finally, the chapter concludes with a summary of how best to apply social exchange theory to later life.

### Social Exchange: An Overview

Social behavior as an exchange process is a concept introduced by the sociologist George Homans in 1958 (Homans 1958). Grounded in sociological and psychological perspectives, Homans suggests that social exchange can be viewed as reinforcement. Individuals ascertain and learn from their past interaction experiences whether their behaviors are rewarding or costly. These positive or negative behavioral consequences reinforce, extinguish, or modify future behaviors in order to achieve desired outcomes and minimize costly ones. As individuals interact with others over time, they tend to select social exchanges that have positive consequences and do their best to minimize those that have negative consequences.

**Social Exchange, as Interdependence.** Behaviors performed by individuals in a dyad, and among individuals in a group, are interdependent (Thibaut and Kelley 1959). Relationships are invested in depending on whether there is a strong enough value or reward relative to the cost or alternative outcome. For example, one may choose to stay with a romantic partner if one feels that love and support are both given and received, but may choose to terminate the relationship if one feels that the relationship is unbalanced or inequitable, i.e., one party is giving more than receiving in the relationship. The evaluation of equitability, however, may be complicated. One could evaluate a relationship as equitable if one partner provides emotional support and the

other tangible support. The evaluation of this type of exchange is very likely dependent on the nature of the relationship between the partners. For example, there is more of an expectation of mutual affection and support between spouses, but less so among friends or neighbors. Interdependence influences with whom individuals continue to interact, as well as the kinds of social exchanges in which they choose to engage as they move through time and live our lives.

**Social Exchange, as Economical.** Apart from sociological and psychological perspectives, which will be considered more fully below, social exchange has been viewed from economic and utilitarian perspectives. Assuming that people are rational, interactions are shaped by a reciprocal exchange of tangible (e.g., financial) and intangible (e.g., emotional) resources. A profit is calculated by subtracting the costs from the rewards. Within an exchange context, power dynamics are created when there is an unequal exchange and one person gets more rewards than the other (Blau 1964; Emerson 1976). Economic exchanges are relatively straightforward assessments of money, status, and power. While economic equal and unequal exchanges are direct and uncomplicated, evaluation of social exchanges can be more complicated as they are influenced by the nature and type of social relationships over the course of our lives. Social relationships involve psychological and social characteristics, although how these are evaluated may not always be evident. Thus, some forms of support (e.g., emotional support) might be worth more than other types of support (e.g., money) to some people. Such assessments might not be readily ascertainable to the neutral observer.

### Aging as a Social Exchange Process

A core principle to these perspectives on social exchange is that they develop over time and accumulate as individuals learn from past interactions, assess their current reciprocal or nonreciprocal exchanges, and decide on future behaviors. James Dowd expanded on the basic social exchange theory to address the circumstances of

older people (Dowd 1975). He argued that as people age, the ratio of rewards to costs associated with social interactions might shift based on social status (e.g., being an elder) and personal resources (e.g., money, power, the ability to work or provide care to others). In his exchange theory of aging, Dowd highlighted the perceived loss of status and power that he assumed are associated with aging (Dowd 1975). He argued that because resources decline with age (e.g., health, income, loss of work or community roles, etc.), older people are more likely to be in unequal or imbalanced social exchanges. These imbalanced relationships can result in a power disadvantage, wherein the older person is required to depend or rely on others to meet their basic needs.

Fortunately, this negative exchange theory of aging has not been widely supported by empirical evidence. People seem to adapt exchange calculations to the individual situation and life circumstances. Rather than taking a contemporaneous and rigid view of exchanges which would often leave the elder at a disadvantage, people appear to take a long-term and flexible view of exchanges with respect to close and/or loved elders. Taking a long-term or lifespan view allows the provision of support to an elder to be considered repayment for support received at an earlier point in time. An adult child might repay financial assistance from a parent during her young adulthood with financial assistance or caregiving during the parent's old age. The provision of one type of support might also be seen as an equitable exchange for the receipt of another type of support, e.g., care of grandchildren by a grandparent might be seen as an appropriate and equitable reciprocation of assistance received from an adult child in negotiating the health care system.

Another unique perspective on the social exchanges of older people is the developmental stake hypothesis first proposed by Bengtson and Kuypers (1971). Their focus was on intergenerational exchanges. Taking an intrafamily multigenerational perspective, they argued that older people have more experience and a lifetime of family relations, which creates a greater investment in the family and shared family values. As a consequence, older people

are more interested in highlighting the closeness of relations with the younger generation, while younger people, more interested in establishing their own adulthood, may be less inclined to do so. The goal of the older generation is to encourage the transmission of important unique family characteristics to the younger generation. The older generation has a developmental stake in such transmission and is, therefore, more likely to emphasize similarities than dissimilarities and closeness rather than distance. Data from the Longitudinal Study of Generations supports this case. Given the older generation's enhanced investment in passing on their values and norms to the younger generations, they maximize the probability of positive exchanges by perceiving their relationship with the younger generations as closer than the younger generation perceives them to be. The older generation is seeking to maintain and optimize connectedness, while the younger generation may be more interested in creating their own contributions. They may see the only way to do so is by establishing distance and independence (Bengtson and Kuypers 1971).

There is considerable evidence suggesting that taking a long-term or lifespan view will offer greater insights into the nature of social exchanges, especially those where the relationship is close. Fung, Yeung, Li, and Yang found that negative exchanges were associated with greater feelings of closeness 2 years later (Fung et al. 2009). One might interpret these findings as indicative of investment, i.e., one cajoles, reminds, and persists with the loved ones one cares about in order to persuade or convince them of one's perspective. Successful investment may create an increased perception of similarity across close relations, especially across generations. Additional supportive evidence of the developmental stake hypothesis can be seen in a recent study. Birditt et al. (2015) found that parents reporting that they felt their relations with their children were important but also more negative had higher feelings of well-being. On the other hand, adults who felt their relationships with their own parents were more important than their relationships with their adult children had poorer well-being. Clearly, lifespan and family

transmission perspectives as illustrative of the developmental stake hypothesis provide a useful framework for interpreting these exchanges and their effects.

Developmental stake is likely to change over time and over the lifespan of generational family members. A more nuanced approach suggests that younger generations may wish to achieve independence and accomplishments on their own, but not necessarily by rejecting their indebtedness to the older generations. The younger generation recognizes that the older generation cared for them when they were young. They appear to be quite willing to reciprocate by providing assistance to the older generation when vulnerabilities emerge, as they often do with increased age. The types of assistance provided are wide-ranging and are likely to depend on the particular circumstances, relationship, and history. They might include needs resulting from declining health, widowhood, functional limitations, or financial strain. Provision of assistance can be considered a continuation of the exchange process. The young are now fulfilling a debt incurred when they were younger by providing to their elders as needed. This type of exchange is more flexible and may not represent a specific payback, i.e., from individual to individual, but rather a broader sense of social exchanges. Thus, an exchange might skip a generation with grandchildren reciprocating for support provided by a grandparent to a parent, when and if the parent is not available.

It should be noted that there are additional potential influences on the interpretation of social exchanges. Not all social exchanges in aging imply negative balances. In some cultures, for example, aging is associated with the higher social status of being an elder, which is associated above all else with respect and power. In addition, older individuals are more motivated to seek out relationships and experiences that provide emotional meaning. They, therefore, adopt strategies that optimize positive social exchanges and minimize negative ones by avoiding conflicts (Carstensen et al. 2003). These strategies allow older individuals to focus on maintaining or increasing the rewarding social interactions with close friends and family members who are most meaningful to

them. As noted above, older individuals can continue to provide in different ways, including caregiving for grandchildren as well as providing financial help to needy adult children. In the following section, a discussion is provided on the development of social exchanges across the lifespan and why they are important.

### **Changes in Social Exchanges over the Lifespan**

The concept of social convoy represents a useful heuristic for examining changes in social exchanges across the lifespan. A convoy is defined as a group of close social relationships that surround an individual. This convoy moves with individuals across time as they age and can consist of family, friends, and other close ties, such as colleagues or neighbors. The convoy model of social relations highlights this dynamic nature of social exchanges as it pertains to adulthood and aging (Antonucci et al. 2011). The framework of the convoy model is developmental by nature and it represents social exchanges as complex, multidimensional, and changing over the life course. It accounts for personal characteristics, such as age, gender, race, and education, as well as contextual characteristics, such as role expectations, community, and work environments. These characteristics are crucial to shaping our social relationships as well as our social exchanges.

Over the life course, convoys can change in terms of structural characteristics, for example, size and composition, as well as functional characteristics, such as providing or receiving aid, affect or affirmational support. Parents, siblings, and teachers may be the closest social exchanges to a child as they provide shelter, emotional support, and learning opportunities. Convoys can increase in size when the individual makes more connections as s/he becomes an adult. Other social ties, such as those with supervisors, colleagues, and romantic partners may become increasingly important in young adulthood as individuals start to establish careers and families. In middle and older adulthood, individuals may

have fewer social ties as aging relatives and friends pass away, and older individuals become more selective in maintaining rewarding social exchanges rather than forming new ties. Aging parents, adult children, and friends are some examples of close ties in adulthood that are often earmarked by frequent social exchanges.

**Support Exchanges in Aging.** An important part of close social exchanges is the exchange of support. Positive social exchanges can provide support and buffer against stress. Support can come in many different forms, including aid, instrumental/tangible support (e.g., financial, buying groceries), affect or intangible support (e.g., emotional), affirmation or informational support (e.g., advice), and companionship (e.g., spousal relationship). In the context of aging, health can be a source of stress and need for support. Support exchanges are very important to health and well-being. For example, perceiving greater support from a partner or spouse is associated with better physical health (Ryan et al. 2014). Support is also linked to better cardiovascular, endocrine, and immune health, as well as lower mortality risks (Uchino 2006).

Social exchanges can also be stressful, involving tensions, conflicts, and arguments. In fact, most social exchanges are both positive and negative. For example, one can have a loving relationship with a spouse but still experience conflicts. Although positive relationships are generally associated with lower mortality and negative exchanges are generally associated with poorer health, under certain circumstances, such as conditions of serious illness, having negative relationship quality with children and friends has been shown to be associated with lower mortality (Antonucci et al. 2010). One possible explanation for this counterintuitive finding is that the negative relationship stems from increased demands from children and friends to engage in healthier behaviors, such as exercising and adhering to prescribed medical regimens. Furthermore, the absence of close social ties, which are usually associated with frequent exchanges, seems to have greater negative implications than having a low positive or high negative relationship as it is related to loneliness. Older individuals who report

feeling lonely have higher mortality risk, which highlights the importance of having close social ties in old age (Luo et al. 2012).

## Factors Influencing Social Exchanges

There are many factors that influence the quantity and quality of social exchanges as individuals age. In keeping with the concepts of social exchange and the convoy model, two major factors that play a role in shaping close relations are considered. These are: (1) psychosocial characteristics, such as reciprocity and the related concept of a support bank and (2) sociodemographic and contextual characteristics, such as age, gender, race, and culture.

## Psychosocial Factors

**Reciprocity.** Reciprocity is the norm in the American culture. An equal or comparable exchange of tangible aid, emotional affection, advice, or information between people or groups is preferred as optimal in social exchanges. This norm can be complicated by considerations of whether there are expectations that the reciprocity be achieved immediately or over the long run, which in turn depends on the relationship to the person with whom the exchange or reciprocity is being maintained. Most research suggests that the two are related. Relatively short-term and less close relationships call for immediate, in-kind reciprocity. For example, borrowing money or a cup of sugar should be returned as soon as possible with exactly what was received, i.e., money or sugar. On the other hand, long-term relationships do not have the same demand characteristics. Money or sugar received might be returned in kind, but there is also the expectation that reciprocity might be achieved over an extended period of time. Thus, the money, sugar, or any other need might be reciprocated in the distant future as needed with whatever is needed. In short-term relationships, immediate reciprocation is expected because it is unclear how long the relationship will last. With long-term relationships, however, there is an

expectation of availability into the distant future. Reciprocation can be achieved in the future and can be modified to meet the other's needs as they emerge.

**Support Bank.** This is a related concept that extends the perspective of reciprocity in the long term to include what essentially amounts to an accounting system similar to a savings account. Support provided at earlier points in time can be assumed to accumulate over time, much as they might in a savings account. Support deposited can be drawn upon in the future as needed and a withdrawal might be directly or indirectly comparable. A parent providing sick care to a child might expect to receive care at a future point in time when s/he becomes sick. Similarly, the provision of economic aid at an early point in time might result in an expectation of sick care or other tangible assistance in the future (Silverstein et al. 2002). Some versions of the support bank have outlined the transmission of deposits across people or generations. Supporting a child through caregiving by a mother or financial support by a father might translate to support expectations provided to a sibling, niece or nephew, other parent or grandparent. As such, the support bank works best within very close, longstanding relationships, i.e., the closest relationships in the convoy model. It provides a useful mechanism for long-term exchanges while at the same time maintains the norm of reciprocity.

### **Sociodemographic and Contextual Factors**

There are a large number of sociodemographic factors that have been shown to influence social exchanges. Four such factors which are illustrative, especially with respect to influences on social exchanges in adulthood, are examined. These are age, gender, race and culture, and context.

**Age.** Initial thoughts concerning social exchange and reciprocity over the lifespan might suggest that younger compared to older people are most likely to report reciprocal relationships or that they provide more than they receive. In keeping with Dowd's argument that older people

are at a considerable disadvantage as they age because they have fewer resources available to them with which to reciprocate, one might assume a linear trend. This is less the case than one might suspect. Overall, in a sample of older people from ages 50 to 74 years, everyone reports that they provide more support than they receive (Antonucci and Jackson 1990). Only among the oldest group, i.e., those over 75, does another pattern emerge. This group is about equally likely to report that they provide more than they receive or receive more than they provide. A very small proportion of people in this age group report reciprocal exchanges. Interestingly, closer examination of this pattern indicates that health and disability rather than age accounts for the change.

**Gender.** Gender differences in social exchanges emerge with respect to the frequency of support, the effects of stressful exchanges, and the specific kinds of support. Women have more social ties than men, provide more frequent social, especially emotional, support than men, and tend to mobilize more support from network members than men during stressful times (Kawachi and Berkman 2001). In addition, women are more affected than men by their close social network members who are stressed, with the stress of others often having a detrimental effect on both their physical and psychological health. There are also differences in the specific kinds of support provided by men and women. Women, for example, are likely to report providing more sick care than they receive across all ages. On the other hand, men report providing more financial support than women, again across all ages. Of course, this gender difference may disappear in future cohorts as women are more frequently employed outside the home and men more often involved with caregiving.

**Race and Culture.** A series of studies offers some unique insights into how other factors might influence the experience of reciprocity. For example, in a comparison of African American, White American, and French elders, several differences emerge. First, comparing older people in these three groups, the majority of people across all groups reported that their support exchanges were reciprocal. The next most common response

was that they provided more support than they received. Reports from African Americans indicated that they provided more support than White Americans and therefore were also less likely to report that they received more support than they provided. A comparison with the French sample of elders, however, puts these differences within a cultural perspective. While the French reported patterns of exchange more like African Americans than White Americans, French elders were unlikely to report that they provided more support than they received and extremely likely to report that they received more support than they provided. While the pattern was similar, the distribution was quite different. Interpretation of these patterns might include socioeconomic differences or cultural differences in expected patterns of exchange. Very likely both explanations are correct. For example, people of lower socioeconomic status may more frequently be in a position where friends and family need help and at the same time be less likely to be able to provide it. Yet although they may be less likely to provide support, there is a greater likelihood of providing support rather than receiving it. Similarly, some cultures emphasize providing over receiving support as the cultural norm, thus making it more likely that people in some cultures report providing support rather than receiving it.

**Other Contextual Factors.** Apart from cultural factors, other contextual changes may lead to changes in the structure, composition, and quality of social exchanges. Common examples in the aging context include retirement, relocation, and widowhood. For adults who have been working, especially those who have been working for many years, retiring and leaving the workplace could mean reduced contact or leaving important relationships that have been formed with coworkers. If those relationships were positive, retirement could represent a loss in supportive and meaningful interactions, which is associated with worse health. However, if those relationships were negative, retirement may actually lower interpersonal stress and be beneficial to psychological and physical health. Interestingly, research has found that some work-related relationships are likely to continue after retirement, which suggests that many

of those relationships are rewarding and meaningful (Cozijnsen et al. 2010).

Moving to a new location, as is often the case among older people, whether it is to another neighborhood or to another country, also leads to changes in social ties. This is particularly true in old age if these individuals have difficulty with physical mobility and cannot maintain their previous close relationships after migrating. Older adults who relocate often have to overcome stressors in addition to diminished or lost close social ties. These stressors might include discrimination and anxiety, which could then be associated with significant declines in physical health and life satisfaction. People who have moved recently and those who moved later in life are particularly at risk for depression (Bradley and Van Willigen 2010). Social exchanges, having positive social relationships, and making new social connections are important to adjusting to changes in older adults' living environment. This is especially the case for widows who move after widowhood to be closer to family and friends who provide support.

Experiencing the loss of a spouse or partner, usually one's closest social network member, can be extremely difficult. It can be even more difficult if the relationship was close and positive, if the death was sudden and unexpected (e.g., car accident), and if the spouse or partner who died was younger. On the other hand, chronic illnesses are a major cause of death as couples age. Caregiving for a spouse/partner with a chronic illness can be very stressful and can take a toll on the caregiver's physical and psychological health. In this case, while bereavement is difficult, it can bring some relief as the burden of caregiving is lifted. Close children and friends often play significant roles in the adjustment to widowhood, especially for wives who tend to outlive their husbands (Ha 2008). It is important to note that many widows, men and women, continue to lead engaged and meaningful lives after widowhood, often by engaging in new exchanges or providing support to other close relations, such as children and grandchildren.

In this section, broad psychosocial and sociodemographic factors as a means for

understanding social exchanges among older adults were examined. The concepts of reciprocity and the support bank offer two theoretical frameworks for understanding social exchanges. At the same time, consideration of age, gender, race, culture, and context as factors influencing social exchanges indicate that both broad and specific characteristics influence support exchanges in late life.

## Summary and Conclusions

Evidence suggests that social exchanges are critical across the lifetime and take on added significance as people age. Some cultures, such as the United States, emphasize the importance of reciprocity in exchanges. However, how that reciprocity is achieved can vary depending on the nature of the social relationship. Classic research indicates that short-term or less close relationships require contemporaneous and precisely equal reciprocity. Yet, long-term, close relationships seem to be more flexible, thereby allowing that reciprocity to be achieved over time and in comparable, though not necessarily, identical exchanges. These differences are important for older people who often have a number of close, long-term relationships and perhaps fewer short-term, distal ones.

The changing nature of the lives of older people suggests that a new view of their social exchanges is needed. Whereas previous theories emphasize the lost power, status, and resources of older people, changing sociodemographics may call for a new perspective. Older people are living longer and are healthier for more of that time compared to previous generations. In addition, there are notable changes in their family demographics. Although they are living longer, more people are entering old age unmarried either because they have never married, are divorced, or widowed. They are likely to have fewer children, children-in-law, and grandchildren, all of whom are also not as likely as in the past to live nearby, which influences the type and frequency of exchanges provided and received.

Notions of reciprocity as explicated by the convoy model and the support bank offer potential, innovative ways for older people to maintain equitable social exchanges. Rather than considering living longer a deficit-inducing circumstance, an individual's life history and experiences, such as age, gender, race, culture, and context, can prepare them for a new old age. Family continues to be important to middle age and older people, as does their stake in the family's future. However, middle age and older people appear to be creating circumstances that will permit them to maintain reciprocal exchanges, either by developing new short-term, contemporaneous relationships, e.g., service exchanges, or by developing multiple types of innovative long-term relationships, e.g., group or congregate housing.

Each of the above theories and perspectives offers insights into how to predict and potentially influence the exchange experiences of older people. Boomers may be redefining social exchanges and aging. As the healthiest generation of older people with the longest life expectancy, boomers are creating new opportunities for exchange through second careers, traveling, education, volunteer work, increased community activism, and active grandparenting. Rather than rely on any single type of exchange relationship, the new generation of older people create new opportunities to both give and receive exchanges. They are finding ways to prepare for and minimize deficit exchanges while maximizing resource building in the experience and anticipation of a healthy, active, and extended old age.

## Cross-References

- ▶ [Intergenerational Relationships](#)
- ▶ [Migration and Aging](#)
- ▶ [Social Connectedness and Health](#)

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## Social Group Interventions for Older Adults

Catherine Haslam

School of Psychology, The University of Queensland, Brisbane, QLD, Australia

### Synonyms

Social cure; Social groups; Social treatment

### Definition

Interventions in the present context are defined as actions taken to improve a state of affairs, which in the case of older adults typically involve enhancing various aspects of health, mood, and general well-being. Social interventions are those that deliberately use or target social processes and occur in a social context that involves one or more people. This entry focuses specifically on social interventions that are delivered in group format.

### Social Group Intervention

There is considerable power in social groups. They provide an important basis for collective action, social influence, self-esteem and self-efficacy, and, most important for the present entry, social support. Social group interventions offer a means to harness this power, provided the group is one that enables formation of a strong sense of connectedness among its members and is a positive source of influence and support. These group-based interventions are primarily

advocated for social purposes as strategies to reduce loneliness and social isolation. Extending on this work, more recent research has promoted the use of social group intervention as a means of shaping identity and influencing broader health-related and well-being outcomes. This entry considers the range and effectiveness of these approaches in reducing loneliness and in protecting the health and well-being of older adults.

### **Social Interventions to Reduce Loneliness**

Changing demographics are putting older adults at increased risk of social isolation. Recognition of the growing cost that loneliness poses to society has led to the development and evaluation of a range of strategies to counter its negative effects, particularly on health (Hawkey et al. 2006; Cruwys et al. 2013). As Masi and colleagues note (Masi et al. 2011), these tend to fall into four domains – strategies aimed at developing social skills, increasing social contact and interaction, facilitating social support, and challenging faulty cognitions. These differing approaches highlight the various causes of social isolation with the implication being that they should be more successful if tailored appropriately to the particular problems facing individuals. In practice though, it appears that these are offered as a function of availability and are not always systematically targeted.

Social skills training is thought to be beneficial for those who have difficulty initiating social contact or for whom loneliness appears to be an enduring trait. For the latter group in particular, increasing opportunities for social interaction is unlikely to be effective unless there is a change in their social engagement style which training may address. To this end, social skills training draws on behavioral techniques that incorporate role play, modeling, and feedback in the course of participants practicing their skills (e.g., initiating and continuing conversation) with others in and outside their group and in a range of contexts (e.g., in person, via telephone). Strategies that

increase social contact focus on managing the external, or structural, constraints to social participation – notably, the lack of time due to competing demands, physical constraints that include geographical isolation, and limited funds. Methods to tackle these constraints include environmental modification to increase the availability of social spaces and the creation of more locally accessible community activity and interest groups. Relatedly, support groups are commonly offered to help people cope with loneliness arising from loss associated with separation or bereavement. These groups target awareness and understanding of emotional reactions to loss in addition to countering feelings of marginalization through sharing these experiences with others. Finally, strategies targeting faulty beliefs draw on a range of cognitive behavior therapies with the intervention focusing on challenging self-defeating and maladaptive thought patterns. Here the aim is not only to raise awareness of these cognitions but also to regard these as hypotheses that can be challenged through testing.

A number of qualitative and systematic reviews have tried to establish the effectiveness of these interventions specifically in older adults. The first, conducted by Rook (1984), highlighted many weaknesses in the methodological quality of studies, which to some extent accounts for the mixed support found across most categories of intervention targeting loneliness. Though, there was recognition in this review of the importance of social bonding that group-based interventions offered and their value in social skills training in particular. McWhirter's review (McWhirter 1990) suggested that a combination of cognitive behavioral and social skills training was more effective than either in isolation and may be particularly beneficial when it comes to managing and dealing with the consequences of ending relationships. The review conducted by Findlay (2003) found little support for using social intervention to reduce loneliness, attributing this largely to weak study designs. Consistent with this, only 6 of the 17 studies reviewed used randomized controlled trial methodology. Nevertheless, of the studies reviewed, findings indicated that loneliness was reduced in 1/5 individually based, 4/6

group-based, 1/2 service-directed, and 1/4 Internet-based interventions. Thus, despite the low quality of studies, there appeared to be greater success in group-based interventions. The two reviews conducted by Cattani and colleagues (Cattani and White 1998; Cattani et al. 2005) considered the differential contribution of group and one-to-one interventions directly, and both studies drew the same general conclusion – that the more successful interventions tended to be long-term group-based interventions that were targeted at specific populations. Being conscious of the low methodological quality of studies, the review identified 13 higher-quality studies. Among these studies, all the interventions effective in reducing isolation ( $n = 6$ ) were group based, while four out of the five ineffective interventions were individually delivered. Notable too was the fact that the intervention strategy used in successful interventions varied and ranged from the use of support groups (self-help and bereavement) to education in association with support and physical activity. So it seemed that the more important factor was the mode of delivery rather than intervention strategy.

As a number of these reviews show, group-based interventions tend to be more beneficial than individually directed treatments in reducing loneliness in older adults. This has been attributed to a range of factors – with groups recognized as providing a good vehicle for communication and contact with others who are experiencing similar concerns and are working toward common goals. Groups also provide opportunities to test developing skills and, most fundamentally, the opportunity to actively engage in a supportive social context. In more recent investigations, researchers have emphasized the capacity inherent in group interventions to shape identity and through this counter the negative health effects of social disconnection. The effectiveness of these group interventions that aim to build a meaningful social identity is discussed in the next section.

Findings from the meta-analysis conducted by Masi and colleagues (Masi et al. 2011) are particularly pertinent given it represents the only study to date that has quantified the effect of loneliness interventions based on the four strategies noted earlier. While this did not focus primarily on

older adults (i.e., people aged over 65 years), 48% of the studies meeting criteria either comprised seniors or included seniors in their larger sample. The studies included in this meta-analysis were classified according to three design types: single group pre-post design ( $n = 12$ ), nonrandomized group comparison ( $n = 18$ ), and randomized group comparison ( $n = 20$ ). All design types were found to have a significant effect on reducing loneliness, with effect sizes ranging from small to large. It was only among those studies using a randomized group comparison design in which intervention strategy was a significant moderator, with studies that addressed maladaptive cognitions producing the largest effect size (mean effect size of  $-0.598$ ). Irrespective of strategy, most studies incorporated group-based intervention (66%). However, the effect of group versus individual intervention was only examined in the randomized and nonrandomized group comparison studies. Only the former was found to have a larger effect in reducing loneliness in nonrandomized design studies, but this difference was not significant.

On the whole these studies suggest that perceptions of loneliness can be reduced with social intervention, but data relevant to what the intervention should comprise are somewhat mixed. Qualitative reviews of older adult studies tend to find greater support for the use of social group-based intervention. The only meta-analysis conducted recommended a focus on maladaptive cognitions due to its larger effects in reducing loneliness. However, it is also worth bearing in mind the fact that 70% of those studies addressing maladaptive cognitions were delivered in groups and that the overall analysis was based on studies conducted with participants across the age range (i.e., from 7 to 96 years). Clearly there is a need for quantitative analysis on the effects of strategy and delivery mode (group versus individual intervention) specifically in older adults to identify the optimal form of intervention.

### **Social Interventions that Aim to Build Social Identity**

There is a growing body of evidence that speaks to the value that social group interventions play in

protecting the general health and well-being of older adults. This direction in intervention draws on evidence from the social capital literature showing that older adults who are more socially engaged are generally healthier and experience better well-being. While these data are based on the integration of different types of social relationships, there is evidence that social group relationships may be especially beneficial for health (Haslam et al. 2014, 2015). This benefit has been attributed to the contribution that social groups make in shaping our sense of self through providing us with a sense of meaning, purpose, and direction (see entry on ► [Social Connectedness and Health](#)). When they are a positive source of influence and support, social groups act as a psychological resource from which people can draw strength and health-enhancing support (Jetten et al. 2014). This reasoning has particular relevance to social group intervention, as it predicts that health and well-being is only improved to the extent that people identify strongly with their intervention group. Thus, unlike the social interventions described above that target loneliness, the strategy applied here is to build and strengthen social identification with others in the group to achieve health and well-being gain.

Results from a number of experimental studies conducted with older adults living in residential care support this prediction. The content and purpose of the social intervention in these studies varied widely and included reminiscence groups who collectively recollected memories and experiences from the past (Haslam et al. 2010, 2014a), design teams tasked to decorate communal spaces (Knight et al. 2010; Haslam et al. 2014b), water clubs to combat dehydration (Gleibs et al. 2011a), and men's clubs to counter social isolation (Gleibs et al. 2011b). The common factor was that all provided a meaningful basis for social interaction. This was even the case in reminiscence which is often characterized as a form of cognitive stimulation, but is also recognized as having an additional social function (Woods et al. 2005). Having a common purpose strengthened members' sense of identification with their social group, and this, in turn, was associated with enhanced cognitive health, mental health, and well-being.

Two studies were particularly notable in their investigation of the contribution that group and individual delivery of the same social intervention had on health outcomes. The first of these directly compared the effectiveness of group and individual reminiscence on memory in a randomized controlled trial (Haslam et al. 2010). Residents engaged in this activity over a period of 6 weeks, either with one member of the research team or in a small facilitated group. Thematic content and time engaged in reminiscence was controlled, as were the materials used to facilitate discussion (comprising tangible props such as objects and photographs from particular time periods). Results showed that group reminiscence, but not individual reminiscence, enhanced memory performance and that this was associated with a greater sense of maintained connectedness among those who reminisced in a social group context. Those reminiscing one on one felt very different and disconnected from others in care after the intervention. Thus, despite engaging in the same content, it took group interaction for the memory benefits to emerge from reminiscing. The second study involved residents in care learning about the benefits of water (Gleibs et al. 2011a). Here, residents were randomly assigned to a water or control intervention (focusing on news and current affairs), which was delivered either in a facilitated social group context or individually with a member of the research team. Only residents in two of these four conditions – water clubs and news clubs – showed any health enhancement which was particularly apparent in their reduced need for general practitioner appointments. Mediation analysis further showed that these benefits were achieved through provision of social support, which emerged in response to a strengthened sense of social identification that developed primarily among residents in the clubs.

One of the clearest demonstrations of the particular role that social identification plays in group intervention is provided in another reminiscence study. In this case, the standard form of group reminiscence, experienced through collective sharing of memories from the past, was compared with a form of song reminiscence involving collective recollection and singing of songs from the

past (Haslam et al. 2014a). Although not uncommon in the reminiscence field, overall analysis showed no effect of reminiscence on either cognitive or well-being outcomes. However, further interrogation of initial identification data (i.e., participants' initial sense of belonging and connectedness to their group) was more positive. These findings indicated that only those who developed a strong sense of identification with their reminiscence groups from the start showed improvement in general cognitive performance and life satisfaction. In this case, identification with others in the social group intervention was the driver of enhanced outcomes.

An interesting dimension to these studies is that engagement in socially stimulating activities had an effect on cognitive performance. Cognitive enhancement is typically associated with cognitive, and not social, stimulation. While it can be argued that cognitive stimulation is a feature of standard reminiscence, it was less prominent in the remaining activities involving water clubs and song reminiscence. Stronger evidence speaking to this point comes from a study conducted by Pitkala and colleagues (Pitkala et al. 2011). In this clinical trial, 235 lonely older adults were recruited and randomly assigned to take part in socially stimulating group activities, that they chose on the basis of preference and interest, or to receive normal community care. Only those who received the social group intervention showed an improvement in cognitive performance as indexed by the Alzheimer's Disease Assessment Scale. This led the authors to conclude that even socially stimulating activities targeting loneliness can improve cognition.

Identification processes have also been shown to be central in managing the mental health of a recognized minority in residential care – older men. Many social activities and interventions in residential care contexts are targeted toward women, and it is not surprising that these have limited appeal to older men. In response, a growing number of men's sheds and clubs have emerged, but there are few investigations of their effects on the health and well-being of older men. One exception to this was a study conducted in the United Kingdom investigating the effect that joining men's clubs had on older men in residential care (Gleibs

et al. 2011b). Given the low numbers of men in the facility, the activity coordinator recruited older men from the community to join the clubs, and together the men engaged in activities that they chose (e.g., watching a sports game, going to the pub). The impact of this social group intervention was compared to that for women taking part in ladies' clubs, which represented the control condition in the study. Results showed no change in the mental health and well-being of women who were already highly identified with others and were neither anxious nor depressed. However, men experienced a significant reduction in depression and anxiety and significantly enhanced well-being in association with feeling more identified and connected with other men through the clubs.

As these data attest, group-based social interventions can be more powerful in enhancing health and well-being. However, they also show that it is not simply a case of joining any intervention group on offer. The social group intervention must be meaningful and valued by those taking part for identification to develop and strengthen. Additionally, the social group must provide a positive basis for influence and support. In the absence of a positive sense of identification, there is no reason or motivation to engage or persist with an intervention, nor any basis for health and well-being gain. Nevertheless, as the Masi meta-analysis shows, there are studies that do not find significant effects of group delivery. Establishing the reasons for these mixed findings is difficult without better process measures, particularly those indexing the extent to which people identify with their social intervention group.

## Conclusion and Future Directions

Social group interventions are commonly used with older adults to target specific problems – primarily social isolation and, more recently, health. Interestingly, the frequency of group-based delivery tends to outweigh individual delivery, and this is not simply a reflection of funding constraints or efforts to make savings. There is evidence showing the greater impact of group-based interventions in reducing loneliness and in enhancing cognitive

health, mental health, and life satisfaction. However, this is not the case in all studies, and this field would benefit from a quantitative review of the effect of group-based social intervention on older adults specifically. Clarity over the best mode of social intervention delivery is just a first stage. Questions still remain about the nature of the intervention, in terms of the best strategy to apply in older adults for particular outcomes, and the dose of intervention. There are currently no clear recommendations about how often social intervention should be delivered nor for how long. Answers to these and other related questions will provide the basis for stronger guidelines to optimize outcomes from social group intervention.

## Cross-References

- ▶ [Aging and Quality of Life](#)
- ▶ [Loneliness and Social Embeddedness in Old Age](#)
- ▶ [Mental Health and Aging](#)
- ▶ [Psychosocial Well-Being](#)
- ▶ [Social Connectedness and Health](#)

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## Social Identity Change and Driving in Later Life

Nancy A. Pachana and Jolanda Jetten  
School of Psychology, The University of  
Queensland, Brisbane, QLD, Australia

### Synonyms

Driving cessation; Social Identity Model of Identity Change (SIMIC)

### Definition

Driving is a key activity of daily living, one which not only serves a functional purpose but which can influence one's self-definition and social identity (i.e., that portion of a person's self-concept derived from group membership). Continuing to drive and even the possession of a valid license to drive in the absence of actual driving have been linked to a positive social identity (e.g., belonging to a group of older adults that is still young and active). Because of this, driving cessation has also been linked, in qualitative and quantitative research, to social identity loss – the change from seeing oneself as belonging to a group of older adults that is independent and active to one that is more frail, less independent, or, simply, older with respect to perceived (as opposed to actual) age. This is one of the reasons why driving cessation as an act (either voluntary or involuntary) has been linked to reduced physical and emotional health and well-being.

### Social Identity Change and Driving in Later Life

Driving is a familiar activity of daily living, one in which many individuals worldwide participate, in most cases without thought for when this important activity may have to be suspended, either on a temporary or a permanent basis. Indeed, although in some densely urban metropolitan centers car

ownership is rare and thus driving less important, in many societies throughout the world, people are heavily dependent on automobiles as the predominant means of transportation (Buys et al. 2012). Continuing to drive is reported by older adults as important for maintaining independence and quality of life (Adler and Rottunda 2006). However, declines in health and cognition may result in older adults ceasing to drive, either voluntarily or involuntarily (Edwards et al. 2008). In turn, driving cessation may affect health and well-being negatively for a number of reasons.

Since driving is not only a practical and useful skill but is symbolically associated with many desirable qualities such as independence, competence, and freedom of mobility, stopping driving is typically associated with many negative emotions and is associated with a decline in physical and mental well-being and an increase in isolation (Fonda et al. 2001; Mezuk and Rebok 2008; Ragland et al. 2005). Consistent with this, older people who stop driving report a loss of control and self-efficacy (Windsor et al. 2009), decreased quality of life (Oxley et al. 2010), and increased dependence upon others (Yassuda et al. 1997).

However, the cost of driving cessation goes well beyond the greater dependence caused by the inability to drive from A to B. It often represents an important life change, one that is associated with social identity change and/or loss. One's social identity can be described as the portion of an individual's self-concept that is derived from perceived membership in a social group (Tajfel and Turner 1979). Traditionally, social identity theory has been used as a framework for describing intergroup behaviors and is increasingly seen as a means to not only explaining but also as a means to influencing such behaviors (Tajfel and Turner 1979; Haslam et al. 2010). In recent years, the theory has been applied more broadly, for example, to explain the way changes to social identity affect health and well-being (Jetten et al. 2012). The Social Identity Model of Identity Change (SIMIC; Iyer et al. 2008; Jetten et al. 2009) views identity change quite broadly and includes anticipated life changes such as the transition from work to retirement, as well as more sudden changes to one's identity such as those that

might result from an acute illness, or with having to stop driving. At the core of SIMIC lies the assumption that, because self is in important ways defined by the groups that we belong to (e.g., age groups), changes in group membership or loss of valued group memberships affects a person’s sense of self in important ways.

Driving cessation can be viewed as an identity change process not unlike other important life transitions such as retirement or changes in health status, in that it can occur acutely or over time and can be voluntary or involuntary. It thus involves many of the factors associated with SIMIC that make it harder to adjust to such a change. Specifically, driving cessation involves giving up a valued identity as a driver and the taking on of a new identity as a nondriver, which is viewed as unattractive and often stigmatized (Eisenhandler 1990). This new identity is very often permanent, with negative effects on the individuals’ broader identity network with respect specifically to maintaining membership in social groups and group activities (Jetten and Pachana 2012).

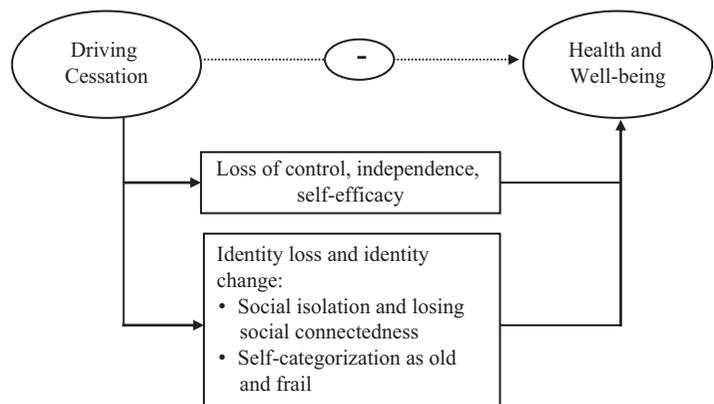
There are at least two ways in which driving cessation involves identity change and identity loss (see Fig. 1). First, driving cessation implies increased barriers to participation in community life and social connectedness (e.g., Glasgow and Blakely 2000). Driving cessation may result in a change in one’s relationship to others, to the extent that one no longer feels they belong to, or identify with, the same social groups as previously. This may be reflected in membership of specific groups oriented around an activity

which is no longer able to be pursued due to changed driving status (such as a hobby or volunteer activity), but also membership in a more abstract group (people who are independent). Thus, an individual who stops driving is likely to find it harder to engage in the social networks and social groups to the same extent as they did before ceasing driving. The social isolation that can occur and the potential for loss of group membership as a result of driving cessation are therefore likely to impoverish the individual’s social identity and, by extension, his or her personal identity (Jetten et al. 2010), and this will negatively affect health and well-being.

Second, driving cessation is also associated with changes in how a person views himself or herself and their relationships to others. When identity change involves a sense of losing identity (e.g., from being a driver to a nondriver), this not only implies a change from a positively valued identity (e.g., a healthy older adult) to a more negative identity (e.g., a frail older adult, unable to drive), it is also a marker of aging (i.e., self-categorization as “young-old” to “old-old”). In this way, driving cessation may well hinder an older adult from feeling they are younger than their chronological age and thus no longer able to “pass themselves off as something they are not” (Hornsey and Jetten 2003). This can be viewed as a categorization threat, whereby others may place them into a social category to which they would rather not belong (Branscombe et al. 1999). In effect, they have lost one means of staving off old age (Gardezi et al. 2006).

**Social Identity Change and Driving in Later Life,**

**Fig. 1** A schematic representation of processes that affect the relationship between driving cessation and health and well-being



There is now a growing body of work showing evidence for these different negative consequences of driving cessation on health and well-being. For instance, there have been several qualitative and, more recently, quantitative studies published that shed light on how older adults think of themselves in relation to stopping driving and the potential impact of driving cessation on social identity in later life. Rudman and colleagues (Rudman et al. 2006) used focus groups of older adults who were either still driving (aged 55+) or had stopped driving (aged 65+) to explore their perspectives on self-regulating their driving behaviors. Continuing to drive was viewed as indicating independence and well-being; those who had not yet ceased to drive in this study almost could not envision themselves in the position of no longer driving: “I can’t imagine not driving” (p. 70). Donorfio and colleagues (Donorfio et al. 2009) examined, among other things, what mid-aged adults thought driving meant to them, personally. As reported by the authors, driving to these persons “meant much more than getting from A to B” (p. 223), hinting at meanings to driving beyond mere functionality.

In one of the first papers to address driving cessation and identity, possession of a valid driver’s license has been seen as explicitly linked to a positive sense of self, while loss of one’s driver’s license was associated with taking on an “older” identity (Eisenhandler 1990). In another qualitative survey, this issue of stopping driving being equated with being older was reported by one participant, after listening to a media program on driving and driving cessation: “I saw a documentary and then there was a radio phone-in. It took me a while, then I thought. . . this is actually about me, now. I suddenly realised I was old and needed to be more careful. It was that that started me thinking (female, aged 75)” (Musselwhite and Shergold 2013), pp. 94).

In a recent qualitative study of driving cessation in persons with dementia, the difficulty of bringing up the topic of stopping driving, due to its high emotional impact, was mentioned frequently by caregivers: “It meant transport, it meant independence, but it was also something about the activity itself that was so important to

him . . . It was his manly activity” (Liddle et al. 2013, pp. 2038).

In a recent quantitative study on the meaning to self in ceasing driving (Pachana et al. 2015), over 200 older adults who had either ceased driving or were contemplating stopping driving were surveyed. Driving cessation was a significant life event, one associated with subjectively feeling older. Irrespective of current driving status, these older participants identified the state of having ceased driving as associated with feeling older than their real age and the state of not having stopped driving as associated with feeling younger than their real age. Participants’ expectations about both the practical hassles involved in stopping driving, as well as identity changes with respect to, for example, social networks, were both significant predictors of the stress associated with driving cessation.

Several authors have also provided evidence that continuing to drive may be an effective way of holding off the *individual* perception of growing older (Gardezi et al. 2006; Rudman et al. 2006; Siren and Hakamies-Blomqvist 2005). Since the changed driving status is associated with so many negative and socially undesirable traits (e.g., dependence), an older adult may have great difficulty making and accepting this social identity transition. In fact, driving cessation for some individuals signals a transition from being young-old to old-old, which is often associated with greater exclusion from mainstream society (Jetten and Pachana 2012). Moreover, this can be viewed as a very public (and likely permanent) transition – an undeniable sign to others that one has become old.

## Conclusion

Driving is an important aspect not only of participating in activities and maintaining mobility but also in maintaining a social identity as independent and effective and possibly even as functioning at a level that belies one’s chronological age. Driving cessation, on the other hand, is associated not only with decreases in physical and mental well-being but also with a shift in social identity to

one which is less desirable and more stigmatized, namely, a nondriver. This shift in social identity and its aftermath are congruent with the Social Identity Model of Identity Change (SIMIC; Iyer et al. 2008; Jetten et al. 2009).

## Cross-References

- ▶ [Age Stereotyping and Discrimination](#)
- ▶ [Social Connectedness and Health](#)

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## Social Media and Aging

Thomas A. Morton  
 Psychology, College of life and Environmental  
 Sciences, University of Exeter, Exeter, UK

### Synonyms

Social networking

### Definition

“Social media” collectively refers to a range of applications that allow user-generated content and person-to-person or person-to-network content sharing via the Internet (Kaplan and Haenlein 2010). This includes applications like Wikipedia, Facebook, YouTube, Flickr, and Twitter, to name a few commonly known examples, as well as blogging sites and online communities. All these applications share the capacity to facilitate interaction, discussion, and exchange between individuals and groups of individuals, who might be physically dislocated but can nonetheless be copresent or who can interact in an asynchronous way, in virtual space.

### Background

“Social media” rose to prevalence in the early to mid-2000s following a series of technical innovations known as “Web 2.0.” Web 2.0 does not refer to any specific advance in technology or programming, but rather is used to refer to the accumulated changes that increased the capacity for user-generated content and made the sharing of this and social interaction via the Internet more possible. Although social media applications share these capacities, individual social media platforms differ on a number of dimensions, including their specific purpose (e.g., social, political, commercial; informational versus entertainment), content and layout (e.g., primarily text or image based), and scope of individual contributions (e.g., being relatively more public versus private, anonymous versus identified, active versus passive in terms of use and engagement). On the boundary of social media are applications that also allow for specific forms of social interaction via the Internet, including email, instant messaging platforms, and Skype, but do not meet the formal definition of “social media” because they do not involve the creation and public sharing of content that exemplifies social media properly. Nonetheless, these applications and technologies also provide opportunities for users to connect with each other and with networks, to share content and interact, and to do so instantly and beyond the constraints of physical and temporal co-location. As such, these forms of online social interaction and networking are often discussed in connection to social media more generally.

Social media are now deeply embedded in the societies of most developed nations and many developing nations also. Social media play a significant role in the everyday personal lives of individuals around the globe and have also been implicated in social and political life via their role in facilitating social movements and collective action (e.g., as exemplified by the “Arab Spring” protest movements in 2010). In the context of aging, interest in social media has been driven by two broad, but related, concerns. First, social media are seen by some to hold considerable promise as tools for supporting the social

participation of older adults who might otherwise be at risk of isolation. Second, as access to information and social services increasingly becomes “digital by default,” concerns have been raised about digital literacy among older adults and the extent to which deficits in skills or access to technology could be creating digital divides that further contribute to the marginalization of older adults. These twin concerns speak to the role of social media, and online interaction more broadly, in contributing to social inclusion versus exclusion. Current research that speaks to these issues is summarized below.

### **Aging, Social Media Use, and Well-Being**

Social isolation and loneliness are issues of concern across the life span, and research has established significant links between the quantity and quality of individual social connections, or the subjective representation of these (e.g., in terms of felt loneliness), and individual mental, cognitive, and physical health outcomes. To broadly summarize this body of research, people who have access to more social connections, who are more satisfied with their relationships, and who participate across multiple social groups tend to be more emotionally and physically resilient in the face of stress, tend to experience better mental and cognitive health, and tend to live longer. Although such patterns are evident in younger and older populations alike, the negative health effects of social isolation and associated feelings of loneliness tend to amplify with age (Hawkey et al. 2006; Ong et al. 2012). As such, the negative consequences of social isolation and loneliness are an issue of particular concern among older adults. Moreover, aging itself is associated with a variety of physical, cognitive, and social changes that can contribute to, or exacerbate, social isolation and feelings of loneliness among older adults. For example, physical impairments can restrict mobility and thereby reduce opportunities for ordinary contact with others in the local community; cognitive impairments can create barriers to easy and effective communication; bereavement can restrict one’s social network;

and moving into long-term care facilities can create distance between one’s self and one’s family. For all these reasons, finding ways to support positive social relations among vulnerable older adults is an important priority both for research and for aged care and public health policy more generally given the aging global population.

Because of their capacity to bridge physical and temporal divides, to enable alternative forms of communication, and to facilitate social connections (Neves 2013), social media applications have been viewed by some as promising tools to reduce social isolation among older populations. Specifically, social media seems to offer a way to help those who have limited physical mobility, who may be living away from their families, or who may be experiencing difficulties with verbal communication, to maintain their social networks and to engage with these effectively. Beyond these uses, social media can also connect people to other public health developments such as tele-care and tele-health, in which interaction with and monitoring by carers and health professionals are conducted remotely, thus having a potentially wider field of application in relation to aging.

There is evidence that older people who are more digitally active tend to experience better well-being. For example, data from large-scale, population-based surveys of older adults in the United Kingdom (English Longitudinal Study of Ageing) and the United States of America (Health and Retirement Longitudinal Study) show significant longitudinal relationships among Internet use and reduced depression (Cotten et al. 2014), improved cognitive capacity (Xavier et al. 2014), and more positive health behavior in areas of physical activity, diet, and smoking (Xavier et al. 2013). These relationships hold when controlling for important demographic indicators (e.g., gender, education, functional impairment, and wealth). Interestingly, the relationship between Internet use and reduced depression was found to be the strongest (and indeed only significant) among older adults who were living alone, or with only one other person, rather than those living in larger households. This particular pattern speaks to the idea that Internet use might provide a useful supplement to social activity

among those who have fewer local opportunities for interaction, thereby attenuating the negative effects of social isolation. However, such links could also be explained by a variety of other processes. For example, relationships between Internet use and improved cognition could be explained both by enhanced social engagement and by increased learning and mental stimulation (Ybarra et al. 2008), and relationships between Internet use, depression, and health behavior could be accounted for by access to health information and other resources, as well as by processes associated with social support, advice, and influence from one's network (Smith and Christakis 2008).

However, correlational links like these, even when longitudinal, could also be explained by other uncontrolled factors associated with Internet use. As such, experimental research is important for understanding the causal links between engagement with specific forms of technology and individual health and well-being outcomes. In contrast to this correlational picture, evidence for the causal role of Internet use in general, and social media specifically, in enabling social connections and contributing positively to cognitive and mental well-being is currently scarce, especially with respect to older adults. Moreover, the studies that have been conducted on this issue have produced mixed findings. Some small-scale earlier studies in this area showed positive effects of Internet provision and supportive training on the well-being of older adults involved (McConatha et al. 1994, 1995). However, more recent larger-scale studies found no or limited evidence of improved outcomes among older adults assigned to receive a computer, Internet connection, and supportive training (Slegers et al. 2008; White et al. 2002; Woodward et al. 2011). Thus, while there is suggestive evidence that points to the potential for social media and other online applications to support the social connections of older adults and through this improve their well-being, at present the evidence for this is inconclusive (Shklovski et al. 2004). To resolve this issue, there is clearly a need for more large-scale well-controlled experimental studies to quantify the causal effects of social media

provision and training, and individual engagement with these, on the capacities and well-being of older adults over time.

### **Perceptions and Use of Social Media and the Internet by Older Adults**

Beyond the specific benefits that may or may not flow from social media use, researchers have also examined the perception and use of social media among older adults. It is often assumed (by younger people) that older adults are not interested in computers and social media or that they are not capable of using these fully and effectively. In line with this, surveys show that age is associated with lower levels of computer use and less engagement with social media. However, despite the persistent age gap, computer use is increasing across time for all ages, and recent US data suggest that the use of social media has increased particularly sharply among adults over 50 years (Madden 2010). These trends suggest that older adults are increasingly interested and engaged with computers, technology, and social media applications. Indeed, there are some who suggest that the age-based "digital divide" may be a historical problem – because current generations have been raised with technology and the Internet. Moreover, as social media becomes more pervasive and part of one's ordinary daily life, this digital literacy will remain as people age. Of course, technology itself ages, becomes obsolete, and is replaced by newer developments. As such, there are still reasons to suspect that the gap in digital literacy between younger and older groups might persist (Friemel 2014).

There may also be specific functional and attitudinal aspects of computers and social media use that act as barriers to individual engagement among older adults. Functionally, for example, physical and cognitive changes associated with aging may make computer use progressively harder: impaired vision and hearing makes it harder to engage with content displayed by computers, and reduced dexterity makes it harder to use a keyboard and mouse to navigate these. However, computers themselves are changing by

becoming more portable and more user-friendly. The use of assistive devices (e.g., a stylus in conjunction with a touch screen) and minor modifications can help to overcome some of the physical barriers to computing experienced by older adults. Beyond functional restrictions, attitudinal barriers might exist. For example, self-perceived ability may limit willingness to engage with computers. A lack of comfort with the perceived norms of social media, the potential for exposure to inappropriate content, and especially fears about privacy and the sharing of personal information have also been identified as particular attitudinal barriers to engagement with social media among older adults (Nef et al. 2013; Xie et al. 2012). With respect to these attitudinal barriers, it is also worth noting the important role of encouragement and support from social networks in facilitating older adults' engagement with technology and the Internet (Friemel 2014). In this respect, features of older adult's offline social networks are likely to contribute to whether and how they engage with social networking online.

Another barrier to older adults' engagement with social media may be what they do or do not find when they go onto social networking sites. Social media can be a useful way for supporting social connections only to the extent that they provide access to others with whom one wants to connect. Given that social media use generally reduces with age, older people might find it difficult to locate friends and peers with whom they would want to interact on social networking sites. The perceived absence of friends online may limit individual participation, thereby creating a reinforcing pattern of underrepresentation of older adults in social media fora. Of course, older adults may not want to only interact with people of their own age. Because social networking is so pervasive among younger adults and children, social media might provide opportunities for intergenerational contact that are welcomed by older adults (Nef et al. 2013).

Aside from the types of social contact that are available, older adults might also be confronted by negative stereotypes about their age group via social media. Ageism is a common form of social prejudice and unlike many other prejudices is one

that is openly expressed and perceived to be legitimate (North and Fiske 2012). This, in combination with the dominance of younger users, could lead to the expectation that age-based prejudice and negative stereotypes on social networking sites should be fairly frequent. Indeed, a recent study conducted an analysis of 84 open-membership Facebook groups that included terms related to older adults in their descriptions and found that the overwhelming majority of these referenced negative stereotypes (Levy et al. 2014). Although this possibility has not been systematically investigated, it seems plausible that exposure to negative stereotypes and prejudice toward older adults via social media sites might negatively affect individual motivations to engage with these.

To the extent that older adults do engage with social media, studies highlight specific features of these that are valued by this population. Consistent with the perceived potential for social media use to address social isolation, studies suggest that one of the most common uses of computers and Internet technology among older adults is for communication and social support (Wagner et al. 2010). As noted above, providing the opportunity for intergenerational contact has also been suggested as a specific value of social media (Nef et al. 2013). Finally, social media provide the capacity for accessing, sharing, and discussing health information, something that may be of particular interest and relevance to older adults – and that might contribute to better health and well-being to the extent that the information found is reliable and contributes to better decisions. Indeed, seeking health information is a common use of computers among older adults (Wagner et al. 2010). However, trust in the credibility of such information can also be an issue for this population (Zulman et al. 2011).

## Summary

Social media represent both the accumulation of technological advances and a shift in the form through which many people now engage with social connections. Reflecting the broader uptake

of social media across society, older adults are increasingly computer literate and increasingly engaged socially online. Because of their unique capacities to transcend time and space, and to offer alternative ways of communicating, sharing, or otherwise being “copresent” with others, it is often suggested that the Internet and social media applications might be useful tools for tackling social isolation among older adults. However, to date, systematic evidence for the effectiveness of Internet connectivity, Internet use, or social media use, more specifically, in supporting the health and well-being of older adults who might be vulnerable to social isolation is limited and, at best, mixed. As such, more research exploring how older adults engage with Internet technology and social media, and the consequences that this might have for their health and well-being, is clearly needed.

## Cross-References

- ▶ [Age Stereotyping and Discrimination](#)
- ▶ [English Longitudinal Study of Aging \(ELSA\)](#)
- ▶ [Health and Retirement Study, A Longitudinal Data Resource for Psychologists](#)
- ▶ [Loneliness and Social Embeddedness in Old Age](#)
- ▶ [Telemental Health](#)

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## Social Policies for Aging Societies

Terry Lum and Gloria Wong  
The University of Hong Kong, Hong Kong, China

### Definition

In this entry, social policies refer to policies that affect well-being of individuals and families. They are usually referring to income maintenance policy, educational policy, social welfare policy, housing policy, and health policy. Aging society refers to a society that has at least 14% of its population aged 65 years or older.

### Background

Population aging affects all aspects of human experience and requires specific social policies that address the needs of older people. Older people face a higher risk of poverty and income insecurity. They have increased needs for health and long-term care. Governments are developing policies to promote successful aging, productive aging, and aging in place. Although population aging affects both developed and developing countries, policy challenges for developed and developing countries are distinct. In this entry, we review four major social policy issues related to aging societies: old-age income support, health

care and long-term care, successful and productive aging, and age discrimination and age equity. In doing so, we draw on policy examples from developed countries such as the OECD countries and developing Asian countries to illustrate the diversity of policy responses to population aging.

### Old-Age Income Support Policies

Economic activities, and hence income, expenditure, and saving, are not distributed evenly across the life span. Typically, younger adults save for retirement throughout their working years via different public and occupational retirement saving programs and private saving. By the time they become too old to work, they finance their consumption by gradually dissolving their assets and by support from their children. Over the last century, governments have developed policies and programs to protect against the risk of poverty in old age and smooth the transition from one's work life into retirement (Holzmann and Hinz 2005; Holzmann et al. 2008).

The social safety net, public pension, and social insurance are three major policies that aim to protect older people from economic hardship and to smoothen consumption over the life course (Smeeding and Sandstrom 2005). The social safety net is noncontributory social assistance program for lifetime poor, sick, and disabled elders who have no or very limited work history. It is usually funded by the general tax revenues and provides minimum safety net benefits against old-age poverty. It can be universal or means-tested. The public pension is generally universal and contributory, either through defined contribution or defined benefit, providing a cash transfer paid regularly to older people. The cash payment is usually small, funded by salary tax in a pay-as-you-go arrangement. It provides a higher-income replacement rate for low-income earners. Social insurance is contributory, mandatory, and universal. It generally links benefits to earning history and provides effective financial protection against old-age economic hardship by spreading the risk over all insured people, within and across generations. Some social insurance programs, such as

the Social Security program of the USA, also provide spouse and dependent children benefits. These three programs, together, create the first three pillars of the World Bank's pension system framework (Holzmann et al. 2008). The fourth pillar of its framework is a voluntary employment-related retirement saving plan, usually in the form of a fully funded defined-contribution individual retirement account or a defined benefit pension plan. Most governments use a combination of these policies to reduce the risk of old-age poverty and improve the economic status of older people. In the USA, the Social Security program alone reduced the old-age poverty rate from 44.4% to 9.1% and lifted 15.3 million older people out of poverty (Van de Water et al. 2013).

Old-age income support programs are under stress in many countries as the size of the elderly population grows rapidly. Population aging increases the needs of old-age income support and at the same time reduces the contribution to those programs. Governments are exploring different ways to reform their old-age income support programs to make them sustainable. These reform efforts can be grouped into two strategies, namely, eligibility-restricting reforms and generosity-restricting reforms. The eligibility-restricting reform aims to abolish or restrict early retirement schemes, increase the statutory retirement age, and gain greater equality in the age at which men and women retire. In generosity-restricting reforms, governments adopt a lower pension benefit ratio to decrease or stabilize pension expenditure (European Commission 2014). Politically, it is easier to adopt and implement the eligibility-restriction reform than generosity-restriction reform.

### **Health Care and Long-Term Care Policy**

Health care and long-term care are other pressing policy issues in aging societies. It is well documented that the rates of morbidity and mortality increase with age. Population aging also affects disease profile, shifting from infectious

and acute diseases that are relatively inexpensive to treat to chronic diseases that are expensive to manage. Therefore, many policy makers assume that population aging is associated with increased utilization of health services and higher health spending. Such perception has also been supported by health-care utilization data. For example, in the USA, elderly people comprised 13% of the total population in 2010, but consumed 34% of the total health-care spending (Centers for Medicare and Medicaid Services 2015). In Europe, older people account for about half of the hospital bed-days (McKee et al. 2002). Governments, therefore, are trying to slow the growth of health spending by finding new ways to finance and organize health care to produce the best health outcomes by the most efficient means (National Research Council 2001). These usually include better coordination of care across health and social services, across different levels of health care, and across private and public health resources; moving treatments and care out of hospital; and enhancing health promotion and disease prevention programs that target amendable risk factors such as obesity, hypertension, mental health, and inactivity (Economist Intelligence Unit 2009; Rechel et al. 2009).

However, recent research findings cast doubt on the population aging-higher health-care spending connection and suggest that other factors, such as the use of advanced medical technology, public health spending, and end-of-life care, may have a larger impact on health-care costs in an aging society (Rechel et al. 2009; Werblow et al. 2007). For example, the USA spent 16.4% of its GDP on health care in 2014, which represents 7.5 percentage points above the OECD average of 9.3%. This is despite the fact that the USA has a much younger population than OECD countries (OECD 2014). Similarly, an analysis of OECD health spending data between 1965 and 1995 also found that age has a negligible effect on an individual's health-care expenditure when proximity to death is controlled for. In fact, most health-care expenditure is driven by medical technology and decision on end-of-life care than by aging population (Werblow et al. 2007).

Long-term care (LTC) is a set of multidimensional services that comprise health care, social care, personal care, and housing and is directed at persons with limited self-care ability due to cognitive decline, functional decline, or chronic illness. It differs from health care as the goal is not to cure or rehabilitate, but to maintain and to reduce the impact of cognitive and functional decline on the quality of life of older people. LTC can be delivered at home (e.g., chore services), in the community (e.g., adult day-care services), or in institutions (e.g., nursing and residential care facilities). Although governments have been increasingly providing long-term care to older people, family members are still the major caregivers of frail elders in all societies, including advanced Western countries such as the USA and UK. Most governments have complicated policies that regulate providers of long-term care services, including manpower, qualifications, safety, hygiene, and physical environment.

LTC is usually financed through taxation, LTC insurance, or through national health-care spending. In some Nordic countries, LTC is tax-funded and is an integral component of their universal health-care system. In the USA, LTC is mainly funded by the Federal Government's Medicaid program and is means-tested. Other governments, in countries such as Japan, Korea, and Germany, use a stand-alone insurance to finance LTC. The LTC insurance is usually contributory and mandatory. A few countries, such as the USA, adopt the medical model of LTC and fund LTC services through the public health system (Francesca et al. 2011).

Many governments are trying to rebalance their LTC services by shifting more resources to home- and community-based care that encourage frail elders to age in place. Some countries are also trialing various forms of participant-directed care, also known as the money-follow-the-older-people programs or personalized social care. The participant-directed program allows frail elders, with support from their family or informal caregivers, to develop individual budgets to support access to more personalized services that meet their individual needs.

Many governments see ensuring and improving the quality of LTC as an important policy priority in aging societies. The most common policy approach in quality control focuses on controlling input, such as staff ratio and infrastructure, by setting minimum acceptable standard and enforcing compliance. Very few countries have a system of systematically monitoring the quality of LTC.

## Successful and Productive Aging Policies

Successful and productive aging are two different, but related, concepts. Successful aging is a multidimensional concept covering physical, mental, and social functioning; life satisfaction; and psychological resources (Rowe and Kahn 1997, 1998). To age successfully, older people work to improve their overall health, minimize their functional loss, increase their social participation, and enhance their capabilities (Rowe and Kahn 1998). Similarly, for those more frail, successful aging involves optimizing physical, cognitive, and social functions, but in the context of accommodating for their long-term disabilities. Regardless of ability and age, autonomy and meaningful engagement are essential for successful aging. Social policies, therefore, aim to minimize the negative impact of disability and health deterioration on functioning and social engagement and to maintain high levels of autonomy. Successful aging policies cover various community support programs that provide older people opportunities to optimize their health and functioning, to engage in socially meaningful activities, and to enhance their autonomy and capability. Environment is crucial to successful aging, and governments have increasingly adopted policies that promote age friendliness in local communities. The Age-Friendly City domains from the World Health Organization have been adopted by a number of societies as guiding principles for age friendliness.

Productive aging policy focuses specifically on increasing opportunities for older people to continue their productive engagement in the context

of aging. Productive engagement of this form refers to any activity that is seen to have economic value (Hinterlong et al. 2001). Economic value can be measured in terms of goods or services produced (e.g., full-time or part-time paid employment) or of the economic cost involved in supporting older people not involved in those activities (e.g., caregiving and volunteering). Productive aging policies also incorporate activities that enhance productive activity in older people, such as education and training. Productive aging engagement has positive effects on older people's health and mental health, but, typically, tends to be taken up by more educated and middle-class elders (Hong and Morrow-Howell 2010; Lum and Lightfoot 2005; Musick et al. 2000). For low-income elders who wish to volunteer, financial support from the government helps reduce the economic barrier associated with participation and makes such participation possible. In the USA, the Federal Government funds the Senior Corps that provides service opportunities for Americans aged 55 years and older. The Senior Corps programs offer modest stipends to help offset the costs of volunteering. Similarly, the AARP Experience Corps® (EC) offer high-commitment volunteer opportunities that bring older adults into public elementary schools to improve the academic achievement of students.

### **Age Discrimination and Age Equity Policy**

Some employment policies are not age friendly. Nevertheless, governments have an obligation to protect people from age discrimination in the workplace. Age discrimination typically arises in response to age stereotyping, where characteristics are attributed to people based on their age. It can result in the setting of arbitrary age limits for hiring, promotion, compensation, and other employment decisions, regardless of an individual's actual ability or potential for job performance. Age discrimination arises when employers use such stereotyping to make employment decisions. For example, an employer may assume that older workers are less interested in training and thus

make decisions about the training opportunities they offer on the basis of age. They may also assume that younger workers are more productive and make hiring decision based on age. Age discrimination, intentional or unintentional, is not only illegal but also harms business when the workforce is rapidly aging. For example, in the USA, the median age of the working population is already 40 years and older (AARP 2006). In the USA, the Age Discrimination in Employment Act has been in place since 1967 to make it illegal for employers, employment agencies, and the federal government agencies with at least 20 employees to discriminate against employees and job applicants who are 40 years or older. It also prohibits age discrimination by labor organizations, such as unions, that have at least 25 members. The best way to prevent age discrimination is to make age-neutral decisions on hiring, firing, work assignments, and benefits and to base these decisions on how well an individual's abilities and qualifications match the criteria set for the job. Finally, an age-friendly work environment, such a more flexible employment term and retirement age and more support in using assisted devices in workplace, is essential for the future of aging societies. Unless we can attract a very large number of older people to remain in the workforce, many societies will face severe labor shortage.

### **Conclusion**

Population aging creates pressing needs that drive social policies. The diverse responses to address these needs reflect the unique strengths and challenges of different societies. These may include different rates of population aging, levels of economic development and wealth, maturity of health and LTC infrastructure, and availability of human resources and dependency ratio. With reference to these previous responses, a new generation of social policies for population aging can be designed, with innovations that turn challenges into opportunities. The interrelatedness and synergetic effects of the four major social policy issues outlined in this entry is an area to be further explored.

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## Social Resources and Centenarians

Alex J. Bishop<sup>1</sup> and G. Kevin Randall<sup>2</sup>

<sup>1</sup>Human Development and Family Science Department, Oklahoma State University, Stillwater, OK, USA

<sup>2</sup>Human Sciences Extension and Outreach, Partnerships in Prevention Science Institute, Iowa State University, Ames, IA, USA

## Synonyms

Affect; Centenarians; Culture; Emotional regulation; Social support

## Definition

Social resources are characterized by structural (social network availability, culture) and functional (instrumental support, emotional support) attributes originating from social interaction and interpersonal engagement. The interplay between structural and functional characteristics in social resources is vital to positive adaptation and

long-term survivorship in human aging. Specifically, social resources contribute to the sustainability of individual health, emotional regulation, positive psychological disposition, and quality-of-life among long-lived adults.

### **Social Support Ties and Centenarians**

Although social resources increase the probability of living long, they often present a quandary for persons living 100 years or longer. Survivorship beyond the expected normative limits of human life expectancy is generally accompanied by co-occurring and simultaneous declines in biological potentials including but not limited to impaired cognitive orientation to time, space, and place; short- and long-term memory deficits; reduced sensory acuity in vision and hearing; poor functional mobility; and diminished performance in everyday decision-making and activities of living (Poon et al. 2010). The acceleration of age-associated losses in human biology experienced by persons living extremely long lives contributes to an increased dependence on sociocultural provisions to manage and sustain individual functioning and well-being (Poon et al. 2010; MacDonald 2007). Paradoxically, researchers commonly assume that most centenarians have outlived the majority if not all of their close immediate familial attachments, as well as other familiar but informal sources of support (e.g., friends, neighbors; Poon et al. 2010; MacDonald 2007). This limited support network of family, friends, neighbors, and others puts centenarians at a unique social disadvantage in terms of both a diminished social functioning and quality of life compared to younger age cohorts (Poon et al. 2010; MacDonald 2007). In some cases, centenarians may have an increased concern about dependency and whether they may have an adequate supply of social provisions to meet their personal needs (Poon et al. 2010). As a result, contemporary centenarian researchers have pursued three primary areas of scientific inquiry pertaining to social resource provisions among persons living 100 or more years: (a) where centenarians live and from whom they

receive social support, (b) the associated link between social resources and functional health in extreme longevity, and (c) the interplay between social resources and experiential and evaluative attributes of emotional well-being.

### **Living Arrangement and Social Resources**

Recently, centenarian researchers have begun to consider the structural conditions of social resources and in particular the comparative examination of interpersonal living arrangements among centenarians. A primary focus of this work has involved identification of where and with whom centenarians may reside, as well as what types of resource provisions centenarians receive from their social network affiliations. Results of this focus include the identification of noticeable sociocultural differences where centenarians may live and from whom they may receive sources of care. For example, the care of old and very old adults in the United States conforms to a Western cultural tradition of filial obligation (Blieszner and Hilkevitch-Bedford 2009). This implies a sense of social duty as well as obligatory ethical practices by blood-related offspring or a legally designated third party (e.g., legal guardian, long-term care/medical institution) to manage and provide social resources for society's older members. Relative to the care of long-lived adults, social provisions are exchanged to sustain a shared sense of autonomy and well-being for both care recipient and care provider (Blieszner and Hilkevitch-Bedford 2009). According to the U.S. Census Bureau (2012), this generally translates into a continuum of support relative to where centenarian men and women reside: (a) alone and independently at home without the presence of assistance others within the household (33.3% of centenarian men vs. 34.0% of centenarian women); (b) independently but with family members or others in the household who may provide unpaid or paid 24-h assistance with basic activities of daily living (43.5% of centenarian men vs. 28.5% of centenarian women); (c) under 24-h direct medical supervision within formalized

long-term care setting (18.2% of centenarian men vs. 35.2% of centenarian women). This appears to confirm that centenarian men in the United States tend to live more often with various family members (e.g., son/daughter, grandson/granddaughter, niece/nephew) and therefore receive more family-based support in the maintenance of everyday social functioning (e.g., mobility, cooking, financial management); whereas centenarian women more likely require more formalized and long-term socioenvironmental provisions (e.g., Medicare/Social Security, nursing and medical care).

Investigators from the Georgia Centenarian Study (GCS) studied social resource differences among centenarians residing in private homes, assisted-living facilities, and nursing homes (Randall et al. 2011). Evidence from the GCS suggests that centenarians residing in nursing homes tend to report lower self-reported social provisions overall compared to their counterparts residing in private homes or assisted-living centers (Randall et al. 2011). This finding appears to persist even for those centenarians who have larger social networks. Although quality of life may be enhanced by interacting with social network members, centenarians living in nursing homes may find it intrusive or even tiring when numerous people come to visit and interact (Cho et al. 2012). Nonetheless, social resources remain essential in improving the degree to which centenarians feel prepared to face everyday life challenges (Randall et al. 2011; Cho et al. 2012). In most cases, centenarians who possess high-quality social ties feel more capable of handling life circumstances regardless of current residential status (e.g., at home, in an assisted-living facility, or nursing home).

Among centenarians living in the United States, those originating from other countries are more likely to coreside at home with others. This appears to be very predominant among centenarians representing Asian countries such as China, Taiwan, and Japan (U.S. Census Bureau 2012). For example, an estimated 61.4% of Asian-American centenarians reside with others in the household compared to only 26.4% of White-Caucasian and 47.8% of African-American centenarians. A majority of social provisions

reciprocated in the care of a centenarian are generally initiated by an adult child or grandchild (Yang 2013). This appears to reaffirm an Eastern cultural philosophy known as filial piety or the act of good conduct and care toward one's parents, elders, and ancestors (U.S. Census Bureau 2012). This is a cultural tradition across many Asian cultures. Traditionally, it is the duty of a male heir to behave out of respect and love while pursuing acquisition of material means to be used in care and support of one's parents or elders (U.S. Census Bureau 2012). Such conditional lifestyle factors contribute to a greater number of centenarians living at home regardless of whether they may or may not need to use public welfare provisions to support normative activities of daily living (Yang 2013). Most interesting is the fact that centenarians do not view their need for support as a burden that increases with continued survivorship (Yi et al. 2008; Wong et al. 2014). Yet, family care providers of centenarians seem to exhibit similar self-reported feelings of burden, symptoms of depression, health problems, and energy compared to noncentenarian care providers (Yang 2013; Yi et al. 2008; Buetner 2008). In effect, family caregivers of centenarians are not immune to caregiving stressors that may eventually compromise one's own need for social resource functioning (Yang 2013).

Characteristics of filial piety have been reported to persist within the social networks of individuals living 100 years and longer in Japan. Investigators have cited evidence that Japanese centenarians commonly endorse a sense of shared history, death/grief, and life domains such as lifestyle habits and work within collectively tight-knit and age-homogeneous groups (Martin et al. 2013). Centenarians on the island of Okinawa, Japan, are most noted as maintaining membership within small collective social network groups known as "moai." Moai typically consist of a shared social network of centenarians who attend to the social needs of other centenarians (Martin et al. 2013). This reflects a reciprocated social system in which elders support and care for other elders. In many instances, moai include a lifelong group of centenarian friends who often coreside together or within very close proximity

(Martin et al. 2013). Moai serve as a “social safety net” in the exchange of social capital (e.g., guidance, physical care, financial assistance, dietary wellness) within everyday social interactions between companions (Martin et al. 2013). In effect, social resource quality appears to be essential in the continued well-being of Okinawan centenarians.

### **Social Resource-Health Functioning Link**

In addition to investigating social living arrangements and underlying resource needs of centenarians, investigations have attempted to clarify the empirical link between social resources and functional health capacity. A majority of reported findings surrounding association has come from the Georgia Centenarian Study (GCS) in the United States. Of key interest has been the determination of how social resources are associated with the performance of activities of daily living by centenarians. Investigators from the GCS have reported negative changes in the performance of activities of daily living (ADL) and social resource provisions to be significantly greater among centenarians compared to persons in their 60s and 80s (Poon et al. 2010; MacDonald 2007). This contributes to a deficiency of age and functioning well at 100 years of age and older. As centenarians experience noticeable declines in their ability to complete everyday instrumental tasks in living (e.g., using the phone, meal preparation, shopping, handling money), an ever-shrinking social support network erodes opportunity to maintain frequent contact with social resource ties that commonly provide assistance (Poon et al. 2010; MacDonald 2007). Among centenarian participants within the GCS, social resources significantly moderate the performance of instrumental tasks in everyday life. Centenarians may initially possess greater social resources, but they continue to experience steeper declines in their functional capacity to perform instrumental tasks over time compared to younger age cohorts (Poon et al. 2010; Randall et al. 2011; Cho et al. 2012). Unlike younger age-groups, centenarians experience increasing reductions in ADL performance

which translates into a simultaneous need for greater social assistance in meeting daily living tasks (Poon et al. 2010; MacDonald 2007). Investigators from the GCS have also extended confirmation of these findings to include the perspective of proxy informants (Buetner 2008). In particular, caregiver reports indicated that centenarians, especially those living independently at home, tend to be in better overall physical health and therefore more likely to effectively perform daily tasks of living on their own (Buetner 2008). Yet, centenarians who receive encouragement from members of a caregiver support system are more likely to attempt performing activities of living, despite experiencing age-associated limitations (Buetner 2008). Thus, the support received from caregivers is an essential social resource and determinant in the functional well-being of centenarians.

Beyond the United States, international-based research efforts have given primacy to understanding the associated link between social resources and physical health functioning among centenarians. There has been some minor global debate whether social resources are essential determinants of health functioning among centenarians. Researchers with the Japanese Centenarian Study conducted a nationwide census-based study ( $N = 1,907$  centenarians; (Ozaki et al. 2007)). Within this sample, approximately 10.4% of centenarians were regarded as “autonomous centenarians (Ozaki et al. 2007).” Such centenarians maintain a strong cognitive reserve and numerous other alternative psychosocial resources (e.g., cognition, diet, exercise, lifestyle habits) that play an essential role in health functioning. Relative to social resources, Japanese centenarians who remain self-sufficient in the performance of daily activities of living tend to view the status of their family relations more favorably than relationships with friends or other nonrelatives (Ozaki et al. 2007). Furthermore, Japanese centenarians who reside alone at home with family are more likely to maintain better cognitive ability and overall functional capacity than their counterparts who may reside within hospital or institutional care settings (Ozaki et al. 2007). Family relations are believed to bolster autonomy

among centenarians to the point of eliminating dependence on nonfamilial supports for health-related assistance in everyday life activities (Ozaki et al. 2007). It may be that the ability to demonstrate competence in completing everyday activities by one's self and without feeling dependent on others external to one's family is a valuable resource for some centenarians.

The issue of autonomy versus dependency as social determinants of centenarian health functioning has also been further explored by a group of Korean researchers (Kim et al. 2012). In this investigation ( $N = 796$  Korean centenarians), social connectedness and activity at 100 years of age and older were identified as essential attributes in reducing the presence of disease and lowering the need for assistance in everyday activities of living (Kim et al. 2012). These findings suggest that social provisions improve health functioning among centenarians. Thus, a case may be made that social resources are valuable to healthy longevity for many centenarians. Still, there are some centenarians whose health seems to fare better without help from others (Poon et al. 2010; MacDonald 2007; Kim et al. 2012). Further clarification of this paradox in the social resource-health functioning of centenarians link is warranted and an opportunity for future investigations.

### Socioemotional Resources of Well-Being

A final area of empirical interest in centenarian research involved socioemotional resources of well-being. A majority of this research focused on understanding how social resources operated in tandem with experiential (e.g., positive and negative affect, loneliness, happiness) and evaluative (e.g., life satisfaction, quality of life) attributes of well-being (Poon et al. 2010). For example, Martin et al. (1997) conducted an earlier cross-cultural comparison of loneliness in centenarian samples representing two countries, Sweden and the United States. Contrasting culture differences in social support and loneliness were evident across the two samples. Among centenarians in Sweden, reported feelings of loneliness

were increased by the presence of greater social resources. Martin et al. (1997) speculated that this counterintuitive finding was likely due to the provision of social support which heightens individual awareness of social losses, and thereby increases emotional longing for close attachment ties which the centenarian has outlived. However, centenarians in the United States indicated feeling more lonely in the absence of supportive resources (Martin et al. 1997). Among other European centenarian studies, such as those in the Heidelberg Centenarian Study, there is supportive evidence that self-reliant beliefs may regulate the extent to which basic social capital (e.g., social support, job training, and extraversion) increase or decrease socioemotional affective outcomes. According to Jopp and Rott (2006), centenarians generally remain resilient to reduced resources that would otherwise produce negative affective outcomes. This is mostly due to proper self-regulation in adapting to loss (Jopp and Rott 2006). Yet, it is important to remember that poor socioemotional regulation can contribute to underlying symptoms of anxiety and depression, which can potentially hinder positive adaptation and overall quality of life (Poon et al. 2010; Riberiro et al. 2014). Further investigation into the interplay between social resource deficiencies, psychological adaptation, and socioemotional well-being among centenarians is warranted.

Recent evidence from the Georgia Centenarian Study (GCS) has confirmed that greater social interaction enhances perceived quality of available social resources among centenarians in the United States. The more accessible social resources are perceived to be, the more positive the centenarian feels in terms of their own psychological state (Poon et al. 2010; Randall et al. 2011; Cho et al. 2014; Margrett et al. 2011). Additional empirical evidence suggests that this may be particularly true relative to cognitive perceptions of fatigue, feelings of loneliness, and cognitive-affective appraisals in life (Poon et al. 2010; Cho et al. 2014; Margrett et al. 2011). In particular, centenarians who possess greater social resources have significantly reduced cognitive-affective perceptions associated with feeling mentally exhausted, socially

isolated and lonely, and dissatisfied and unhappy with life (Poon et al. 2010; MacDonald 2007; Cho et al. 2014; Margrett et al. 2011). However, such reported associations between social support and psychological well-being outcomes may be partially explained by the extent to which U.S. centenarians feel they are in good physical health, can foster positive social relationships, or have the ability to independently perform activities of daily living needing assistance (Poon et al. 2010; MacDonald 2007; Randall et al. 2011). Researchers with the Iowa Centenarian Study have reported significant mean-level decreases in positive affect but not negative affect (Martin et al. 2012). Most notably, growth-curve changes in positive affect appear to reflect simultaneous decrements in social assistance, physical health status, and self-reported health functioning over time (Martin et al. 2012). In turn, it appears that any shift from positive to negative emotionality among centenarians over time may be due to co-occurring life events linked to changes in one's biological or social resources.

It should be noted that life history is an often forgotten yet equally important social element of underlying emotional well-being reported by centenarians (Poon et al. 2010). da Rosa et al. (2014) conducted a cross-cultural comparison of U.S. and Japanese centenarians (da Rosa et al. 2014). This examination involved a cross-examination of life event data reported from  $N = 239$  centenarian participants from the Georgia Centenarian Study and  $N = 309$  centenarian participants from the Tokyo Centenarian Study. Results provided valuable insights into overall cultural differences in socioemotional history of centenarians. For example, centenarians in the United States more frequently endorsed positive socioemotional experiences linked to achievement-oriented events commonly interconnected with everyday social living including education/schooling, marriage, and the raising of children (da Rosa et al. 2014). Although Japanese centenarians were somewhat similar in their reporting of these events, da Rosa et al. (2014)

reported that positive social experiences seemed to be counterbalanced by socioculturally shared traumas reflecting human suffering and hardship. Specifically, Japanese centenarians endorsed more cohort-linked sociohistorical events surrounding warfare (e.g., World War II) and natural disaster (e.g., Great Kanto Earthquake of 1923). The endorsement of these traumatic sociohistorical events by Japanese centenarians appears to demonstrate a collective or shared cultural response in coping with human loss and mortality (da Rosa et al. 2014). Initial evidence across various centenarian studies suggests that positive and negative historical events impact the degree to which centenarians achieve contentment and finitude in life (Poon et al. 2010). Future investigation is needed to clarify the extent to which the sociohistorical lives of centenarians act as resource by which socioemotional well-being is derived.

A qualitative study of near-centenarians and centenarians in Hong Kong recently revealed four major themes that best summarize the interplay between social resources and living long and well (Wong et al. 2014). First, it is not the quantity of people in one's life that necessarily count, rather it is the quality of persons by whom one is surrounded that matters most to flourishing. Second, interpersonal connections through social engagement are essential to achieving a sense of meaning and passion in life. Third, social domains (e.g., living arrangement, work) represent valuable sources of comparison by which a long life can be appraised, judged, and accepted. Fourth, the conditions of social life operate as a mechanism by which individuals can deepen a sense of faith and hope in living a better future one day at a time. These four themes seem to reiterate the value and impact of social resources for persons living 100 years of age and beyond. Based on the evidence presented in this summary, there are still many unanswered questions regarding how social resources are maintained, managed, and used by centenarians residing across varying residential environments and sociocultural contexts. Nonetheless, there is no denying that social resources

remain an intricate, yet essential, element of individual functioning and well-being at the extreme upper limits of life.

## Cross-References

- ▶ [Age-Related Positivity Effect and Its Implications for Social and Health Gerontology](#)
- ▶ [Aging and Quality of Life](#)
- ▶ [Cross-Cultural Aging](#)
- ▶ [Grandparenthood and the Changing Nature of Social Relationships](#)
- ▶ [Loneliness and Social Embeddedness in Old Age](#)
- ▶ [Social Cognition and Aging](#)
- ▶ [Strength and Vulnerability Integration](#)

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## Social Support and Aging, Theories of

Kira S. Birditt<sup>1</sup> and Nicky J. Newton<sup>2</sup>

<sup>1</sup>Institute for Social Research, University of Michigan, Ann Arbor, MI, USA

<sup>2</sup>Wilfrid Laurier University, Waterloo, ON, Canada

### Definition

As innately social beings, social relationships are integral to survival and well-being. From the cradle to the grave individuals depend on their social ties for resources and support. Social relationships, although often beginning with maternal attachments, encompass a whole range of people across the life span including family, friends, and peripheral ties. This article begins by defining social relationships; then discusses the current theories and the research with regard to life span changes in relationship quality and the implications of relationships for health and well-being. The article ends with a discussion of directions for future research.

### Positive and Negative Dimensions of Relationships

Across the life span, individuals engage in a whole variety of social relationships from immediate families, to spouses, friends, coworkers, and neighbors. These social ties vary widely in their positive and negative qualities (Rook 2015). Positive aspects of relationships include the support provided, companionship, affection, and social control. Support include instrumental, informational, and emotional support. Instrumental support includes financial and other types of material support as well as errands and sick care. Informational support involves advice. Emotional support involves listening and providing affection. Relationships also provide control or regulation of health behaviors. Negative aspects of social ties include inappropriate support,

unsolicited support, criticism, demands, irritations, and conflict. Ambivalent relationships are defined as those that are simultaneously positive and negative.

### Theories of Social Support

#### Convoy Model

According to the convoy model of social relationships, individuals are surrounded by close social ties across the life course and those ties are sources of support as well as strain (Antonucci et al. 2013). Social ties vary in their quality (e.g., positive and negative), function (e.g., types of support exchanged), and structure (number of network members, contact frequency, geographical proximity). The social ties that surround the individual vary by both personal (e.g., gender, age) and situational factors (e.g., social roles) and those factors as well as the characteristics of close social ties are closely linked with health and well-being. According to the convoy model, the support provided as well as the negative aspects of those ties are more closely linked with well-being than the structure of those ties. Over the life span the convoy is continuous in some ways but changes in others. Young adults have larger networks that tend to be more diverse, that is, with more family and friends, than older adults who tend to have a greater number of family members in their networks. However, older adults with diverse social networks generally report higher well-being; those with restricted or socially isolated networks are associated with the lowest well-being. Social networks also vary by gender. Women generally have larger social networks but also feel more burdened by those network members than men.

#### Socioemotional Selectivity Theory

According to socioemotional selectivity theory (SST; Carstensen et al. 1999), individuals change across the life span in terms of their goals and those goals directly influence their relationships. When individuals are young and perceive time as more limitless, they have more information-focused goals in which they are willing to engage

with a variety of social partners in order to achieve careers and meet romantic partners. As people age and perceive time as more limited, they become motivated by emotion-focused goals and become narrower in the selection of social ties in which to engage. Having emotionally meaningful and poignant connections with people becomes paramount. Studies testing this theory document that the number of close social ties is similar for different age groups, but numbers of casual acquaintances are smaller among older adults. This preference is theorized to be less driven by age and more by temporal perspective; for example, a study examining middle-aged adults with a life-threatening disease found that people with shorter life expectancies had similar social partner preferences to older adults (Charles and Carstensen 2007). Research also reveals that as people age they reduce their interactions with people with whom they feel less emotionally close. Older individuals are also less likely to attend to and remember negative information than are younger individuals, a phenomenon referred to as the positivity effect (Carstensen and Mikels 2005; Mather and Carstensen 2005).

### **The Strength and Vulnerability Integration Model**

The strength and vulnerability integration (SAVI) model emerged from SST. According to the model, as people age they experience increased ability to avoid negative experiences due to improvements in emotion regulation skills (e.g., attention, appraisals, behavior). In turn, avoidance of negative experiences is associated with improvements in well-being. As a result of the ability to avoid negative experiences, older adults report more positive and fewer negative interpersonal experiences. Older adults will look similar to or worse than younger people, however, when they are not able to avoid negative experiences. For example, under circumstances in which older adults experience increased and sustained negative emotion (e.g., when under chronic stress), they have less physiological flexibility to recover and thus experience decreased well-being (Charles 2010).

### **Functional Specificity Theory**

According to the functional specificity theory of relationships (Weiss 1969), relationships are specialized in terms of the functions they serve. There are six different emotional support provisions of relationships, which together help to maintain individuals' well-being. These provisions are: (1) attachment, or an emotional bonding that provides security; (2) reassurance of the individual's worth or value; (3) guidance when it is needed; (4) reliable help and assistance in times of need; (5) a sense of shared values, interests, and companionship; and (6) being needed by another for love and care. This theoretical approach implies that having people in one's social network who together can provide all of these provisions is ultimately more beneficial for one's health and well-being than having a restricted network where only a few of these provisions are represented.

### **Relationship Quality Across the Life Span**

Overall, research suggests that relationships improve in quality as individuals grow older. In general, older people report less negativity in their relationships and they are more likely to use avoidance in response to interpersonal conflict than are younger people. This has been found across relationships with the exception of the spousal tie. For example, in a 12-year longitudinal study, Birditt et al. (2009) found that the parent-child tie and the friend tie decreased in negative relationship quality over time whereas the spousal tie actually increased in negativity when people remained married to the same person. Studies also show that the parent-child relationship often increases in quality after adolescence.

New research is emerging indicating that examining average trajectories does not provide a complete picture of how relationships change over time; for example, spousal ties vary in terms of whether they remain consistently happy or decrease in happiness over time. Couples may experience early marital stressors and these

stressors may lessen only during late middle-age in marriage when the challenges couples face – such as establishing careers and raising a family – have decreased. This suggests that relationship satisfaction increases as children leave home or retirement is reached. For example, studies show that for many women, their relationship satisfaction with their spouse increased as adult children left home, as opposed to the commonly-held belief that many middle-aged parents are faced with an “empty nest” (Gorchoff et al. 2008). The departure of children and imminent retirement may provide opportunities for couples to share leisure time, as well as encourage greater relationship satisfaction.

### Relationship Quality and Gender

Men and women often show different approaches, expectations, and social network quality in all types of relationships, whether with a spouse, friend, or family member. Compared to men, women typically have larger social networks, are thought to have more complex and intimate relationships, and are relied on more often as providers of support. Women tend to be more upset by interpersonal arguments and demands from others whereas men become more upset by work and financial problems (Almeida and Kessler 1998), reflecting societal gender norms of nurturance and intimacy for women, and agency and instrumentality for men (Eagly et al. 2000). In general, men also tend to continue occupying positions of power in societies while women continue to be more responsible for the care of others. These factors lead to differential socialization in the expression of emotions, especially negative ones; for example, among men it is more acceptable to express anger, whereas among women it is more acceptable to express sadness. However, the body of literature concerning gender differences in all types of social relationships presents a complicated picture: although women are more prone to reinforce affiliative social norms in general and to have more positive and emotionally close relations than men, they may also be relatively more demanding, feel more burdened by others' problems, and report more negativity in their relationships (Birditt and Antonucci 2007). A brief

summary of some of the literature concerning gender differences in spousal, friend, and family relationships is provided below.

Arguably, the close relationship that has been most researched in terms of gender differences is the spousal relationship. Extant theory and research suggest that this relationship is an especially close, intimate, and unique source of support, and that – particularly, perhaps, in older age – positive and negative aspects of spousal relationships relate to well-being for both men and women in similar ways (Antonucci et al. 2001). However, the mechanisms required to maintain spousal relationships may differ by gender and change over time. Often, for example, wives are perceived as better providers of support than husbands. In examining this phenomenon in younger couples early in their marriages, Neff and Karney (2005) found that although husbands and wives did not differ in the amount of support they provided each other, they differed in when they provided support: Wives tended to provide better support on days that their husbands experienced greater stress, but when wives experienced greater stress, husbands displayed both support and negativity. However, in older couples (in their 70s, on average), researchers have found fewer gender differences in either negative or positive quality in relationships with spouses (Antonucci et al. 2002).

How husbands and wives react to stress, either within the context of negative marital quality or in general, can also differ. Husbands may be more likely to react physiologically than emotionally, given their propensity to internalize their emotions in the marital context. In contrast, wives may be more visibly reactive to marital stress than husbands, due to their greater relational orientation and investment. For instance, wives tend to use more destructive conflict and demand strategies whereas husbands are more likely to report constructive and withdrawal strategies. This demand/withdraw pattern of marital conflict states that the demander is usually the woman, who pressures the other through emotional requests, criticism, and complaints, and the withdrawer, usually the man, retreats through defensiveness and passive inaction. Some research has found

that, although women are no more demanding, men are more likely to withdraw, such that the wife-demand/husband-withdraw interaction is more likely than husband-demand/wife-withdraw interaction, especially when discussing a change the wife wanted (Christensen and Heavey 1990). Adding complexity to gender differences in negative spousal relationships is the idea that, at least in midlife, this relationship can be a particularly important source of support among people without best friends, who are more likely to be men (Birditt and Antonucci 2007). In addition, women are more likely to report low quality relationships, or express disappointments in relationships.

Friends are an important source of social support, often sharing an accumulation of experiences and often originating from the same historical cohort. Women typically have larger social networks than men, and they tend to seek supportive interactions with other social network members when key sources of support, such as a spouse, fail to provide it. For example, women may be more likely to express their feelings of being let down and how their husbands get on their nerves to close friends. In research on married adults aged 60–91 who also had a best friend, women with friends in whom they could confide were more satisfied with life compared with women without a confidant, whereas men who confided in a friend were less satisfied with life than men who did not (Antonucci et al. 2001). In contrast, women with a best friend who got on their nerves also exhibited higher life satisfaction, whereas men in the same situation exhibited lower life satisfaction, indicating that women and men view friendships in very different ways.

Indeed, the extent to which men and women self-disclose in friendships also differs: Married women often tend to disclose as much to close friends as they do to a spouse, whereas married men do not. Gender differences in relationships with friends seem to be stable across the adult life span, although friends may become an even greater source of social support for women who tend to outlive their spouses. In research examining older adults (mean age = 73), women frequently had higher expectations of friends than men, and placed a greater emphasis on intimacy,

whereas men's friendships often focused more on shared activities (Felmlee and Muraco 2009).

Consistent with gender norms of nurturance, women are more involved in adult child–parent relationships (Lye 1996). Adult child–mother relationships are closer than adult child–father relationships, particularly for daughters, although older mothers also confide in their daughters more than their sons. Additionally, older mothers may also prefer to rely on their daughters for both instrumental and emotional support. Again, however, this relationship is a complicated one: Although women report feeling closer to their children, they also report feeling both more positive and more negative about them (Antonucci et al. 2011).

### Relationships and Health/Well-Being

Overall, a great deal of research has shown that relationships are important for psychological well-being, health, and a longer life span (Thoits 2011; Uchino 2004). In general, negative aspects of relationships are more highly associated with well-being and health than are the positive aspects of relationships. Relationships also buffer the effects of stress on health and well-being.

The literature with response to the two closest relationships people often report having, the spousal tie and the parent–child tie is reviewed below. Married people report better physical health, live longer, and are less distressed than unmarried individuals. Better quality marriages are associated with fewer psychological and physical health problems and greater life satisfaction and, in general, married individuals in middle age and older adulthood report better overall health than those who are unmarried. Destructive conflict behaviors (e.g., yelling, insults) in response to marital conflict are associated with increased blood pressure and endocrine changes. Greater physiological reactivity in the laboratory predicts divorce and lower marital satisfaction 10 years later. Daily diary research has revealed links between couples' interactions (e.g., intimacy, affection, communication) and self-reported well-being, cortisol, and DHEA-S levels. Marital quality is also associated with cardiovascular health. In a meta-analysis assessing the relationship between

marital quality and health, Robles, Slatcher, Trombello, and McGinn (Robles et al. 2014) found that marital dissatisfaction was consistently related to structural indicators of cardiovascular disease as well as functional indicators, including blood pressure.

Researchers still debate whether there are gender differences in the link between relationship quality and health, often finding that men are more physiologically reactive than women to marital conflict. However, more recent research indicates that there are few gender differences in the link between marital relationship quality and physical health (Robles et al. 2014). In a recent study, Birditt and colleagues conducted an examination of marital couples (Birditt et al. 2015) and found that there were interesting dyadic effects of negative marital quality and stress such that husbands had higher blood pressure when wives were more stressed, although the reverse was not evident. These associations were greater when husbands reported more negative feelings about the relationship. Thus, when examining married couples there may be more evidence of gender differences because the gender differences are within rather than between couples.

The parent–child tie has significant effects on well-being and health. Parents report greater well-being when their children provide them with emotional support or affection and when they report greater positive quality relationships with children. Parents also reported fewer depressive symptoms when children relied on them for tangible support. Thus it appears that parents benefit from both receiving and giving support to their children. Additionally, parents' well-being appears to be affected by their perceptions of how well their children are doing in their lives: parents whose adult children have more problems report lower well-being whereas parents who report that their children are well-adjusted (e.g., happier, satisfied with their lives) have greater levels of well-being.

Studies have also assessed associations between parental ambivalence and parental well-being. Parents who report greater ambivalence (i.e., high positive and negative relationship quality) report greater depression. Lowenstein

(Lowenstein 2007) examined mothers and fathers aged 75 and older in England, Norway, Germany, Spain, and Israel to determine whether their feelings of ambivalence, solidarity, and conflict predicted quality of life. In all countries, ambivalence predicted lower quality of life, whereas solidarity predicted greater quality of life. Additionally, solidarity had a greater impact on quality of life than ambivalence.

Parent–child relationship quality also influences adult children's well-being. Adult children who reported lower parental support as children also reported greater depressive symptoms and chronic illnesses in adulthood. Less support from mothers and greater strain with mothers and fathers were associated with greater psychological distress among adult children. It is important to note, of course, that these studies are cross-sectional. Children who report lower well-being may be more likely to view their parents in a negative light and remember their childhood experiences as having been more negative.

Other studies have examined the associations between parent–child relationship quality and well-being for both generations simultaneously. Fingerman et al. (2008) assessed the associations between ambivalence and well-being among parents and offspring and found that ambivalence predicted lower psychological well-being among mothers, fathers, and offspring. Overall, it appears that relationships have important influences on physical and psychological well-being. More research is needed, however, on the longitudinal effects of the relationship on well-being.

## Future Research Directions

There are several directions that future research should pursue in the field of social relationships, aging, and health. For example, studies need to examine more deeply how relationships change over time as people grow older; current longitudinal studies of social relationships do not have several waves and are not lifelong in nature. The present literature also often includes one individual's perception of relationships, and it is clear from the marital and parent–child literature that

it is important to include multiple perspectives because individuals in the same relationship may not agree or have distinct perspectives on the same tie. Widening the focus on gender differences in the perception of relationship quality would be useful. For example, examining how men and women approach long-term friend or family relationships over time, particularly in nongender-matched relationships, such as male–female friendships. Additionally, more research needs to examine multiple social ties in the same study because social ties may interact in unique ways to influence well-being. Further, although there have been advances in the examination of biological systems that account for links between social ties and health, they have primarily been used in the study of the marital relationships. Further studies need to examine the influence of multiple social ties on biological indicators of health in order to understand how relationships, and perhaps particularly relationship qualities, “get under the skin” to influence health and well-being.

## Conclusion

In sum, social relationships vary widely in their supportive as well as positive and negative qualities. The negative and positive dimensions of relationships have important implications for health and well-being across the life span. Theories of social support suggest that although relationships change across the life span they become increasingly salient for well-being as individuals grow older.

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## Socioemotional Selectivity Theory

Tammy English<sup>1</sup> and Laura L. Carstensen<sup>2</sup>

<sup>1</sup>Washington University in St. Louis, St. Louis, MO, USA

<sup>2</sup>Department of Psychology, Stanford University, Stanford, CA, USA

### Definition

Socioemotional selectivity theory is a life-span theory of motivation that posits age differences in goals result from shrinking time horizons. When time is perceived as expansive, individuals will prioritize information-focused goals. When time is perceived as limited, individuals will prioritize emotion-related goals.

### Overview

Socioemotional selectivity theory (SST) is a life-span theory of motivation grounded in the uniquely human ability to monitor time.

In particular, the theory posits that age differences in goals result from shrinking time horizons. Goals influence social preferences and the composition of social networks. Because goals also direct cognitive processing, SST postulates that attention, memory, decision-making, and emotional experience are influenced fundamentally by the perception of time. Unlike most developmental theories of adulthood, which place primary emphasis on past experience, SST considers ways in which perceptions of the future change motivation. Indeed, in some ways, SST is not a developmental theory at all but rather a social psychological theory about perceived time and goals. SST maintains, for example, that younger people who face endings through terminal illness, wars, or other more benign endings, such as geographical relocation, display similar changes in motivation.

According to the theory, temporal horizons direct two overarching sets of goals that govern much of human social behavior. One set of goals concerns the acquisition of knowledge; another concerns the regulation of emotional states. Both sets of goals activate behavior across the life-span, but the relative importance and priority placed on them varies as a function of time horizons. The emphasis on a mechanism of perceived time, which can be cleanly separated from age as well as subjected to experimental manipulation, affords SST an unusual strength among developmental theories. SST is falsifiable. That is, the postulates of this theory can be tested and evidence can be gathered that either supports or fails to support its predictions.

SST is based on the idea that goals are set in temporal contexts, such that individuals focus their energy on goals that are feasible to pursue given the time they have available. When time is perceived as expansive, SST posits that individuals will prioritize information-focused goals. Under these conditions, people allocate their resources in a way that will help them prepare for the nebulous far-off future. Time is spent exploring the environment and gathering all manner of information in case it may be useful down the road. Individuals who perceive the future as long will invest in emotionally taxing activities if

the experience may allow for new learning or future opportunities. When the future is constrained and time is perceived as limited, emotion-related goals grow in importance. Under such temporal conditions, individuals prioritize emotional satisfaction over exploration and gathering information. People are motivated to invest in emotionally meaningful experiences that will provide more immediate payoffs. They spend time engaging in activities that make them feel good and savoring the positive aspects of life.

## History

The first publication describing SST appeared in 1991 in the *Annual Review of Gerontology and Geriatrics* (Carstensen 1991) and was later elaborated in the 1993 volume of the *Nebraska Symposium on Motivation* (Carstensen 1993). In 1999, the *American Psychologist* published an overview of the theory in an article titled, “Taking Time Seriously in Life-span Development” (Carstensen et al. 1999). An essay describing the theory was published in *Science* in 2006 (Carstensen 2006).

In its original formulation, the theory was offered to provide an account of the purported “paradox of aging,” a term coined to refer to high levels of emotional satisfaction despite age-related losses. In this formulation, the theory focused on goals as instantiated in social preferences. As evidence accrued and new hypotheses were put to test, SST was applied to emotional experience and later to cognitive processing.

## Social Preferences and Relationships

According to socioemotional selectivity theory, as temporal horizons shrink, people live in the present. They shift attention away from the long-term future and prioritize the most important aspects of life. For most people, this prioritizes close relationships and emotionally meaningful interactions. As a result, the composition of social networks changes, as do social interactions, such that individuals choose to spend more of their time

with close others as time horizons diminish. Initially, the fact that social networks get smaller as people age led to concern about older adults being lonely and depressed. Subsequent research, however, revealed that this change in social networks reflects a proactive pruning process whereby older adults increasingly invest their limited time in relationships with close others (Lang and Carstensen 2002). That is, older adults maintain their most meaningful, core relationships and let go of less satisfying, peripheral social partners. Similarly, when asked to imagine they have a half hour of free time, older adults prefer to spend time with a close social partner rather than a novel one, whereas younger adults do not show this preference. Moreover, relationship quality improves over time with children, spouses, and other meaningful partners, presumably a reflection of both experience and motivation.

Reasoning from SST, these age differences in social interaction are due to changes in time horizons. Older adults have relatively shorter time horizons (because they have less time left in life), so they prefer spending time with close others who provide a sense of emotional meaning. If time is limited for younger adults, they too would be expected to show a preference for emotionally meaningful partners, theoretically because they would then prioritize emotional goals over information-focused goals. Similarly, if time is expanded for older adults, they would be expected to prefer novel social interactions that have the potential to provide new information or future opportunities.

Several studies have manipulated time perspective to determine whether it changes social preferences, as postulated by SST. One of the first studies to do so found that when younger adults were asked to imagine moving alone across the country, their preferences aligned with those of older adults (Fredrickson and Carstensen 1990). When primed to think about this social ending, younger adults preferred to spend time with family rather than a novel social partner (an acquaintance or author). Artificially expanding time horizons in older adults also eliminates age differences in social partner preferences. When asked to imagine a medical breakthrough that

would allow older people to live an additional 20 years in relatively good health, older adults no longer prefer to spend time with family; in this case, social preferences are indistinguishable from those of younger adults.

Naturally occurring events also shift time horizons, preferences, and goal pursuit. After the terrorist attacks on the USA on September 11th, young adults reported preferring to spend time with family rather than novel social partners, presumably because the fragility of life had been highlighted by these events (Fung and Carstensen 2006). A similar pattern of findings emerged among young adults in Hong Kong in the months before the handover of Hong Kong to the People's Republic of China, when the future of the country was uncertain and the end of an era loomed large. Consistent with SST, a year after the handover, young adults in Hong Kong preferred novel social partners, as they had the year before the handover (Fung et al. 1999). Young adults who have shortened time perspective due to terminal illness also display social preferences similar to older adults. Before there was an effective treatment for HIV, young HIV-positive men who were experiencing symptoms of AIDS were found to conceptualize social partners similar to the elderly (Carstensen and Fredrickson 1998). HIV-positive men who were not yet experiencing symptoms of AIDS appeared similar to middle-age adults, and healthy gay men conceptualized the social world as an age-matched representative sample did.

Time horizons can be constrained by the experience of social endings or endings that represent the culmination of important chapters in one's life (e.g., graduations, births, weddings, moving). According to SST, changes in time perspective have important implications for how individuals choose to spend their time and with whom they will surround themselves. When constraints are placed on time, people focus on emotional goals and enjoying meaningful interactions with close others.

## Emotional Experience and Regulation

SST postulates that focusing on the present and prioritizing emotionally meaningful experiences

will benefit emotional well-being. By the late 1990s, scores of cross-sectional studies had documented superior emotional functioning in older as compared to younger adults. Although one notable exception, Charles et al. (2001), observed improvement in emotional well-being in multiple cohorts over time, there remained concern that cohort differences rather than age accounted for the findings. Carstensen's group undertook an innovative longitudinal study utilizing experience sampling in the late 1990s in order to examine intraindividual change in emotional experience in everyday life (Carstensen et al. 2011). They found an increase in emotional well-being, as well as emotional stability, across a 10-year period. Emotional experience became increasingly positive as individuals grew older. When older people experienced negative emotions, they reported intensities comparable to younger people. The frequency of experiencing negative emotion, however, was significantly lower for older adults.

Emotional life does not simply become more positive with age, but rather it becomes richer and more complex. Older adults are more likely to experience positive and negative emotions at the same time. According to SST, this poignancy arises as a result of the bittersweet moments that occur when time horizons are constrained. Indeed, even young adults experience poignancy in situations where endings are salient. When asked to imagine being in a personally meaningful location for the last time, individuals report mixed emotions (i.e., feeling both happiness and sadness) regardless of their age (Ersner-Hershfield et al. 2008). Similarly, on graduation day, college seniors experience more poignancy when reminded it is the last day they will be a student at that university (i.e., college is ending for them). When time perspective is constrained, individuals focus on emotional meaning, resulting in a more satisfying and rich emotional experience.

## The Positivity Effect and Cognitive Processing

The *positivity effect* was identified in experimental tests of SST. The effect refers to an age-related

preference in attention and memory for positive relative to negative information (Mather and Carstensen 2005). Older adults' tendency to focus more on positive information is thought to reflect cognition operating in the service of emotion-related goals. That is, because goals direct cognitive resources, SST predicts there are age differences in processing emotional information.

Initial work on SST and cognitive processing focused on age differences in preferences for emotional information in general. For instance, it was revealed that older adults are more likely to prefer and remember advertisements framed in terms of emotional meaning (e.g., "capture those special moments") rather than information gain (e.g., "capture the unexplored world"). When asked to imagine a medical advance that would allow them to live an extra 20 years in reasonably good health, however, older and younger adults were comparably likely to prefer the information-focused ads as the emotion-focused ads (Fung and Carstensen 2003). These findings suggest that emotional information is more salient for older adults because they typically have more limited time horizons than do their counterparts.

In subsequent work, researchers began to test the idea that certain types of emotional information may be particularly salient for older adults. Older adults' prioritization of emotional goals may direct their attention to positive information more than negative information. Now referred to as the *positivity effect*, the phenomenon has been documented across a wide range of emotional stimuli, including faces, pictures, words, and music, and in various types of experimental paradigms (Reed et al. 2014). For instance, when presented with pairs of faces, older adults orient more towards happy faces than neutral faces and orient away from sad faces compared to neutral faces. They are also more likely to remember happy faces than sad faces. Younger adults do not show this attentional bias or differential memory for happy versus sad faces. Age differences in processing of emotional information have also been observed at the neural level, whereby older (but not younger) adults show less amygdala activation to negative pictures than positive pictures (Mather et al. 2004). In an important test of SST,

Mather and colleagues examined the role of executive functioning in the positivity effect. If positivity is driven by age-related differences in goals, then positivity should be reduced when older adults have insufficient cognitive resources to direct towards their emotional goals. Indeed, older adults no longer show a disproportionate preference for positive information when cognitive resources are constrained in a dual attention task. There is also less positivity in memory among older adults who perform poorly on cognitive control tasks (Mather and Knight 2005). These findings suggest that the positivity effect reflects a top-down controlled process whereby individuals attend to goal relevant information.

The most recent work on the positivity effect has focused on the impact it may have on health-related behaviors and decision-making. For example, older adults' preference for positive information has been documented in the context of framing health behavior messages (Notthoff and Carstensen 2014). In one study, young and older adults were given pedometers and provided information about walking. Older adults who had been told about the benefits of walking (positive framing) walked more over the ensuing week than did those who had been told about the risks of not walking (negative framing). In contrast, younger adults walked the same amount regardless of the type of information they were provided. In a follow-up study, older adults who were told about the benefits of walking showed an increase of about 1,000 steps per day across 4 weeks, while older adults who were warned about the risks of not walking did not show a significant change in their walking. These findings suggest that promoting health changes in older adults will be better served by highlighting the benefits of engaging in health behaviors rather than focusing on the risks of failing to engage in such behaviors.

Consistent with SST, age-related positivity is not found when older adults are focused on information-related goals, either because it is demanded by experimental tasks or because they are naturally motivated to gather more information in that context. In one study, younger and older adults were asked to imagine they had to choose a new physician and health plan (Löckenhoff and

Carstensen 2007). They were presented with a grid of information that described four different physicians (or health plans) on a number of dimensions. Compared to younger adults, older adults were more likely to focus on positive characteristics when reviewing information and when later recalling features of the different physicians and health plans. These age differences in information processing were eliminated when individuals were told to “focus on the specific facts and details” when reviewing the different options. In this information-focused condition where goals were equated across age groups, younger and older adults showed a similar even-handed review (and recall) of the information they had been presented. A recent study found that positivity is also reduced in contexts where older adults are naturally motivated to focus on information gathering (English and Carstensen 2015). In particular, relatively unhealthy older adults were less likely to show positivity in their review of information when making health-related decisions than were healthier older adults. Importantly, being in poor health was only associated with lower positivity for health-related decisions. When making decisions that were not related to health (e.g., choosing a new car), older adults showed similar levels of positivity regardless of their health status. These findings suggest that personal relevance or importance of the decision can shift goals, and thus, processing of information.

Older adults naturally tend to prioritize emotion-related goals, and therefore, they focus more on positive features in the environment that can enhance their emotional well-being. There are times, however, when older adults instead prioritize knowledge-acquisition. In these situations, SST would predict a redirection of cognitive resources, such that older adults no longer favor positive over negative. The age-related positivity effect only emerges when goals are unconstrained by the context and individuals have the cognitive resources required to pursue their goals.

## Conclusion

For many years, social scientists presumed that old age was a time of loneliness and despair.

As evidence accrued, it became clear that not only are older people less lonely than young people, they suffer lower rates of virtually all mental disorders than their younger counterparts and report greater happiness and satisfaction with their relationships. According to SST, older adults show these improvements in social functioning and psychological well-being because their limited time horizons lead them to prioritize emotional goals. Age is typically a good proxy for time left in life, and it is the perception of time, rather than age per se, that influences goal priorities and, therefore, the allocation of cognitive resources and the behavioral patterns individuals display.

## Cross-References

- ▶ [Age and Time in Geropsychology](#)
- ▶ [Aging and Psychological Well-Being](#)
- ▶ [Aging and Quality of Life](#)
- ▶ [Emotional Development in Old Age](#)
- ▶ [Life Span Developmental Psychology](#)
- ▶ [Motivational Theory of Lifespan Development](#)
- ▶ [Positive Emotion Processing, Theoretical Perspectives](#)
- ▶ [Age-Related Positivity Effect and Its Implications for Social and Health Gerontology](#)
- ▶ [Second Generation Socioemotional Selectivity Theories](#)
- ▶ [Strength and Vulnerability Integration](#)
- ▶ [Time Perception and Aging](#)

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## SONIC Study, A Longitudinal Cohort Study of the Older People as Part of a Centenarian Study

Yasuyuki Gondo<sup>1</sup>, Yukie Masui<sup>2</sup>, Kei Kamide<sup>3</sup>, Kazunori Ikebe<sup>4</sup>, Yasumichi Arai<sup>5</sup> and Tatsuro Ishizaki<sup>2</sup>

<sup>1</sup>Department of Clinical Thanatology and Geriatric Behavioral Science, Osaka University Graduate School of Human Sciences, Suita, Japan

<sup>2</sup>Tokyo Metropolitan Geriatric Hospital and Institute of Gerontology, Tokyo, Japan

<sup>3</sup>Department of Health Science and Department of Geriatric Medicine and Nephrology, Osaka University, Graduate School of Medicine, Suita, Japan

<sup>4</sup>Department of Prosthodontics, Gerodontology and Oral Rehabilitation, Osaka University Graduate School of Dentistry, Suita, Japan

<sup>5</sup>Center for Supercentenarian Research, Keio University, School of Medicine, Tokyo, Japan

### Synonyms

Epidemiological survey; Longitudinal study; Cohort study; Narrow age range design

### Definition

SONIC study is a longitudinal epidemiological survey. The purpose of this study is clarifying age similarity and difference in factors associated to healthy longevity and maintaining higher well-being among different age groups from 70 to 90 years.

### Limitation in Centenarian Studies

The main methodological limitation of centenarian studies is derived from the specificity of their focused age group: “centenarian.” More specifically, even though that collecting data from centenarians are time consuming and highly loaded

work, it is difficult to find clear evidences for longevity factors or psychological and social characteristic of centenarian without setting up control group(s). Comparisons with reference data (population norm or control group(s)) make it possible to highlight specific characteristic of the group of centenarians. However, even in centenarian studies that do use control data, it can be difficult to clarify the characteristics of centenarians by simple comparison, because the true control for centenarian would be individuals of the same cohort who did not survived to 100 years of age. Specifically, cross-sectional comparisons between centenarians and younger controls cannot distinguish aging-related changes or the influence of studied factors on longevity. Overall, these problems make the findings of centenarian studies difficult to generalize.

There are centenarian studies that collect data only from centenarians (Jopp et al. 2016; Gondo et al. 2006; Stathakos et al. 2005; Samuelsson et al. 1997; Motta et al. 2005). In many of these cases, researchers were attempting to describe the characteristics of centenarians in the target population. However, focusing solely on centenarians – in other words, not using younger control data or comparable population norms – precludes understanding centenarians' relative functional status or specific characteristics. This is a fatal disadvantage of centenarian studies, particularly if the researchers are interested in human aging process or factors related to longevity. The average life expectancy and age-specific mortality rates differ substantially across different countries and populations. Therefore, control data from the same population would be needed for each centenarian study to ensure sufficient generalizability of results. Furthermore, this framework is essential if researchers are aiming to compare findings with other centenarian studies.

Despite these limitations, researchers can still perform useful correlational analyses to clarify the relationships among the variables and construct models to predict subjects' physical, emotional, and cognitive functions using only centenarian data (e.g., Jopp et al. 2016). Such studies have a variety of applications, such as identifying the

necessary support needs for centenarians. However, it is still difficult to conclude whether the findings obtained from such studies are unique to the centenarians or are common phenomena among other age groups. We would be unable to make any definitive conclusions regarding these effects without running the same analysis on the control group(s).

It is quite possible that differences in medical, physical, social, and cognitive function will have different influences on psychological state in different age group(s). Recent studies on emotion have indicated the importance of cognitive resources for maintaining well-being in elderly people (Mather 2012; Scheibe and Carstensen 2010); in contrast, oldest old people maintain a higher level of well-being regardless of cognitive decline (Gondo et al. 2013). This phenomenon is also shown in the final part of this entry. To develop theories that resolve such paradoxical phenomena, concurrently collected control data are important. So far, only a few centenarian studies have established control group(s) to overcome the abovementioned problems. For example, Georgia centenarian study has 80 Octogenarians (80–89) and 100 young controls (20–59) as references (Poon et al. 2007).

A second important methodological issue is that even centenarian studies that utilize younger control group(s) or that compare their data with existing norm(s) will be unable to provide a clear picture of centenarians' characteristics if they rely on cross-sectional comparisons. The exceptions to this limitation are certain variables that are static over time, such as birth order or genotype. In such cases, we could interpret the observed finding as a characteristic of longevity even when a comparison is made with an exciting epidemiological data set. For example, centenarians have been repeatedly found to have a higher frequency of the E2 genotype of apolipoprotein E (APOE), which is currently believed to be the strongest genetic factor for longevity in comparison to younger age individuals (Blanché et al. 2001). However, see the argument of accepting this method by Lewis and Brunner (2004).

In contrast to these static variables, psychosocial variables (e.g., well-being or family

membership) and other biological features (e.g., blood albumin or number of teeth) are not stable characteristics; rather, they change with age especially in the oldest old. Accordingly, it would not be possible to determine from the results of direct comparison of these characteristics between controls (e.g., octogenarians) and centenarians whether the observed differences are reflection of the innate characteristics of long-lived individuals or merely indicating the result of aging-related changes.

Centenarian studies seeking to understand longevity-associated personality traits face this problem. Researchers often contrive new ways to obtain precise results, by using a new analysis framework (Martin et al. 2006; Masui et al. 2006) or by developing new designs such as focusing offspring of centenarians (Givens et al. 2009). As an example of the former, Masui et al. calculated expected scores for personality traits at the age of 100 years using accessible data from individuals aged 50–79 years old (Masui et al. 2006). They calculate formulae of aging-related change of personality traits based on the abovementioned middle- to old-aged individual data then estimated personality scores of 100 years old for deceased individuals. Finally, they compared these scores with scores of living centenarians to highlight personality traits associated with longevity. Although this approach is currently considered the best possible way of utilizing cross-sectional data, it still does not avoid the risk of type I error because cross-sectional data tend to overestimate age-related changes. As far as they adopt any cross-sectional design, centenarian studies cannot escape from this limitation.

As an example for the latter, the New England Centenarian Study compared personality traits between offspring of centenarian parents and offspring of non-centenarian parents. They suppose that centenarian offspring share 50% of genetic characteristics with centenarian. This pseudo-case-control design has the advantage of saving time and the findings can be verified by employing the longitudinal follow-ups. Here, the “case” refers to the centenarian candidate (offspring of centenarian) and the control refers to an individual in the same cohort who did not

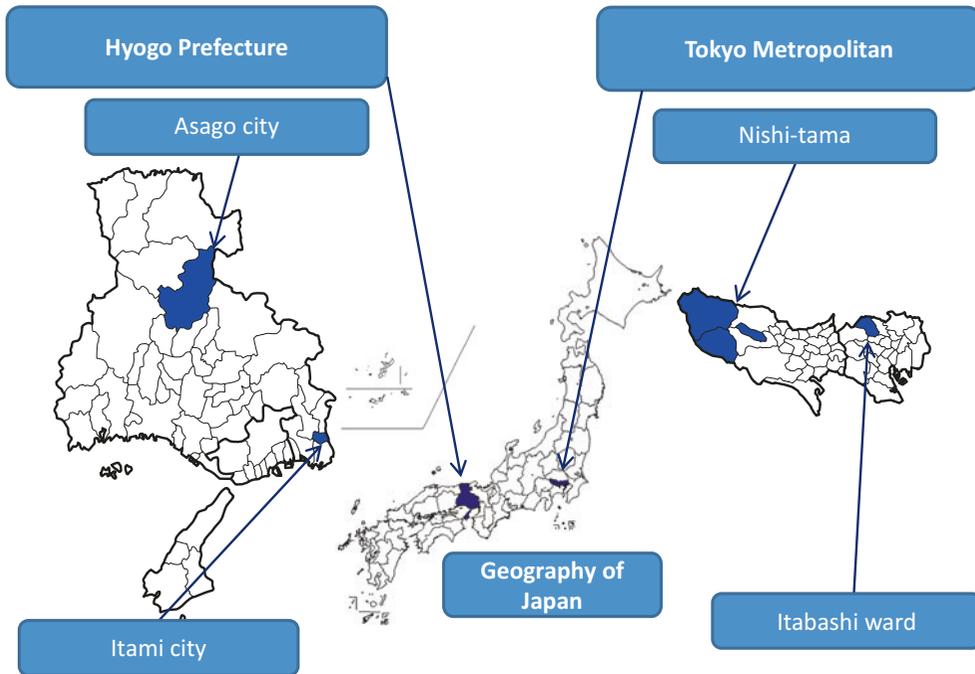
survive to 100 years old (e.g., spouses of centenarian offspring). Ideally, cases and controls should be extracted from existing large-scale longitudinal epidemiological studies that have been accumulating data for a long time. A case-control longitudinal study would also enable researchers to make a more accurate estimation of average aging-related changes in variables for both survivors and non-survivors. This idea was used as reference in designing the SONIC study and will be described in more detail later on.

### Concept of SONIC Study

As mentioned above, a major limitation of centenarian studies is a lack of appropriate control group(s). To overcome this limitation, we conceived SONIC as a longitudinal case-control study as this was considered the best solution for clarifying the characteristics of centenarians, by including a large group of individuals who might survive until 100 years old. The most preferable research design is to follow up the same birth cohort over a long period. This procedure is similar to a sequence of projects using Danish individuals from 1895, 1905, and 1915 birth cohorts (Christensen et al. 2013; Engberg et al. 2008). The authors of those projects asked cohort members to participate in a study at the ages of 90 and 100. Adapting this concept, the SONIC study adopted three methodological considerations.

First, the SONIC study utilizes three control groups of different ages (70s, 80s, and 90s) for a centenarian cohort, which we are planning to run in the future. At the same time, these control groups can serve as controls for other centenarian studies, such as the Tokyo Centenarian Study (Gondo et al. 2006). The first-wave data is available for identifying the genetic characteristics in comparison with centenarian studies and can be used to explore age-group differences/similarities in the factors influencing well-being and other psychological variables.

Second, we are planning to follow up the three control cohorts over a long period and expect that a certain number will become centenarians. This longitudinal portion of the study enables us to run



**SONIC Study, A Longitudinal Cohort Study of the Older People as Part of a Centenarian Study, Fig. 1** Location of four survey regions in Japan

case-control comparisons between centenarians and non-survivors and thereby explore factors influencing longevity. Additionally, longitudinal data would enable precise estimates of aging-related changes in targeted variables for each age group in both deceased and survived individuals.

Third, we used a narrow age-range cohort design (Hofer and Sliwinski 2001). Each cohort includes individuals whose ages fall within a range of 3-years (e.g., 69–71 for a 70-year-old cohort). The main reason for setting up narrow age-range cohorts was to focus more on individual differences in the aging process and health outcomes. When considering individuals of a wide range of ages while focusing on individual differences, we can use chronological age as a covariate to control age differences in variables not at the focus of the analysis. Recent studies however indicated that this method of statistical control might not be appropriate for variables in the medical or biological dimensions. Indeed, inter-individual and intra-individual variability of biomarkers are much greater in higher chronological

age groups, and correlations between chronological and biological age are much smaller than expected (Mather et al. 2011; Sprott 2010). Therefore, in the SONIC study, we utilized the 3-year narrow age range, which is ignorable age difference in each age group.

In addition to these methodological qualities, the diversity of environmental conditions such as main industries (e.g., agriculture in the rural, light and heavy manufacturing in cities), social resources, and infrastructure in survey regions are a notable characteristic of the SONIC study. We selected two subregions (an urban area and a rural area) from major geographic regions (the Tokyo metropolitan area, in eastern Japan, and Hyogo prefecture, in western Japan). In total, we collected data from four separate regions with different social and economic environments (Fig. 1). The Table 1 indicates the names of the city/village and their total populations.

Along with offering control data for other centenarian studies, the SONIC study has two main purposes as an independent study. The first is to

**SONIC Study, A Longitudinal Cohort Study of the Older People as Part of a Centenarian Study, Table 1** Total population, sampled invitee, and participant of SONIC study in each four region

Regions	City/ Rural	Total Population	Aging ratio (%)	70s cohort			80s cohort			90s cohort		
				Sampled	Participated	Participation ratio	Sampled	Participant	Participation ratio	Sampled	Participant	Participation ratio
Itami	City	196,127	20	1,000(471)	250(124)	25.0(26.3)	1,566(653)	317(157)	20.2(24.0)	530(133)	72(29)	13.6(21.8)
Asago	Rural	32,814	30	1,155(547)	243(114)	21.0(20.8)	1,249(524)	195(92)	15.6(17.6)	315(84)	36(22)	11.4(26.2)
Itabashi	City	535,824	21	1,075(510)	239(94)	22.2(18.4)	1,295(507)	269(118)	20.8(23.3)	921(277)	130(54)	14.1(19.5)
Nishi- tama	Rural	164,592	25	1,077(543)	268(147)	24.9(27.1)	1,281(560)	192(90)	15.0(16.1)	208(67)	34(18)	16.3(26.9)
Total		929,357		4,307(2,071)	1,000(479)	23.2(23.1)	5,391(2,244)	973(457)	18.0(20.4)	1,974(561)	272(123)	13.8(21.9)

Note: number shown in parentheses indicate men

clarify aging-related changes in multiple domains of human functioning and the dynamics of interaction among these domains throughout the extreme old age period (from 70 to  $\geq 100$  years). Most previous studies have reported declines in functions with age, but there is no guarantee that aging-related decline is linear. For example, the incidence of diagnosis of arteriosclerosis or dementia incidence appears to increase until at around age 90 years, after which it plateaus (Homma et al. 2001; Miech et al. 2002). However, Corrada et al. (2010) presented contrary evidence for dementia incidence. This phenomenon can be understood in terms of survival effect, namely, that individuals who exhibit progression of arteriosclerosis do not survive to an age of 90 years. However, we do not have enough data to examine such phenomena. In case of arteriosclerosis, we could not conclude whether arteriosclerosis progression in nonagenarians becomes slower and maybe stops at this age or whether individuals with mild atherosclerosis are able to survive their 90th birthday and longer. The longitudinal follow-up of the three narrow age-range cohorts will doubtlessly be able to help answer this type of question.

The second purpose is to identify the factors influencing healthy longevity, including psychological well-being. The target variables were chosen not only from centenarian studies but also from studies of younger elderly participants. Therefore, the SONIC study can examine whether findings from centenarian studies can be replicated in younger elderly individuals and at the same time examine whether younger elderly participants show results that are consistent with those of centenarian studies. Below, we will describe the detailed methodology of the SONIC study.

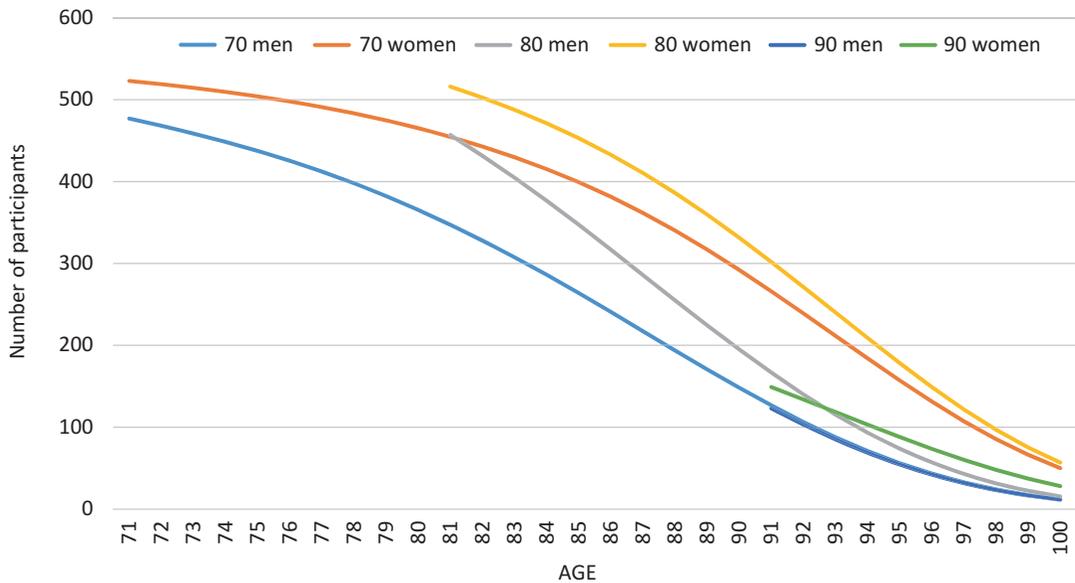
## Overall Design of SONIC

In addition to assessing the three main cohorts, namely, septuagenarian (70s), octogenarian (80s), nonagenarian (90s; details see below), we are planning to collect data from a parallel cohort of centenarians in 2022 with similar methodology as

the three main age cohorts. In that year (i.e., in 2022), the first 90s cohort participants assessed in 2012 will reach 100 years of age. So far, however, we have been conducting only a small centenarian survey in various regions of Japan with different research design and the procedure to improve methods to collect data from centenarians. Therefore, centenarian portion of the SONIC study will not be mentioned in this entry, and we will call the 70s, 80s, and 90s cohorts the SONIC main cohort in the following.

## Sample Size Estimation

Because of the multiple study purposes (description of the aging process and identification of factors influencing healthy longevity) and multidiscipline nature of the variables collected in the SONIC study, it was not possible to calculate which might be an appropriate sample size. Hence, we prioritized maximizing the number of participants expected to survive to 100 years old. At the planning phase, we aimed at have 100 centenarians in each age cohort as endpoint. We calculated the estimated sample size of first-wave participants based on the survival ratio for each age and sex derived from a complete life table of Japan. The results indicated that about 1,600, 1,300, and 700 participants were necessary to obtain 100 centenarians from the 70s, 80s, and 90s cohorts, respectively. However, it was not feasible to collect such a large number of participants with a limited budget. Therefore, we decreased the targeted number of first-wave participants to 1,000 for 70s and 80s cohorts. Consequently, the expected number of centenarians would be between 60 and 70 for these two cohorts. Because we estimated the participation ratio for 70s and 80s cohorts as 25% and 20%, we oversampled the 80s cohort in comparison to the 70s cohort. For the 90s cohort, considering the high ratio of certification for long-term care (in the 90–94 age range, 66.2% had this certification in 2013 in Japan), we invited all individuals among the targeted age range in the four surveyed regions.



**SONIC Study, A Longitudinal Cohort Study of the Older People as Part of a Centenarian Study, Fig. 2** Estimated number of survivors of SONIC participants in the longitudinal phase

We intended to include the same number of participants among regions irrespective of the total populations of each region. Therefore, we restricted the geographical region within which we sent out invitation letters to potential participants living in urban areas. The total population, aging ratio, and the invited and participating individuals in each region are shown in the Table 1. Regardless of the smaller total populations in rural areas, difference in number of older populations between urban and rural areas were quite small, especially in the 90s cohort. The participation rate for men was higher than for women in the 80s and 90s cohorts, but not in the 70s cohort.

The expected survival curves for the first wave of the SONIC study, separated by age group and sex, are shown in Fig. 2. The expected numbers of participants to reach 100 years old for the 70s, 80s, and 90s cohorts are 62, 69, and 39, respectively. Because there were fewer participants in the 90s cohort, we plan to recruit a new cohort of individuals in their 90s when we run the second wave survey for the 90s cohort.

## Procedure

### Recruitment of Participants

The data collection for each age cohort was performed in different years because of the large number of participants recruited. The first-wave survey began in 2010 for the 70s cohort, 2011 for the 80s cohort, and 2012 for the 90s cohort. Second-wave surveys began in 2013 in the same order. We are planning to conduct a follow-up assessment on each cohort every 3 years. As such, third-wave surveys are expected to start in 2016 with the 70s cohort.

All individuals invited to participate in the survey were recruited from residential registries. We obtained names, genders, birth dates, and addresses for individuals in the specific range of birth dates from the local government office. The range of birth dates was slightly different among the four study regions because of the differences in the schedule of creation of the registry database by the local government, allocation of the time slot which we can use to transcribe data at the local government office, and difference in the starting date of recruiting participants in each region.

The SONIC study was designed as an invitation-type survey. We asked invitees to visit survey venues located near their residences. Most of these survey venues were local community centers owned by the local government. The invitation letters sent out to invitees described the purposes of the SONIC study and its methodological details. We asked them to send back an agreement letter, wherein invitees indicated the appropriate date and time of participation if they were interested. About 2 weeks before data collection, we sent reminders to invitees of the place, date, and time of their survey. We also sent a questionnaire booklet comprising items on socioeconomic status, psychosocial variables, medical conditions of self and family, dental conditions, and food intake, which invitees were asked to complete in advance at home and bring to their appointment. In case participants could not fill booklet by themselves or with the help of family member, we asked all questionnaire items at the survey venue.

At the survey venue, participants were given an overview of the SONIC study and signed a consent form before taking part in the performance tests. At this point, participants were asked about their current physical condition, if they had a history of cardiovascular disease, and whether they had undergone hospitalization in the last 6 months. To ensure their safety, we then examined their body temperatures and body oxygen levels. For participants who showed high risks according to these measures, we began the investigation with a medical history (taken by medical staff), which resulted in exclusions for the performance tests. Most individuals with a history of cardiovascular diseases or who complained about pain did not participate in the physical examination.

### Investigated Variables

Participants underwent the following examinations in a random order at the survey venue: a check of the prefilled questionnaire booklet and answering additional questions on psychosocial variables in face-to-face interviews; cognitive tests; interviews regarding work or household work to create a work complexity rating; current

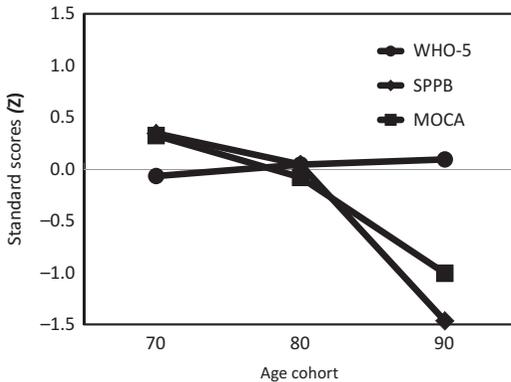
**SONIC Study, A Longitudinal Cohort Study of the Older People as Part of a Centenarian Study, Table 2** Main psycho social variables collected in SONIC study

Psychological variables
Mental health (WHO-5)
Personality (NEO-FFI)
Emotional well-being
Life satisfaction
Valuation of life
Selection, optimization, compensation
Gerotranscendence
Social variables
Social network (direct)
Social network (indirect)
Social support
Other variables
Main occupation and work complexity
Household work complexity
Leisure activities (current)
Leisure activities (within this week)

leisure activity; short physical function tests; medical tests including blood samples, blood pressure, breathing capacities, carotid ultrasonography, and dental checkups including numbers of natural teeth, occlusal force, taste sensitivity, and masticatory performance. The main psychological variables collected in SONIC study are listed in Table 2. In total, examinations took about two and half hours to complete. If participants were unable to finish the tests within this time frame, we asked them to visit the survey venue again or asked if we could visit their homes to complete the questionnaire.

### Preliminary Analysis of SONIC First Wave Data

Although the advantage of SONIC study is the longitudinal part of the data, we can report only on cross-sectional comparisons at present. Here we demonstrate age cohort differences in main variables of physical, cognitive function and well-being. Physical function were accessed by Short Physical Performance Battery (SPPB; Guralnik et al. 1994), cognitive function was accessed by Montreal Cognitive Assessment (MOCA; Nasreddine et al. 2005), and mental health was assessed by WHO-5 well-being index (Awata et al. 2007). Standardized scores for these variables among the three age cohorts are



**SONIC Study, A Longitudinal Cohort Study of the Older People as Part of a Centenarian Study, Fig. 3** Comparison of standardized scores among three age cohorts

presented in Fig. 3. As shown in the figure, physical and cognitive function are lower in the 90s cohort. In contrast to these functional limitation, well-being of 90s cohort was at the same levels as in younger cohorts. As we mentioned in this entry, we cannot conclude that higher well-being in 90s cohort are characteristic of long-lived survivors or reflecting age-related change. This important question will be answered by completion of longitudinal follow-up phase of SONIC study. We believe that clarifying aging-related background factors that cause this type of dissociation must be possible by our case-control longitudinal study. The SONIC study will also allow to test many other important gerontological research questions not mentioned here. Future research progress in a variety of research disciplines is expected.

### Cross-References

- ▶ [Aging and Mental Health in a Longitudinal Study of Elderly Costa Ricans](#)
- ▶ [Australian Longitudinal Study of Aging \(ALSA\)](#)
- ▶ [Australian Longitudinal Study of Women's Health \(ALSWH\)](#)
- ▶ [Berlin Aging Studies \(BASE and BASE-II\)](#)
- ▶ [Canadian Longitudinal Study on Aging, A Platform for Psychogeriatric Research](#)

- ▶ [China Health and Retirement Longitudinal Study \(CHARLS\)](#)
- ▶ [Chinese Longitudinal Healthy Longevity Study](#)
- ▶ [English Longitudinal Study of Aging \(ELSA\)](#)
- ▶ [Health and Retirement Study, A Longitudinal Data Resource for Psychologists](#)
- ▶ [Health, Work, and Retirement Longitudinal Study](#)
- ▶ [Interdisciplinary Longitudinal Study on Adult Development and Aging \(ILSE\)](#)
- ▶ [Irish Longitudinal Study on Ageing \(TILDA\)](#)
- ▶ [Korean Longitudinal Study of Ageing \(KLoSA\): Overview of research design and contents](#)
- ▶ [Longitudinal Aging Study Amsterdam](#)
- ▶ [Melbourne Longitudinal Studies on Health Ageing \(MELSHA\)](#)
- ▶ [Swiss Interdisciplinary Longitudinal Study on the Oldest Old \(SWILSOO\)](#)

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## Spatial Cognition and Wayfinding

Scott D. Moffat

Georgia Institute of Technology, Atlanta, GA, USA

### Synonyms

Navigation; Spatial orientation; Spatial visualization; Visual imagery

### Definition

Spatial cognition is a term often used to refer to varied aspects of cognitive processing. It refers to spatial perception, spatial visualization, visual mental imagery, spatial memory, and spatial navigation. Most psychometric measures of spatial cognition emphasize the mental manipulation of geometric figures or forms. Spatial cognition in the context of wayfinding refers to the ability to

understand your position in the world and to use this knowledge to navigate to desired locations and destinations.

## Introduction

Although, much less studied that some aspects of cognition (e.g., memory) spatial processing has important implications for the lives of older people. For example, Lord and Webster (1990) reported that elderly persons who had fallen in the previous year performed more poorly on a measure of spatial perception, compared to age-matched controls who had not fallen. In addition, we routinely tax our spatial computational skills in daily life when we attempt to find our car in a busy parking lot, travel to an unfamiliar location in a new city, or try to reverse directions to find our way back home. Older adults have self-perceived deficits in navigation and develop behavioral patterns to avoid unfamiliar routes and places (Burns 1999). Assessments of navigational/route-finding skills in older adults provide evidence of age-related differences in these skills. Moreover, impairments in navigational skills (e.g., “wandering”) are often apparent in the early stages of Alzheimer’s disease. The systematic study of spatial cognition has both important theoretical and practical importance in geropsychology.

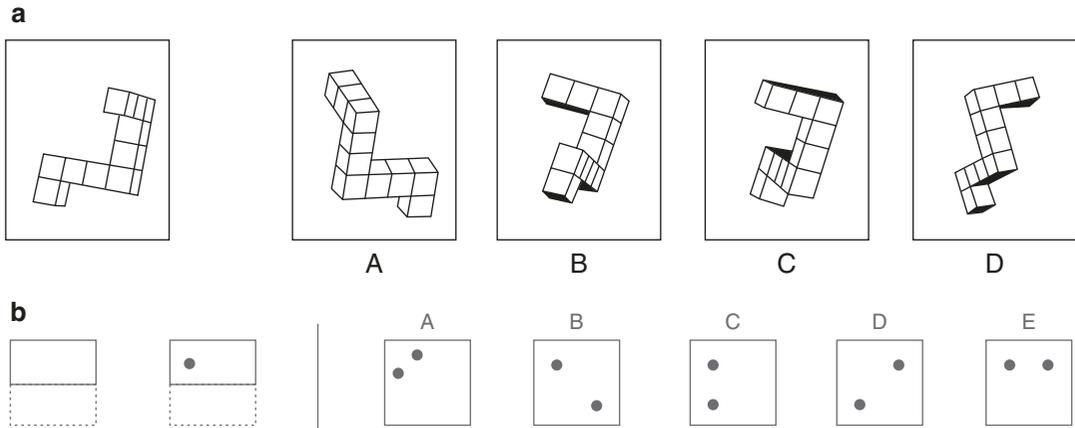
## What Is Spatial Cognition and How Is It Measured?

Spatial cognition is a relatively generic term that refers to a wide variety of cognitive measures sharing as a common feature the reliance on visual as opposed to verbal cognitive processing. Within this general cognitive domain, two traditions of study have emerged. In what I broadly identify as the psychometric approach, spatial cognition is typically measured using laboratory-administered tests involving the manipulation of either physical or imagined objects as stimuli. In a complementary approach, spatial cognition is studied from the ecological perspective of wayfinding or

navigation. The wayfinding and psychometric traditions tend to emphasize different aspects of spatial processing. Psychometric measures tend to be object oriented and static (do not require movement of the observer or the scene) and emphasize spatial manipulations of relatively small objects presented on the printed page (or computer screen). The wayfinding perspective emphasizes a more dynamic processing that takes place over a larger-scale space and tends to emphasize the movement of the whole body through the three-dimensional world (either real or simulated). Another unique aspect of the navigation/wayfinding perspective is that during navigation the whole spatial scene is typically not visible all at once and is encountered piecemeal, which requires integration of spatial scenes and views over time. This feature places demands on spatial working memory and episodic memory for items, landmarks, and cues encountered on a route. In both traditions, there has been robust consideration of individual differences, in particular in relation to sex and age of participants. Interestingly, scientific studies of these domains of spatial processing have tended to occur mostly in parallel with the wayfinding/navigation perspective often being more influenced by models of episodic memory encoding and retrieval than by the literature on object visualization. There is some justification for this parallelism, given that the psychometric and navigation tasks seem intuitively different, are only modestly correlated, and share somewhat different brain mechanisms. For these reasons, this paper will consider each of these aspects of spatial cognition in their own sections.

## Aging and Psychometric Measures of Spatial Cognition

Spatial abilities are typically measured by tests that require the imaginary transformation, rotation, or visualization of everyday objects (e.g., hands, animals) or abstract shapes. Factor analytic studies of psychometric spatial measures have identified multiple spatial dimensions (Ekstrom et al. 1976), including, but not necessarily limited



**Spatial Cognition and Wayfinding, Fig. 1** (a) In the mental rotations test (Vandenberg and Kuse 1978), participants choose the two figures from the four on the *right* that represent rotated versions of the target figure on the *left*. In the paper folding test, a series of drawings depicts a square

piece of paper being folded before a hole (*small circle*) is punched through all folds (**b**, *left* of *vertical line*). The participant must determine the resulting arrangement of holes when the paper is completely unfolded and select this from among the five alternatives (*right* of *vertical line*)

to, the spatial orientation factor best exemplified by mental rotation tests, (See Fig. 1a) and the spatial visualization factor exemplified by, for example, the paper folding test (see Fig. 1b).

There have been several meta-analyses of spatial cognitive performance across the life span and these have shown robust age-related differences in psychometric measures of spatial cognition. Most recently, Techentin et al. (2014) performed a comprehensive meta-analysis of the literature of age-related differences in psychometric measures of spatial cognition. These authors examined 138 effect sizes from 78 published studies. Importantly, they quantified separate estimates of age effects for both spatial orientation and spatial visualization factors and also examined the effects of possible moderator variables. Among the moderators considered were whether the age effects differed as a function of accuracy versus reaction time scoring criteria, sex distribution of the samples, education history, and year of publication (to examine change in effect size over time for secular/cohort effects). This meta-analysis revealed a substantial effect of age on spatial cognitive measures and identified the importance (or lack thereof) of possible moderator variables. Overall, younger adults outperformed older adults by approximately 1.0 standard deviation (SD),

with moderately larger effects when reaction time was used as a dependent measure (1.30 SD) than when accuracy was used as dependent measures (0.95 SD). The large effect size when accuracy was used as an outcome measure argues against a strictly processing speed account of spatial age differences. However, it should be noted that even when accuracy is measured in a study, the test is most often still timed (with a maximum time limit) and older adults may respond differently to speed-accuracy demands than younger adults. In addition, Techentin et al. (2014) found a small positive effect of higher education but no effect of spatial domain (orientation vs. visualization). Moreover, there was no evidence of change in effect size as a function of the publication years considered in the study (1958–2011). This latter finding suggests that the effect size has been robust through several decades of research.

A feature of the age differences observed across studies that must be emphasized here is that the effects are large by conventional effect-size criteria and are also among the largest effect sizes observed in the cognitive aging literature. For example, according to Verhaeghen (2003), the age-related effect sizes for short-term memory is 0.36 SD, 0.52 SD for more complex working

memory, and 0.67 SD for recall of story details. The age difference in spatial cognition is of similar magnitude to that of verbal list learning ( $d = 1.0$ ) and seems to be exceeded only by the larger effects on perceptual speed ( $d = 1.21$ ). It seems noteworthy that the magnitude of the age difference in psychometric measures of spatial cognition is among the largest of the age effects in cognitive aging, although the factors explaining this are poorly understood.

Of course, a meta-analysis can lose certain nuances of differences between studies by emphasizing commonalities rather than unique aspects of research designs. One of the most consistent and interesting findings in the domain of spatial cognition is the linear relationship between the degree of mental rotation and the time required to solve a mental rotation problem. That is, as the degree of misalignment between stimulus and target increases (say between 45 and 135°), the longer it takes a participant to arrive at a “same/different” judgment (Shepard and Metzler 1971). Indeed, this finding is often considered the quintessential evidence that a task requires mental rotation versus some other spatial or nonspatial solution strategy. Moreover, individual differences in the slope of this “mental rotation function” are also said to reflect individual differences in speed or efficiency of rotation. Several studies have investigated the nature and meaning of age differences in mental rotation reaction time slopes and a few are considered here to illustrate the main findings and to highlight some differences in perspective.

Several studies have found that mental rotation intercepts and slopes are greater in older than in younger adults (e.g., Jacewicz and Hartley 1987). Furthermore, steeper slopes in mental rotation tasks are often interpreted as evidence for slowing or reduced efficiency in the rate of mental rotation. That is, an individual with a shallow slope is relatively unaffected by the magnitude of the required rotation and is hence more efficient or faster at rotating. However, mental rotation tasks, like all complex cognitive tasks, are composed of separable components. Although full consideration to the literature on visual imagery is beyond our scope here, Dror and Kosslyn (1994) identify

image generation (generating a stored image from memory), image maintenance (maintaining the image in visuo-spatial working memory), image inspection (analysis of the image in working memory), and image transformation (e.g., mentally rotating the image) as essential components. In addition, post-rotation decision-making processes also play a role.

Hertzog and Rypma (1991) reasoned that age differences in mental rotation rates may not reflect mental rotation speed per se and designed a study to investigate age effects on encoding, rotation, and decision-making during a mental rotation task. Hertzog and Rypma (1991) presented a stimulus and target serially rather than simultaneously, as in most MR tasks in order to isolate the processes of interest. Replicating other studies, the authors found poorer performance by older adults at all three stages but only a weak rotation slope difference between age groups. The authors concluded that age-related differences in mental rotation rates may reflect decay of the stimulus from working memory and post-rotation decision-making processes. This study highlights the utility of considering even seemingly “pure” measures of spatial cognition (e.g., mental rotation) as complex cognitive tasks, the age effects for which may depend on specific and subtle subcomponents.

## Age Differences in Navigation and Wayfinding

As seen above, there is a rich literature concerning the study of age-related differences in psychometric measures of spatial cognition. As noted in the introduction, these measures tend to be object centered and focused on a relatively small spatial scale.

These are important cognitive tasks that assess critical human faculties; however, the psychometric approach may overlook the dynamic nature of spatial cognition as it is utilized on a daily basis by most people. Arguably, the most important manner in which our spatial cognitive systems are challenged is during navigation where we must learn a route to a new goal or locate an object or person in our environment. The most obvious

difference between psychometric and wayfinding approaches is that navigation/wayfinding requires physical movement through space (and concomitant dynamic visual processing) and explicit memory for previously viewed scenes/routes, whereas paper and pencil tests require no movement through space.

There has been a tradition of wayfinding and orienteering studies in humans but these have mostly neglected possible age-related differences. This is partly due to the difficulty of studying human navigation because it takes place over a relatively large-scale space which exceeds what can be accomplished in the laboratory. As well, in the real world, it is difficult to gain experimental control over the features of the environment; there are inevitably between-subject differences in familiarity of the local environment and limitations of older people's physical function may compromise mobility. While some studies have examined older adults' capacities for navigating a large-scale space, this field of inquiry is experiencing something of a resurgence of interest due to the development of a virtual environment technology which has brought the systematic study of large-scale navigation into the laboratory and into the MRI scanner.

### **Age-Related Differences in Navigation and Orienting in the Real World**

There is considerable evidence now for age-related differences in navigational/route-finding skills. One approach to the study of spatial navigation in older people has been to measure navigation in "real-world" settings such as supermarkets, hospitals, or university campuses. Kirasic (1991) assessed the navigational skills of younger and older women in supermarkets and found that younger women acquired the spatial information in the environment faster than did their older counterparts. Wilkniss and colleagues required participants to navigate through the hallways of a hospital after being presented with a map of the environment and route that they were required to follow. They found that older adults took longer to navigate through the hospital than

younger adults and that the older adults made more frequent turning errors. Interestingly, older adults recalled objects which were encountered along the route just as well as younger subjects, but compared to their younger counterparts, they were deficient at placing those objects in their proper temporal sequence (Wilkniss et al. 1997).

An often used measure of place learning in nonhuman species is the Morris water task. Briefly, this task requires an animal to locate a platform which is hidden beneath the surface of an opaque pool of water. Surrounding the pool are visual cues which aid the animal in pinpointing the location of the platform. Over successive trials the animal comes to learn the location of the platform as revealed by faster escape latencies and shorter path lengths to the target. One study has replicated the Morris water task on a human scale by requiring older and younger adults to remove then repeatedly replace a pole in a circular enclosure which was surrounded by visual cues. Across a series of learning trials, older adults showed greater displacement error in replacing the pole compared to younger adults suggesting age-related deficits in place learning in older humans (Newman and Kaszniak 2000). This type of measure is usually described as "place learning" and might be considered similar to locating your car in a parking lot by judging its distance and bearing from environmental cues.

### **Assessing Age-Related Differences in Virtual Navigation**

Navigation in the real world is the most ecologically valid approach to studying navigation. However, as noted above there are difficulties associated with doing so and this has led to many studies now employing virtual environment technology to study age differences in navigation. As in most domains of cognitive aging, the methods are variable but these studies generally consist of computer-presented (or rarely head-mounted) displays depicting a first-person perspective and equipped with an interface device such as a joystick, mouse, and arrow keys to allow movement through the simulated world.

As one could imagine, this itself entails potential pitfalls in the assessment of older adults because they may have limited experience using computers and visual disturbances or may differentially suffer from the elimination of vestibular and proprioceptive feedback that accompanies real-world navigation. Nevertheless, with careful training and appropriate use of visuomotor controls, older people can interact quite effectively with the computer environment (Moffat 2009).

Moffat and Resnick (2002) developed a virtual MWT (vMWT) similar to the one described above. As with the real-world task, the results of the study confirmed substantial age effects on virtual environment place learning. These basic age differences in a virtual MWT have subsequently been replicated and extended by other authors (Driscoll et al. 2005).

In a task more similar to the hospital or supermarket studies listed above, Moffat and colleagues challenged older and younger adults to solve a computer-based route-learning task in which several intersecting corridors ultimately led to a goal point (Moffat et al. 2001). Participants were instructed to find a goal point and remember the route. An important distinction in scoring was made between “information errors” (the first visit to an error location in which the subject had no previous knowledge that a corridor did not lead to the goal) and spatial memory errors (repeat visits to error locations that they should have remembered did not lead to the goal). It was found that older participants made more spatial memory errors but did not make more information errors than their younger counterparts indicating that elderly individuals differed only in their tendency to revisit error locations and not in their initial exploration of the environment.

As noted above, one of the limitations of using VE presentations of navigation tasks is that it deprives the participant of vestibular and proprioceptive feedback that is normally available in real-world navigation tasks. Lovden et al. (2005) investigated the effect of age on spatial navigation through a VE using an interface which required participants to walk on a treadmill to initiate simulated movement through the environment, thus providing proprioceptive feedback. These authors

found that providing walking support on the treadmill attenuated (but did not eliminate) the age differences in navigation accuracy (Lovden et al. 2005).

Another approach to the examination of age differences in navigation has been to quantify the ability of younger and older individuals to spontaneously develop or use a map of the environment. A second component of the study by Moffat et al. (2002) described above required participants to draw a freehand map of the vMWT environment and to designate the platform location on the map. Older individuals showed evidence of impairment in cognitive mapping as revealed by their poorer map constructions of the environment and their impaired ability to locate the platform on the experimenter-provided maps of the environment. Interestingly, there was no age effect on the recall of the object cues present in the environment. Consistent with the results of Wilkniss et al. (1997), older individuals appeared to have comparatively spared object/item memory (at least if the number of objects to be remembered is low) but are deficient at using those objects to assist in navigational behavior.

Sjolinder et al. (2005) provided younger and older participants with an overhead map of an environment to investigate the effects of navigational aids on the age differences. Sjolinder found that although the older participants subjectively felt more secure with the map, it did not improve efficiency in navigating the environment (Sjolinder et al. 2005). Similar results were obtained in another VE study of cognitive mapping which showed that older participants required more time to form a cognitive map of an environment than young individuals and required more time and made more errors when subsequently using the map for orientation (Iaria et al. 2009).

## Brain Mechanisms of Age Differences in Navigation

Behavioral age differences in spatial navigation have been consistent across studies. One major advantage of VE testing is that it makes

navigation tasks adaptable to the MRI scanner environment. Indeed, neuroimaging studies in younger participants have identified a network of structures that are involved in spatial navigation. These structures include the hippocampus, parahippocampal gyrus, parietal cortex, and retrosplenial cortex (Burgess 2008).

The role of the hippocampus and associated medial temporal lobe structures in human navigation have been of considerable interest, in part because of the very precise animal models of spatial navigation that localize “place” and “grid” cells to the hippocampus and entorhinal cortex, respectively (Moser et al. 2008). Likewise, in human aging there has been great interest in the role of the medial temporal structures in mediating age-related navigation impairments.

Three studies have now reported quite consistent results demonstrating reduced or absent hippocampal/parahippocampal activation in older as compared to younger adults during virtual navigation. Meulenbroek et al. (2004) had younger and older participants learn the layout of a virtual house by viewing and remembering a sequence of turns through the house. Compared to older adults, younger subjects showed stronger activations in the supramarginal gyrus and posterior parahippocampal gyrus.

Moffat et al. (2006) investigated the neural mechanisms of age differences in spatial navigation in an fMRI study. Fifty-one healthy individuals (30 young, 21 old) were scanned while performing a VE navigation task. The task differed from the Muelenbroek study in that participants actively navigated through the environment using a joystick, while the participants in the Muelenbroek study passively viewed the navigation task. The results showed that compared to their younger counterparts, older adults showed reduced activation in the posterior hippocampus, parahippocampal gyrus, and retrosplenial cortex. This study also demonstrated that increased activation in the hippocampus/parahippocampal gyrus was associated with more accurate navigation.

Antonova et al. (2009) provide further converging evidence that changes in the parahippocampal cortex may be a major component of the age differences in navigation

performance. As with virtually all navigation studies, these authors report a widespread neural network being activated in young and older adults. In addition, they report that only young adults significantly activated the bilateral hippocampus and left parahippocampal gyrus during encoding.

Of particular importance in these functional imaging studies of navigation and aging is the consistent observation of reduced activation in older adults in the hippocampal/parahippocampal complex and in the retrosplenial cortex of the posterior cingulate gyrus, despite quite different task demands across studies. These areas play a critical role in spatial navigation in both human and nonhuman species (Burgess 2008). In particular the hippocampal/parahippocampal area has been hypothesized to act as a cognitive map receiving egocentric and motion-derived information from other cortical regions and converting this input into an allocentric representation of the environment. This suggests a clear divergence in the neural systems devoted to spatial navigation in younger and older participants. It will be important for future studies to try to understand both the mechanisms and implications of the reduced medial temporal contribution to elderly navigation.

## Do Spatial Strategies Change with Age?

Another dimension on which people differ in solving navigation tasks is in their strategic preferences. Although researchers have described navigation strategies using variable nomenclature, the most common terms are egocentric and allocentric. An egocentric strategy is one in which an individual uses a frame of reference centered on the self, for example, remembering left and right turns relative to your own body. An allocentric strategy is one in which the individual adopts an external frame of reference, for example, by developing a mental map of the environment in which the individual is one object with coordinate relations with other objects in the environment.

One approach to this question of deducing possible strategy differences between older and younger adults was to simply ask participants

how they solved a navigation task. Doing this, Driscoll et al. (2005) recorded spontaneous descriptions of people's own navigation strategies and subsequently coded them as either egocentric or allocentric and found that self-reported allocentric strategy decreased with age.

A more direct way to assess this issue is to perform specific environmental manipulations that may reveal more objectively strategic preferences. In an animal navigation study, rats were trained to locate a goal for a reward in a two-choice T-maze. There were multiple ways in which the rat could learn the location of the reward. One possibility was an egocentric strategy in which the rat always turned left while another possibility was an allocentric strategy in which the rat moved to the same absolute location designated by external room cues. Barnes and colleagues tested this by rotating the maze following training and starting the rats in a different arm. Barnes et al. (1980) showed that older rats were more likely to use an egocentric strategy to solve the maze while younger rats were more likely to use an allocentric strategy.

Rodgers and colleagues performed a very similar manipulation using a virtual two-choice Y-Maze in humans and found an overwhelming preference for the use of an egocentric strategy in older adults (83%) compared to a slight preference for allocentric strategy use in younger adults (54%). Harris and Wolbers (2014) extended these results by noting that in a given navigation task, it is often optimal to switch between strategies flexibly as the task demands change or as you gain more familiarity with an environment. These authors showed that older adults were impaired compared to younger adults specifically in switching from an egocentric to an allocentric strategy, suggesting that aging may also affect the dynamic strategic processing required for successful navigation.

Although no studies have specifically tested brain activation during egocentric versus allocentric processing in older adults, Iaria et al. (2003) showed in a sample of younger participants that while adopting an allocentric strategy, the hippocampus was activated and when adopting an egocentric strategy, activation was primarily in the caudate nucleus. This suggests that the overwhelming preference for egocentric

strategy in older adults may underlie and possibly explain their under-recruitment of the hippocampus and parahippocampal gyrus that has been observed in functional MRI studies.

## Conclusion

Spatial cognition is an important and somewhat understudied aspect of cognitive aging. Nevertheless, important and consistent results have been observed across different labs employing varied study procedures. Psychometric measures of spatial cognition show robust age-related differences with effect sizes among the largest in the cognitive aging literature. There is currently a dearth of studies in this area investigating the possible brain mechanisms of the age differences in mental rotation or spatial visualization.

The study of spatial navigation is having something of a resurgence in cognitive aging as more researchers investigate both the behavioral and brain mechanisms of age differences. Under-recruitment of the hippocampus and related medial temporal lobe structures may underlie the navigation impairment in older individuals. This under-recruitment may be caused by or even interact with age-related changes in navigation strategy preferences. Among the advantages of spatial navigation assessment are its dynamic processing and ecological validity. By its very nature, navigation is an inherently complex cognitive task that depends on widespread brain networks and many component cognitive processes.

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## Spirituality and Religious Participation in Later Life

Holly Nelson-Becker and Kimberly Sangster  
Loyola University School of Social Work,  
Chicago, IL, USA

### Synonyms

Faith; Belief; Creed; Religiousness; Practice of faith, belief, or ritual; Sacred matters; Mystical experience; Immaterial; Holism

### Definitions

As older adults live to increasing ages, spirituality and religious participation form an important

source of meaning and purpose and relate to the ways older people choose to interact with what they deem as sacred. For many older adults, spiritual and religious participation include involvement in traditional world faith communities.

### **Spirituality**

Spiritual awareness develops through relationships with one's inner self, others, nature, the universe, and ultimate reality, whatever a person understands this to be. Spirituality is the manifestation of the search for significance and purpose in life. Spirituality is an integrative, holistic component of life that can touch on physical, cognitive, emotional, and relational aspects. In the human services, spirituality is generally viewed as a larger domain that may or may not encompass religion.

### **Spirituality and Religious Participation in Later Life**

As older adults live to increasing ages, spirituality and religious participation form an important source of meaning and purpose and relate to the ways older people choose to interact with what they deem as sacred. For many older adults, spiritual and religious participation include involvement in traditional world faith communities.

### **Religion**

Religion is an organized system of beliefs, behaviors, rituals, and ethical principles or values shared by a community and transmitted over time. Religion is expressed through cultural lenses and traditions.

### **Spirituality and Religious Affiliation**

Spirituality and most especially religion are of deep value to most older adults. While questions about the importance of religion have appeared in many national surveys, questions about the importance of spirituality are rare. In fact, the term spirituality is often less well understood by older people who as a group endorse religion over spirituality. For them, the meaning of these two concepts may be conflated, with spirituality

viewed as a component of religion, if seen separately at all. Sixty-nine percent of adults in the USA aged 65 years and older report that religion is very important to them; that differs from the 45.7% of those between 18 and 24 years who name religion as very important (Pew Forum on Religion in the Public Life 2008). However, the high rating of importance of religion has trended down by seven percentage points over the decade from 1998 to 2008. Further, 90% of older adults express belief in God (Pew Center: Growing Old in America: Expectations Versus Reality 2009). The fourth most common daily activity performed by older adults (behind talking with friends and family, reading, taking medication, and watching TV) was praying (Pew Forum on Religion in the Public Life 2008). Older adults not only report that religion is important to them but also they integrate public or private religious behavior into their lives. Increasing age has been related to higher levels of religious belief but not to attendance when health is controlled (Wang et al. 2014). Overall, like the rest of the population, older adults, too, report being religious only, spiritual and religious, spiritual only, or neither religious or spiritual. In the literature, these domains are referred to as R/S or S/R. In keeping with this tradition, this entry will use R/S to honor the more frequent use of the term *religious* compared to *spiritual* given by older adults.

Across all age groups, older adults (over 65 years) are the most religiously affiliated group. According to the US Religious Landscape Survey (Pew Forum on Religion in the Public Life 2007), about 84% of those ages 60–69 have stated that they hold membership in Christian religions; an additional 5% have membership in other world religions such as Islam, Hinduism, and Buddhism, bringing the full percentage to about 89 (Pew Forum on Religion in the Public Life 2008). There is a slight increase in these percentages for those over age 70. To a greater extent than the USA, the UK has long hosted a diverse population. This is demonstrated by greater numbers of older adults affiliating with world religions (72% report being Christian) and 15% of the population reporting to be atheist or agnostic (Association for Religion Data Archives: Religious

Adherents 2011). Globally, those who self-identify as part of a religious faith include the following: Christians (31.5%), Muslims (23.2%), unaffiliated (16.3), Hindus (15.0%), Buddhists (7.1%), folk religionists (5.9%), other religions (0.8%), and Jews (0.2%) (Pew Research Center 2012). *Folk religionists* comprise African traditional religions, Chinese folk religion, American Indian religions, and Australian aboriginal religions. The category of *other religions* comprises Baha'is, Jains, Sikhs, Shintoists, Taoists, and many other smaller faith groups (Pew Research Center 2012).

## Descriptions

*Spirituality.* Psychology, social work, counseling, and other helping professions generally distinguish between spirituality and religion as being associated but conceptually distinct. Spirituality is often used as a broader more inclusive term that refers to the search for meaning and purpose. For many people, it is a process of dynamic discovery that unfolds over time with aspects that sometimes advance and other times regress as individuals face or choose not to face their own blockages and fears. Pargament, drawing on the work of Tillich and other theologians, refers to this as “a search for significance, in terms related to the sacred” (p. 32) (Pargament et al. 2013). Although he calls this a definition of religion, it more closely resonates with a spiritual understanding. The consensus conference to develop standards of spiritual care for palliative care suggested, “Spirituality is that aspect of humanity that refers to the way individuals seek and express meaning and purpose, and the way they experience connectedness to the moment, to self, to others, to nature, and to the significant or sacred” (p. 887) (Puchalski et al. 2009).

One of the views carried by a number of people who self-identify as spiritual, including indigenous groups, is that spirituality pervades everything, including inanimate objects such as rocks and stones. Thus everyone has an innate spiritual self whether this is acknowledged or not. Conceptually, the idea of the spiritual may be viewed in several forms: (1) as one aspect of the

biopsychosocial spiritual self, (2) as an inner center or core of the person, or (3) as something beyond everything that has a material/physical essence and transcendent to the self. These are not mutually exclusive ideas. Dependent on culture and worldview, the meaning of spirituality can expand to include presence of deceased loved ones, angels, guides, energies, and other forces (Nelson-Becker and Canda 2008). Connecting to nature for many older people remains a key expression of the spiritual. One older woman living independently reported that what she saw outside her window each morning was “a view of eternity” (Nelson-Becker 2003). The actual vista included a tiny corner of Lake Michigan which she later explained was her connection to spirituality. However, it is also important to note that the term spiritual applied to inner experience is not typically used by many older people (especially those residing in the Western world) who prefer the word religion as the umbrella term for all aspects. This seems to mark a generational difference in discourse between older adults and those born in the 1950s or later (Coleman 2011).

*Religion.* Religion is a marker for the Judeo-Christian social context in which many older people in Western culture were raised, although that is changing. With immigration and globalization, the number of older people expressing affiliation with world religions mentioned above, though small, is increasing. Religion refers to the organization, beliefs, ethical values, rituals, and behavior that are transmitted over time and shared by a community. Often, though not always, this includes belief in a divine power, transcendent being, or sacred source of meaning. Ancient sacred texts and modern devotional literature including stories about origins form part of most religions, although some have developed through oral traditions. Responsiveness to social injustice and moving synchronously with the rhythms of holidays and festivals are other aspects in the lives of older people of faith.

*Religion as resource.* Religion has been an important resource for social connection and for comprehending what is beyond ordinary understanding throughout history. For example, some

older Holocaust survivors wonder why God would allow the devastation of the Jewish people during World War II. Religion is embedded in nearly every culture, although with its own unique representations and manifestations. For older people who are beginning to lose social friendships through widowhood and death, the church, synagogue, mosque, or sangha offers an important source of connection and reconnection, especially with younger persons with whom they might not otherwise engage. *Faith* and *belief* are other terms commonly used by older persons in reference to the doctrine or teachings of a religion or their own thinking that is not based in substantive proof. Faith and belief are valuable because they express ideas about how the world/universe is and one's relation to it, assumptions based on deepest roots or foundations of being. Thus, religious tenets can offer reassurance to older persons. Most religious traditions offer a positive view of the cosmos and the place that humans have within it. Life especially is valued; it holds meaning and purpose. Further, religion can facilitate the expression of powerful emotions that lie beyond thought and include gratitude, peace, joy, and hope. Religion can provide comfort, the sense that one can turn to God or a sacred source when life becomes difficult or depressing. Religious rituals and ceremonies can offer renewal or recognition of transitions and life endings. Prayer in groups or alone (private prayer) and meditation facilitate a sense of nearness to the transcendent power as well as a sense of responsibility to a community and care for the earth, a sacred home for all beings. Religions offer general guidance for the best course of action taking into account needs of self and others, and most religious faiths have role models one can look to and reflect on for inspiration.

*Spiritual well-being or spiritual strengths.* The National Interfaith Coalition on Aging, with representatives from several religious faiths, described spiritual well-being in 1975 as an affirmation of living in relationship with self, community, environment, and God that cultivates wholeness (National Interfaith Coalition on Aging 1980). Spiritual strengths refer to specific aspects of religious faith and spiritual beliefs that serve as resources and anchors during times of

health crisis or transition. Many older persons report reliance on prayer as a tool to counter physical and emotional pain. Comments by older adults include statements such as "God made this world so beautiful. We've got to be thankful. Maybe I might not be thankful this morning [because of my pain], but I've got to get to it this afternoon." Religion alludes to basic principles that "develop heart, mind, soul, and body." "You treat people better. You have peace within yourself and peace and harmony among people" (Nelson-Becker 2003). Reading sacred texts also provides comfort and insight. Religion is viewed as an opportunity for tolerance and greater understanding of others. It is more often pondered in a positive light by older adults as something that offers benefit, though not always. Joy, hope, forgiveness, and acceptance are a few of the outcomes of spiritual strengths.

*Spiritual suffering and spiritual struggle.* Spiritual suffering concerns all the existential, religious, and spiritual conflicts people encounter during the life course that cause emotional pain or anguish. Spiritual struggles are active endeavors to either maintain or change spiritual views that are threatened. Spiritual suffering can ensue from discouragement, despair, abandonment, emptiness, detachment from self and others, fear, demoralization, and ambivalence or doubt about former beliefs. Spiritual pain also may emerge from a sense of separation from God, precipitated by illness or other loss. While older age may be a time for reconstituting the self and deepening, it may also be a time of sorrow over sensed failures, disappointment, and grief related to the meaning one assigns to one's experience of life.

*Spiritual care.* Even though somewhat less likely to use formal therapy than younger groups, older individuals do seek out and use formal psychotherapy supports. Spiritual care is the official province of pastoral care professionals, chaplains, and other spiritual leaders such as rabbis, priests, ministers, clerics, monks, nuns, imams, and shamans. Some of these leaders may have specialized study while others do not; some are ordained and some are lay (not ordained but possibly certified) ministers. Certainly, they should be

used as referral sources when feasible as well as sources of specific denominational or spiritual group knowledge resources. Generally there are fewer clergy than therapists, so frequently therapists are the ones available when psychospiritual crises or problems emerge. Also, fewer clergy have received the mental health education and training that licensed professionals have. Spiritual triage (beginning assessment of concerns) may be required from any first-line professional staff, especially those working on interprofessional teams. Mental health professionals should all have some training in assessing and addressing R/S needs of clients, with those who have particular affinity and comfort in this area encouraged to seek ongoing professional development.

### **Ethical Practice and Boundaries**

Some mental health professionals feel uneasy about addressing religion and spirituality with older clients or choose to avoid it entirely because at times, well-intentioned professionals have attempted to privilege a spiritual or religious point of view. This section will identify those general concerns, discuss the reasons that assessing religious and spiritual needs is essential (especially those that are unmet), and provide guidance on working with spiritual issues and use of prayer with clients.

*Concerns about proselytizing.* One of the concerns mental health practitioners often have about discussing spiritual and religious issues with older clients is that they may be perceived as proselytizing or seeking to convert clients to a particular system of belief. In the past, people of goodwill, who thought they held the best answers, have stepped across boundaries. A risk for clients is that they are vulnerable and lack power in the relationship, so any assent would be manipulation and not freely given as an act of faith. Even though religious belief and practice have resulted in positive outcomes for many older people, that is not universally the case (Puchalski and Ferrell 2010). The level of intimacy is such that religion cannot be prescribed the way one might suggest exercise, certain reading material, or other “homework.”

*Importance of assessing religious and spiritual needs.* It is important to ask broad questions in assessment about whether these areas are important to the client and whether he/she would like them to form part of therapeutic work. If unasked, older clients particularly will often not mention what could be a significant source of comfort or distress. Taking cues from the practitioner about what is perceived as a level of discomfort, they may hesitate to reveal their spiritual or religious beliefs that are fundamental and integral to their constructed self. The unethical practice would be to avoid the area entirely. If it emerges that R/S is an area of interest or concern for the client, then the task for the practitioner becomes one of listening fully and holding in check one’s own assumptions and stereotypes. Although psychologists tend to rate religion as beneficial, when client beliefs shift farther from mainline beliefs and norms, these professionals demonstrate greater tendency to rate them as pathological (Post and Wade 2009). Even when affiliated with a particular religious faith, many older individuals may have developed their own unique understandings and expressions within that faith.

*Professional work with older clients around spiritual issues.* At moments when spiritual and religious issues emerge as a main concern, older clients can be referred to board-certified chaplains (available from many faith traditions) or leaders in their own faith community. However, there are occasions when the need is so immediate and the pain so profound that psychologists, counselors, and social workers should listen intently, no matter their own background or personal faith or non-faith preference. Some practitioners may feel unprepared and assume that it is best for clients to work with someone from their own religious or spiritual group. However, practitioners do not need to match clients on their spiritual genetics. In fact, at times a person from a secular or humanistic background may serve as the best resource because he/she can approach the problem with a fresh mind free of assumptions. The key requirement is that the professional be prepared to use all of his/her training and skill to listen deeply to what the client may find

extremely difficult to discuss or be conflicted about revealing.

*Praying for or with clients.* Holistic work with clients include integrating attention to many parts of the self. Although chaplains have had training in leading prayers after genuine invitation by clients, other mental health professionals have not. Unless there are exceptional reasons such as the client and therapist are members of the same faith tradition, there is a risk of abuse in participation in prayer. On some occasions, an older client may ask a professional to pray with them. Depending on the background of the professional, he/she might consider standing/sitting in respectful silence while the client prays. Because of risk of coercion, it is best when these requests are initiated by the client. Following the client's initiative, without engaging in behavior that would seem to cause harm to the professional's own belief system, seems like the optimal approach.

### **Spiritual Assessment with Older Adults**

Assessment of spiritual and religious needs remains inconsistent in many agencies that work with older people. The Joint Commission as a health-care oversight agency requires some form of spiritual assessment in hospitals and other health-care organizations, but it offers little guidance in how these assessments should be structured. Classic measures of religiousness were whether an individual was affiliated with a religious faith and whether they prayed. More recently, a common question is how important religion and, separately, spirituality are in an individual's life or whether their spiritual needs are met. While the area may be checked off, there is little here to encourage a longer encounter. Better constructed assessment tools for therapeutic work cultivate a conversation about needs and desires by providing a framework that can point to later intervention. Quantitative tools explore specific areas such as coping, beliefs, values, and daily spiritual experiences (Fetzer Institute 1999). The health literature also has a number of qualitative assessment tools such as FICA (faith and belief, importance, community, address in care or

action). Before taking a full spiritual history or comprehensive assessment, it is helpful to ask a preliminary question about what gives an older person meaning and purpose (Nelson-Becker et al. 2006). If religion and spirituality surface here, these can be further explored, if the client wishes. If the individual indicates they have no interest, then that can be information noted and no further questions need be asked. Assessment of R/S should be directed by client needs and interests but can provide a prolog into intervention.

### **Spiritual Interventions**

Spiritual interventions should be utilized cautiously with respect for all spiritual and religious positions but can be an empowering tool for older adults who may use R/S coping discussed below. Many older adults have spiritual portfolios or repertoires, strategies that have proved useful to them in the past for coping with stress. A mental health professional might assist someone in expanding their portfolio by helping them consider ways to deepen their spiritual practices or to try new ones. While these may include individual spiritual practices, learning to engage with spiritual communities in new ways may be another possible area for exploration. Making innovative use of pastoral care opportunities or small group meetings and support are other ways. Faith communities are growing older and they are beginning to explore ways to connect older and younger members as well as teach practices such as the recognition and inclusion of older people with mental health needs. There are some useful guidelines to consider in this area. Spiritual intervention should be preceded by client request. Practitioners should develop clinical expertise and cultural competency through education and training, respecting religious and spiritual diversity and any prohibitions within specific religious traditions. Finally, where available, this work should be research informed.

*Spiritual resilience* is a quality that enables people to mediate difficult circumstances and still flourish (Nelson-Becker 2013). It is present when an older person manages ambiguity

successfully by full immersion in and enjoyment of the moment. Similarly, benefit-finding is the ability to engender a positive outcome in the midst of severe health or other threats. Loss and grief are visible in personal histories that include stories of pain, but out of those stories, a reintegration and recovery of a new self can occur.

*Spiritual reminiscence* is a process that considers individuals' life stories and how meaning can continue to be understood or reframed from significant life events (MacKinlay and Trevitt 2010). Although useful with almost any older client, if they have some cognitive impairment, they can be paired with another person or their significant other to develop a dyadic story. This describes an in-the-moment process of meaning reconstruction and providing provisional purpose while addressing issues of vulnerability, reason to hope, and despair. Persons with dementia, like everyone, have stories to tell, but they will require assistance in structuring them in a way that returns meaning both to themselves and others. Spiritual stories are a validation of life lived experimentally without knowing the ending in advance and give witness to the woundedness and resilience of the storyteller. Storymining is the act of the professional who asks questions that can help highlight the meaning of a life, the wrong turns that were the right ones, for example.

*Incorporating compassion, courage, fluidity, hope, trust, joy, and equanimity.* Human values define the experience of being human, yet developing greater compassion, courage, fluidity, hope, trust, joy, and equanimity is seldom identified as a goal. Much therapeutic work takes a problem-focused approach instead of a spiritual development approach. Contemplation of the risks and benefits to full authenticity is another under addressed topic. Shame, guilt, greed, and other unsavory maladies also may remain unrecognized in a mental health lexicon that privileges standard complaints common in aging such as depression and anxiety. Forgiveness, too, is an important area of therapeutic work that can take greater significance in aging when a lifetime affords more opportunities for forgiving and being forgiven. Contemplating some of the ancient vices and

virtues anew may yield new places for enhancing the quality of life for older people.

## Spiritual and Religious Coping in Older Adults

R/S occupies a unique space in the lives of people for whom it matters. The level of profundity and the core issues related to spirituality such as the quest for meaning and purpose, experiencing deep joy in recognizing the beauty of life and all beings, or dealing with doubt or sense of abandonment/anger toward an ultimate being/transcendent power/God touch on foundational beliefs central to a sense of personhood. Although religious beliefs and related ideals may falter in stressful circumstances of aging when older adults encounter chronic and acute illnesses, increasing frailty, and adapt to unwanted changes, religious coping has been found to offer benefit beyond social and psychological resources (Pargament et al. 2013). In a study of 79 older adults asked to identify their three most difficult life challenges and subsequent coping styles, the most common coping styles included tapping social resources (talking with friends or soliciting instrumental help), religious coping (attending church, praying, reading the Bible/Talmud/Koran, using resources provided by God/faith), personal coping (depending on oneself, accepting the situation, using humor), or idiosyncratic or avoidant coping styles (placing trust in physicians, crying, not coping) (Nelson-Becker 2004). The primary coping style was more salient than the type of problem, and older people used their preferred coping method on most identified problems. Religious coping was the dominant coping pattern for African-American respondents. Traditional religious practices of prayer, meditation, reading religious texts, and using religious teachings as a moral compass or guide and helping to banish loneliness through altruistic behavior of helping others are important aspects of religious coping. One older African-American woman spoke of placing her trust in God, "I'm helpless without God, that is where my help comes from." Another African-American woman who was a storefront minister exhibited a

strong belief in the benefits of using religious practices:

As I said earlier with prayer, Bible scriptures, meditation, seeking the answer from within, so I can do the will. I don't move too fast-I make the attempt to get an answer about what to do about a situation. I don't worry myself. It's like a touch on the shoulder. 'You're my child. You don't have to worry. It's going to be alright.' Then I adjust my mind to accept whichever way it turns out. In the end I find it to be the best.

A Caucasian woman detailed the manner in which she integrated her faith with her daily life. These rituals helped her achieve some important routines in her day and enhance life meaning since it was difficult for her to leave her home due to some physical limitations. Her preferred activity would have been to attend church frequently:

I have my daily practice of meditation, Bible reading and prayer. That's daily. I don't miss. My Bible reading has to be every day. In the morning I'll get up at 6:00 or maybe earlier and have my meditation and prayer, then reading. I have daily readings—three of them. I go back to bed and maybe sleep until 9:30. I have to listen to Joyce Meyer (a Christian speaker) on TV at 12:00.

Although spirituality was less often cited as a specific resource in this older age group, it was mentioned as something inside the self that provides courage and inspiration. An older Jewish American woman commented, "When you really feel very sad, you want to turn to something. This is when you use spirituality." Another older adult man spoke about the difficulties in managing interpersonal relationships, "You meet people who don't act right. My spirituality helps me leave them alone. I'm able not to get angry." A third individual spoke of spirituality as something mysterious that was difficult to fully articulate, "You use spirituality in the sense of you don't see but you know it's there. Just like the solution [to a problem]. All of a sudden it's there – aiding you and letting you know how to go about it." R/S are significant tools for many older people in managing increasing frailty, mental health issues such as depression, or simply maintaining a satisfactory quality of life.

*Dementia and caregiving.* Religious coping has been viewed as valuable to clients diagnosed

with early-stage dementia. When disconnection from others due to communication problems and loneliness disrupted their sense of identity and self-esteem, relationships with God were deemed important, regardless of varying attributes/descriptors assigned to conceptions of God (Beuscher and Beck 2008). Hope was expressed in living fully through daily experience rather than impractical hope for cure. Spirituality in later-stage dementias is evident in the power of ritual for communication when speech is no longer available. The body remembers when the mind cannot, and people with dementia are able to sing religious hymns or participate in religious chants and prayers that have been embedded in their being from young ages. Religious coping has also proved a valuable benefit to caregivers of older people and individuals with disabilities who experience great stress in provision of high levels of direct physical and emotional care. Caregivers under benefit in the reciprocity transactional measure when they give more than they receive. They often relinquish earlier dreams of what they wanted to accomplish or how they wanted to spend their time, sacrificing (making holy) a new project to devote themselves to the welfare of another person, often one who is deeply loved.

## Religion, Health, Mental Health, and Aging

Considerable research over the past 20 years has examined overall physical and psychological well-being, a variety of specific health outcomes, mortality, health behaviors, and the role of faith communities in the prevention and impact on older adult health (George et al. 2013; Koenig et al. 2012). Research strongly suggests that R/S beliefs, behaviors, and religious participation influence older adults primarily in five specific ways: (1) development and maintenance of a meaning-making system, (2) social support and pro-social engagement with others, (3) social control of certain behaviors that affect health, (4) consolation, and (5) decision-making guidance around medical treatment and end-of-life

decision-making. The interaction of religion on health and mental health, however, is complex and not always explicit nor positive.

Specifically, mental health is maintained or enhanced by providing a sense of purpose and meaning in life. R/S beliefs have the potential to validate emotional suffering and provide an emotional “holding environment” for coping with life’s stressors and unanswerable questions. R/S communities foster a sense of belonging and opportunities for social relationships. They reduce social isolation. R/S beliefs encourage positive attitudes and emotions, such as hope, joy, and forgiveness that enhance well-being as well as neutralize negative emotions such as anxiety or depression. R/S beliefs and behaviors influence lifestyle choices that impact health, such as excessive alcohol use, sexual promiscuity, gambling, and drug abuse. Some R/S beliefs and practices affect one’s ability to cope with medical illness, loss, life stressors, and crises. The use of prayer, sacred texts, ritual, and congregational support can aid coping. R/S beliefs and the influence of faith communities guide medical decision-making, including whether or not to receive care. This can influence discussion and decisions regarding the development of an advance directive for medical care and decisions to begin, continue, or end medical treatment and provide definition to what constitutes “futile care” and assist with end-of-life decisions.

Not all R/S beliefs and practices are beneficial to health and well-being. Negative religious coping has been consistently linked with poor health outcomes. Those who believe their god has abandoned or is punishing them exhibit increased distress. Additionally, internal or external motivation for R/S beliefs, practices, and participation can strengthen or weaken the health effect. Older adults whose religious involvement is intrinsically motivated experience satisfaction from their beliefs and practices. Those who are externally motivated engage in beliefs and practices to receive something in return such as praise, respect, or social status. Internal motivation is linked with positive health outcomes, while external motivation is linked with negative health outcomes.

### **Religious Diversity and Struggle: An Example of LGBT Older Adults’ Relationship to Faith**

Lesbian, gay, bisexual, and transgender (LGBT) elders have coped not only with the stigma and disregard of general society but also with spiritual violence meted out by authorities of various religious denominations. Religious leaders claimed the voice of sacred texts, the position of theological truth, and doctrinal mandate in relation to sexual orientation. Sacred religious texts have been used as weapons to legitimize harm and ostracism and make claims about one’s lack of worthiness to engage the divine and supportive religious community.

Spiritual identity occupies different levels of importance and contributes to self-understanding in varying degrees. For some, spiritual identity is core to who one is; it is a foundational aspect of self, central to how one views and approaches the world. To others, it is a part of the self that is accessed in times of distress or extreme gratitude, and yet to still others, spiritual identity is consciously not important at all. The process of integrating spiritual identity and sexual identity is complex and fraught with emotion. It is frequently a time of spiritual struggle. The outcome of this spiritual struggle can be positive, negative, or a combination. The historical time in which these elders came of age and the diversity of religious views regarding homosexuality can complicate this struggle. Some LGBT elders have developed a personal spirituality that supports a whole sense of self and provides strength and inspiration apart from their religious tradition (Witten and Eyler 2012). Those who have maintained a relationship with their religious tradition frequently have adapted their internal belief system to relieve the conflict between their sexual and religious identity.

An experience of deep grief is a common reaction for those whose spiritual identity is threatened. Anxiety can ensue as one tries to find one’s bearings and redevelop self-understanding. Individuals may feel that they no longer have access to God, their religious community, or spiritual home. A sense of what was known as true, good,

enduring, and nourishing might be shattered, at least for a time. Thus, there is loss of self-understanding and diminished access to the strength and coping assistance that was historically available and engaged. Out of this devastation, many LGBT elders have developed strong spiritual identities in the face of societal and religious discrimination. Many have emerged with a life-affirming spirituality that is a source of strength, comfort, and energy as well as the source of personal resilience.

The relationship between organized religion and LGBT elders is complicated at best. While dialog is currently taking place with religious authorities and lay people regarding religious participation, theological validation, and embrace of LGBT individuals within various faith communities, this is a newer development. Historically, LGBT elders have come to expect rejection from places of worship and religious institutions. Given this history and social context, many LGBT elders faced conflict as to how to reconcile these seemingly incompatible parts of themselves, a nonheteronormative sexual identity and a spiritual identity. Some choose to deny religious identity or deny sexual identity, compartmentalize their identity, or integrate their identity.

Many LGBT elders have experienced great pain and rejection from their faith communities. As LGBT adults age, feelings of vulnerability may emerge. Reliance upon existing spiritual resources and religious communities is common during times of stress and can aid in coping with these complex feelings. A large number of LGBT elders are committed to their religious and spiritual identities and have exhibited great resilience, strength, and growth in the face of homophobia, stigma, and rejection. Engaging their spirituality and accessing social support, including religious institutions, will help LGBT elders flourish through their later years. However, it is also important to understand that this vulnerability may impact LGBT elders in a detrimental way. Fears and concerns about being discriminated against when unable to care for oneself may become overwhelming. Some elders have expressed concern that they may be forced to move from an open, integrated sexual and

spiritual identity into a compartmentalized identity. They are concerned about being in a position of trying to “pass” as heterosexual for their own safety and ability to receive services. In essence, go back into “the closet.” This is a looming spiritual crisis for LGBT elders.

## Conclusion

Religion and spirituality have formed part of the cultural landscape for older adults in communities across the world. They touch on many aspects of life which are nourishing: opportunities for social support and shared understanding, deeply held foundational beliefs, emotional richness, and strategies to bring personal peace or harmony in the face of intrapersonal and interpersonal conflicts. However, as societies change, older adults change with them. As their religious and spiritual sensibilities grow, diminish, or remain stable throughout longer life trajectories, there will be many possibilities for practitioners to enhance their understanding of a widening emergent field and of ancient resources for human flourishing. As research methods both expand and retain rigor, practitioners will be better able to recognize the complex associations of religion and increasingly with advancing generations of spirituality.

## Cross-References

- ▶ [Aging and Psychological Well-being](#)
- ▶ [End of Life Care](#)
- ▶ [Mindfulness Approaches](#)
- ▶ [Palliative Care](#)
- ▶ [Psychology of Wisdom](#)
- ▶ [Resilience and Aging](#)

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## Stage Theories of Personality

Edward Helmes

Department of Psychology, James Cook University, Townsville, QLD, Australia

### Definition

A stage theory of personality proposes a series of fixed developmental levels that are associated with different elements of personality, progress in the complexity of the expression of personality, and are experienced in the same way by everyone in a society and across different cultures.

### History

The earliest stage theories of personality arose from the psychoanalytic writings of Sigmund Freud, and many of those who later went on to develop their own stage theories continued to do so in the psychoanalytic tradition. For the most part, these early theories were primarily concerned with developmental stages in children and considered the personality of adults in much

less depth, with even less consideration given to the personality of older adults. For a very influential example, Freud's theoretical stages of psychosexual development (Freud 1965) applied only to childhood and adolescence and were regarded as stable throughout the adult years. These developmental stages formed the core of the influences that formed the adult personality and its fundamental adjustment to life and its challenges. Another tradition in which stages are prominent is the developmental stage theory of Piaget (1954), who focused upon the cognitive development and resulting differences in observed abilities of children as they progressed in age. Adulthood in the psychoanalytic tradition was presumed to be stable and relatively unchanging except in response to strong environmental pressures. Later theories that built upon the psychoanalytic model retained the focus on childhood development, but some later theories focused more on personality differences among adults during the midlife and later-life periods and elaborated upon aspects of personality during adulthood.

## Early Theories

After Jung finally split with Freud in 1913, his writings focused more on the influence of culture on the development of personality features in individuals and expanded on psychosocial developments in the second half of life without adopting a set of fixed developmental stages. Among his other contributions, Jung is credited with the idea of important developments in adult personality around the age of 40 that later evolved to become the concept of the midlife transition or midlife crisis (Jung 1971). It must be remembered that in general most stage theories of personality are based upon data collected from, and the resulting theories derived from, comparatively well-educated individuals from North American and European societies. Thus, Jung described a process of individuation during the adult years in which individuals became more clearly defined and differentiated from one another as individuals adopted different responses to the demands of adult life. Whether the implicit assumption in this

that all cultures and societies involve increasing differentiation among adults can be supported outside of well-educated Westerners is rarely addressed among early stage theorists. One of the distinct elements of Jung's work is his sensitivity to the issue of culture and its influence on developmental processes.

The appeal of stage theories is partially based upon the introduction of such additional secondary concepts as the midlife crisis. These ideas are often intuitively appealing but are also more difficult to support empirically. There is also the conceptual problem for a stage theory if empirical results do not support the secondary concept in question. This is the case of the midlife crisis, in which later research has shown not to be universal in all who reach midlife, not to appear at the same age in midlife, and not to necessarily involve significant emotional upset (Rosenberg et al. 1999). Despite such a lack of empirical support, concepts such as the midlife crisis remain popular in modern cultures and have seemed to acquire a life of their own independent of empirical evidence and the implications of disconfirmation for the parent theory. Indeed, little research on stage theories is being done currently. A PsycINFO literature search was done for this topic, using the terms "stage theory" and "personality" and "older adults." A total of only 52 hits were returned, many of them not relevant. In addition, many texts for adult development and aging courses give comparatively little space to stage theories in comparison to newer trait theories.

## Lifespan Theories

The first comprehensive stage theory of adult personality change and development that covered the lifespan was that of Erik Erikson (1950, 1964) and Erikson et al. (1986). Erikson's theory emphasizes the interplay between the individual and society in developmental processes and can be seen as an extension of Jung's work. The eight stages proposed by Erikson are clearly articulated and intuitively appealing, including both significant relationships with other people in one's life and intrapersonal processes.

Widely influential, Erikson's stage theory was based on the idea that psychological development required the successful resolution of psychosocial crises. With a rich and clearly described base, the theory influenced many other writers and researchers in the area of personality development. At the same time, Erikson's theory primarily focused on childhood and adolescence, with five of the eight stages covering the first 20 years of life: basic trust versus mistrust, autonomy versus shame/doubt, initiative versus guilt, industry versus inferiority, and identity achievement versus identity diffusion. Issues arising during childhood and adolescence can recur under crises in later life, so the developmental sequence is not entirely fixed and rigid. Erikson devoted three stages for the remaining years of life that covered a substantially longer period of time. Of the three stages of adulthood, the first stage of young adulthood involved the psychosocial crisis of "intimacy versus isolation" and occurs during the 20s and 30s, while the second adult stage is based on the resolution of the crisis of "generativity versus self-absorption" that occurs during the period of the following 25 years from 40 to 65 (Whitbourne et al. 1992). This stage has perhaps attracted more research than any other in the accumulated studies involving the theory. The stage of generativity is predominant in midlife according to most research on the topic as many adults reach this stage of development (Sneed et al. 2006). Some studies have shown that generativity appears to be lower in both younger and older adults than those in their late 30s and early 40s, as predicted by the theory. The final stage that occurs during old age involved the crisis of "integrity versus despair," which covers the period of time from late adulthood to death (Erikson et al. 1986). This period of life can easily cover an additional 15–30 years of life for individuals whose health remains sufficiently robust to place them among those surviving beyond the average life expectancy. It seems to be a feature of most stage theories whose developers are in midlife in that later life is seen to be a relatively stagnant and unchanging stage of existence that begins with retirement and continues placidly until death.

## Modern Theories

Despite its intuitive appeal and resulting broad influence, recent years have seen a relative decline in research on Erikson's theory in parallel with the increasing influence of trait models of personality and personality development. It is none the less evident that Erikson's stage theory has had a broad influence on others who have developed more focused theoretical and empirical accounts of the development of personality characteristics in adult life that do extend into later life. These include the theoretical developments of Levinson (1978, 1996) and Vaillant (1977). In common with Erikson's theory, such more recent theories are built upon the broad sequence of developmental events that are almost universally observed in modern Western societies, while retaining links of psychoanalytic theories. Early childhood, preschool days, the years or decades of formal education, employment and marriage, parenthood, and retirement are events and activities that are virtually universal in modern Western societies and are becoming more dominant in the societies of developing countries as Western influences continue to spread. Formal transition ceremonies, such as initiation rites, are far from universal in Western cultures and their survival is variable in developing countries. Individuals may exhibit substantial variation in how they progress in life across the cultural range of stages without considering the relatively consistent variation between cultures that can be exceeded by variation within a culture or society.

Much of the existing research on stages of personality development that does not deal explicitly with childhood and adolescence focuses on the middle period of life, the decades of adulthood. Several other investigators have focused their work on refining and elaborating upon Erikson's stage of identity and have expanded upon the original ideas of this level of development. Levinson's theory (1978, 1996) focuses on early to middle age (age 20 to age mid-40s) and incorporates six stages: leaving the family, entering the adult world, settling down, becoming one's own man, midlife transition, and re-stabilization and beginning middle adulthood.

Like many stage theorists, Levinson bases his theory upon situations and events that generally occur during relatively specific and consistent periods in a person's life. The theory was originally developed on the life situations of four occupational groups of men and thus lacked a certain amount of generalizability.

## Modern Theories

As a psychiatrist, Vaillant (1977) had a rather different perspective on stages of personality development than most personality theorists, in that he was most concerned with the success adults had with the major issues of adulthood: forming an intimate relationship, establishing a career, and transmitting knowledge to the next generation. Vaillant was working in the predominant psychoanalytic tradition that has influenced much of the theoretical developments on the topic of personality structure. Unlike more rigid theorists about personality, and like Loevinger (1976), he does not assume that everyone progresses at the same rate or necessarily reaches the most advanced or highest level or stage. He is particularly interested in the manner in which adults adapt to life and in particular the role of defense mechanisms, a psychoanalytic concept for processes used unconsciously to deal with anxiety. He proposed six levels of defense mechanism, with the highest adaptive level being altruism; the highest adaptive level involves participation in society and care for others. It is in the maturity of the ego defenses that Vaillant's work can be seen as a stage theory. Successively less mature defenses include repression, omnipotence, denial, autistic fantasy, and help-rejecting complaining. The least mature level deals with stress by requesting help and then rejecting offers of assistance. Autistic fantasy involves image distortion, typified by daydreaming instead of taking action. Denial involves the disavowal or refusal to act or to acknowledge personal hurt. The omnipotence level involves minor image distortion by emphasizing one's special attributes. Repression reflects mental inhibition and dealing with stress by expelling thoughts and desires from conscious

awareness. From data collected through a series of longitudinal studies that are still ongoing, he was able to demonstrate the stability of individual personality characteristics over a 45-year period of time. Examples include the prediction of income during work life by extraversion scores obtained 45 years earlier.

A somewhat different stage model was developed by Harry Stack Sullivan (1953) who proposed seven developmental epochs, six of which occurred prior to adulthood. Sullivan proposed stage transitions in terms of psychological development rather than of the biological factors favored by most stage theorists working from a psychoanalytic perspective. Unlike many stage theorists, Sullivan felt that the majority of adults did not achieve the most advanced stage of development. Like that of Erikson, Sullivan's model has never been formally discredited by convincing empirical evidence but has fallen from prominence in recent years as other models have increased in popularity. Sullivan's focus on interpersonal relationships has, however, retained its utility into the present (Noller et al. 2001).

## Ego and Moral Developmental Theories

Also classed as a stage theory, the work of Loevinger (1976) on ego development also is based upon psychoanalytic thinking. From this perspective with the dominance of the ego in adult life, viewing ego development as part of an individual's personality is relatively straightforward. Extending Erikson's model, Loevinger proposed eight stages of ego development with the last six stages occurring during adult life. At each stage, four areas are essential for the development of personality: character development, interpersonal style, conscious preoccupations, and cognitive style. The six stages of adult development proposed by Loevinger comprise conformist, conscientious-conformist, conscientious, individualistic, autonomous, and integrated. Most American adults operate at the second of these stages, conscientious-conformist. Relatively few adults achieve the level of the integrated stage, fewer

than 1% by one estimate (Cook-Greuter 1994) and between 2% and 3% by another report (Heaton 2011). Unlike the majority of stage personality theorists, Loevinger's theory relies upon evidence derived from an empirical source, the Washington University Sentence Completion Test, to evaluate the level of ego development, which provides stronger support for this approach than perhaps for older models of personality development that rely upon stages.

A related theory to those in the domain of personality is the stage theory of moral development proposed by Kohlberg (1981). For some, moral development is outside the domain of personality, while for others with a broader perspective, moral development is closely related to ego development and can be included among stage theories of personality. A feature of this theory is that a distinction is made between the form of thinking (the topic of thought) and the content of thinking (why one thinks that way). The reasoning behind the behavior is the important element. Moral development is typically assessed by a procedure in which the participant responds to a series of hypothetical moral dilemmas. In each one, different principles are in conflict. Based on responses to such dilemmas, three basic levels of moral development were developed, each of which can be divided into two further stages, resulting in six levels or stages in all. These stages are preconventional (punishment and obedience orientation and naïve hedonism), conventional morality (good-person orientation, social order maintenance orientation), and postconventional morality (social contracts and individual principles of conscience orientation). Kohlberg speculated about a seventh stage, unity orientation (confrontation with death), that developed in the second half of life (Kohlberg et al. 1983). The model has been a popular topic of research, and much of the research supports the general progression that is a fundamental aspect of the theory. In addition, the theoretical stages appear to occur in the proposed fixed order and in the proposed sequence, and that sequence appears to be widespread across different groups and cultures, something not always evident (Gardner and Macky 2012; Heaton 2011).

## Summary

Stage theories of personality have an intuitive appeal. They simplify complex phenomena into discrete categories that are substantially easier to understand than the complexities of continuous development. At the same time, it must be recognized that human development does not involve the dramatic stages of development that are seen in nature. No human experiences the changes equivalent to those seen from caterpillar to pupa to butterfly that undoubtedly are clear and distinct stages of development. Human development is basically continuous with occasional major events, such as the sudden death of a loved one, that force changes. It would appear that in most cases stage theories arise from the imposition of artificial transitions upon a continuous process. Most stage theories are silent upon the issue of the necessary processes (see Connors and Richards 2002 for an example of a model of stage transitions). Conditions for transition from one stage to another and whether the same processes operate across all transitions or if different ones are involved at different stages are rarely, if ever, specified.

As with several other theories of personality development, the reliance upon psychoanalytic thinking about personality and its development by many theorists discussed here poses some difficulties with the decline in credibility and acceptance of much psychoanalytic thought. It cannot be denied that biological and social influences impose constraints upon possible developmental sequences and enforce others. Whether the human imposition of a limited number of categorical labels on a fundamentally continuous process advances scientific progress is arguable.

Narrow theories, such as Kohlberg's on moral development, are more likely to have stronger empirical support than very broad conceptualizations of human development in general. While Erikson's theory has broad appeal and substantial empirical support, it is relatively silent upon what is necessary for the progression from one stage to another and whether such processes remain constant across all stages.

While research on stage theories continues, it is clear that trait theories have become more popular over time while the popularity of research on stage theories has become notably less prominent. In part this may be due to most such stage theories ultimately being based upon psychoanalytic theory, and their decline in popularity may arise from their association with psychoanalysis rather than any inherent flaw of their own.

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## Stereotype Threat and Aging in the Workplace

Courtney von Hippel<sup>1</sup>, Elise K. Kalokerinos<sup>2</sup> and Julie D. Henry<sup>1</sup>

<sup>1</sup>School of Psychology, The University of Queensland, Brisbane, QLD, Australia

<sup>2</sup>Department of Psychology and Educational Sciences, KU Leuven, Leuven, Flemish Brabant, Belgium

## Synonyms

Aging workforce; Employee retention; Job attitudes; Mature age workers; Social identity threat; Stereotyping

## Definition

Stereotype threat is the concern that others are evaluating you through the lens of negative group-based stereotypes (Steele 1997). Over the past two decades, hundreds of laboratory studies

have demonstrated that stereotype threat disrupts performance when people attempt difficult tasks in domains in which they are negatively stereotyped, such as women in math and African Americans in academics (Nguyen and Ryan 2008). It has been over a decade since this research was extended to older adults. Here too the accumulated research evidence demonstrates that older adults are susceptible to the performance-impairing effects of stereotype threat (Abrams et al. 2006). Although the majority of stereotype threat research has examined performance decrements, a smaller body of research demonstrates stereotype threat can lead people to disengage from domains in which they feel stereotyped. Although every job involves being judged by other people, employees from negatively stereotyped groups such as older workers have the added concern of being judged on the basis of stereotypes about their group. Importantly, it is not necessary for people to believe the stereotype is true of their group to experience stereotype threat, nor is it necessary that they believe that the stereotype describes themselves. Stereotype threat effects emerge when people worry that others *might* evaluate them on the basis of the stereotype. This entry discusses the concept of stereotype threat and its relevance for older employees and the organizations who employ them.

### **Stereotyping and the Aging Workforce**

Over the next few decades, the aging demographic will pose major challenges in the workforce in most industrialized nations. These developments have led policy makers and organizations to try to retain older employees for as long as possible. For example, in Australia the predicted labor shortage and pension burden have prompted the government to introduce financial incentives to delay retirement, with the pension age increasing to 70 years by 2035. While government inducements are undoubtedly important in helping to retain older employees, it is equally important to examine the

psychological factors that may affect well-being in the workplace and, ultimately, retirement decisions.

There are numerous stereotypes about older employees, and thus stereotype threat is a psychological factor that seems likely to be of particular importance. While some of these stereotypes are positive perceptions that reflect perceived gains in “wisdom,” more common are negative perceptions that emphasize reductions in “wit.” Older adults are often stereotyped as inflexible, frail, incompetent, out of touch, and slow, and consequently it comes as no surprise that older employees are susceptible to stereotype threat.

In the first demonstration of stereotype threat in late adulthood, older adults who were told that age leads to poorer memory performance did worse on a memory test than those who were told that older adults often perform just as well as younger adults (Hess et al. 2003). One reason stereotype threat disrupts older adults’ performance is that it consumes their working memory resources (Mazerolle et al. 2012). Interestingly, performance deficits under conditions of stereotype threat are more pronounced among the young-old (i.e., 60–70 years) than the old-old (71–82 years) and among those with higher levels of education (Hess et al. 2009). There is now more than a decade of accumulated research on aging and stereotype threat, and a recent meta-analysis revealed that these performance decrements emerged across a range of cognitive domains (e.g., memory and arithmetic) as well as physical tasks (e.g., flexibility and driving performance) (Abrams et al. 2006).

### **Stereotype Threat and Mature-Age Workers**

Age-related stereotypes also exist about older workers: Although research has consistently demonstrated that workers’ age is generally unrelated to job performance (Ng and Feldman 2008), many people continue to hold negative opinions about older workers. Research has demonstrated that younger workers rate older workers as having lower job qualifications and less potential for

development. Older workers are also viewed as less productive, less flexible, and less willing to learn than their younger counterparts (Posthuma and Campion 2009). In short, stereotypes relating to older employees are consistently negative and generalize across most occupational settings. Although industries such as law and academia tend to value older employees for their experience and connections, in most vocational settings older employees report feeling that they have been put out to pasture and believe that their younger counterparts are given more training opportunities and are more likely to be assigned to high visibility projects. For all of these reasons, older workers are likely to experience stereotype threat, as they have good reason to worry that their colleagues are evaluating them on the basis of the “older worker” stereotype.

### Beyond Performance Decrements

In the original theoretical description of stereotype threat, Steele (1997) described two types of consequences. First, he proposed that acute experiences of stereotype threat would lead to performance deficits, and this consequence is now well documented in laboratory studies (although this line of research has not been extended into the workplace yet). In contrast, the other consequence proposed by Steele has received much less attention. Specifically, Steele also suggested that chronic experiences of stereotype threat should lead people to disengage from the stereotyped domain over time. This possibility is of great potential importance for both organizations and older employees, as disengagement from work and the organization is associated with a variety of negative job attitudes (e.g., lowered job satisfaction) and greater intentions to quit.

To examine the relationship between stereotype threat and disengagement, job attitudes and turnover intentions were assessed among employees aged 50 or older in Australia and the USA (von Hippel et al. 2013). Across three diverse samples (i.e., traditional office environment, law enforcement, and a general internet survey), older employees who experienced

stereotype threat at work were less satisfied with their jobs, were less committed to their employer, and reported more work-related mental health problems. Negative job attitudes are important variables in their own right, but reduced job satisfaction and commitment are also associated with increased intentions to resign and retire. And thus it is not surprising that negative job attitudes were related to an increased interest in resigning and retiring among older employees. Interestingly, older employees who occupied higher status positions within their organizational hierarchy experienced less stereotype threat than their lower status counterparts, suggesting that not all older employees are equally susceptible to stereotype threat.

Negative workplace attitudes have been shown to impact performance, leading people to be less productive. If older employees who experience stereotype threat also show performance decrements (as seems likely given the robust effects of stereotype threat on cognitive performance in controlled lab-based studies), it could lead their colleagues to believe that stereotypes about older employees are true. Poignantly, the end result is a self-fulfilling prophecy and a self-perpetuating cycle of stereotype threat which has negative consequences both for the older worker and the organizations who employ them.

### The Ubiquity and Subtlety of Stereotype Threat in Everyday Life

Stereotype threat is something that nearly everyone will experience at one time or another. For example, when a female driver makes a mistake and another driver beeps his horn, she may have a niggling feeling that the male driver attributed her driving mistake to the fact that she is a woman. These same feelings can arise for older employees in the workplace. For example, if older employees' recommendations are passed over in favor of suggestions put forward by younger colleagues, they may worry that age was a factor in this decision. It is these types of subtle experiences in the workplace that can make people wonder whether they *might* be being evaluated

on the basis of stereotypes about their group. Consider these comments made by older employees who reported sometimes feeling stereotyped at work based on their age:

Because I am now older than many of our clients, I get the impression it is felt that I no longer am 'in touch' with the clients, despite the fact my specialist knowledge means I have a good understanding of my area. Because my organisation is 'innovative', 'cutting edge' and encouraging of new ideas, it is sometimes assumed anyone over 40 won't have any ideas worth listening to. Or am I just old and paranoid and idealess?

I sometimes feel that I am invisible because of my age (at work). I have difficulty at times with getting people to include me and listen to me.

I believe that perceptions around my age tend to exclude me from the mentoring program and leadership development. Due to now being an 'empty nester' I have more than ample time to commit to my work – but I think that because of my age, I am not utilised enough.

I feel very comfortable in my position but I think that people sometimes view my age as a burden, especially young people that think you are too old to be working and that they should have all the opportunities over older workers.

In none of these examples is it clear that the subjective experiences these employees described reflect actual stereotyping on the part of their colleagues. Rather, it is their concern of being stereotyped that constitutes stereotype threat. These examples illustrate that overt discrimination is not necessary for older employees to feel stereotype threat. Rather, subtle events can occur in the workplace that make people wonder whether they *might* be being evaluated on the basis of stereotypes about their group. For example, a technologically capable older employee may worry that his preference for a paper diary will confirm the stereotype that older employees are less willing to learn new technologies, and that he will be judged as less technically skilled or valuable as a result. It is also important to note that the accuracy of the stereotype (about oneself or the target group in general) is irrelevant to whether people experience stereotype threat. Indeed laboratory research often reveals that it is the exceptionally talented members of the stereotyped group (e.g., female math majors at top ranked universities) who are most susceptible to stereotype threat.

Many workplaces are replete with reminders that certain groups are devalued, such as a small proportion of minorities or women in the upper echelons of the organization. For older employees, these reminders may even be well intentioned. For example, offers of help by younger employees to their older counterparts (e.g., to carry a heavy or unwieldy object or to help unjam the photocopier) may be interpreted as a sign of being stereotyped. Other cues may not be as well intentioned, such as patronizing tones or social exclusion – cues that appear in the earlier quotes from older employees who experienced stereotype threat. Regardless of the specific reminders, workplaces that contain many such cues are likely to lead to chronic feelings of stereotype threat for older employees. Under situations such as these, employees may experience stereotype threat from the moment they walk in the office door each morning until they leave at the end of the day. The end result would be the stringing together of a series of acute events into a chronically aversive state. It is easy to imagine how a situation such as this could lead to work-related mental health problems and ultimately premature retirement.

### What Can Be Done?

The experience of stereotype threat at work may counteract efforts to retain older employees in the workforce. As a consequence, it is important to take action to neutralize stereotype threat in the workplace to avoid the unnecessary loss of older workers as well as to increase workers' satisfaction and well-being. Unfortunately, despite hundreds of studies documenting the negative effects of stereotype threat, there is far less known about the best ways to counteract the negative consequences and minimize experiences of stereotype threat. Although research will be necessary to determine the best approach, suggestions are provided based on previous research.

Organizations may be well served by making a concerted effort to promote *positive stereotypes of older employees*, which may help to counteract the existing negative stereotypes. Positive stereotypes of older employees focus on their

experience, wisdom, dependability, and conscientiousness and have had demonstrable positive effects on older adults' performance in previous research (Levy and Leifheit-Limson 2009). It may also be possible to address stereotype threat by *increasing positive intergenerational contact*. Laboratory research demonstrates that declines in cognitive performance after stereotype threat disappear when older adults experience positive intergenerational contact (e.g., quality of contact with people 35 years or younger during the week before the testing session) (Abrams et al. 2006). *Offering training and development* to older adults can make them feel more valued and less like they are being left behind by the organization. Older workers often feel they are missing out on training that younger workers receive, which is particularly problematic when the training is viewed as important to job performance. Finally, research suggests that *self-affirmation* may help diminish the negative consequences of stereotype threat (Cohen et al. 2006). Self-affirmation involves reflecting on one's important achievements, values, or traits. This kind of intervention would be easy to implement on both a personal and an organizational level and would not be resource intensive.

## Conclusions

Most jobs involve being judged by peers, supervisors, or customers, yet older employees have the added concern of being judged on the basis of their age. It is the awareness that others may evaluate you through the lens of negative stereotypes that triggers stereotype threat, regardless of whether people believe the stereotype to be true of themselves. Given the prevalence of age-based stereotypes, it is likely that many older employees experience stereotype threat at least occasionally. Thus, although it is commonplace to experience evaluation apprehension when being judged, stereotype threat can result in additional concerns for older employees. It is therefore important for stereotype threat research to be extended into organizational settings more broadly, as the existing data suggest that stereotype threat is a concern for

organizations who desire to retain their older talent and help them reach their potential.

## Cross-References

- ▶ [Age Discrimination](#)
- ▶ [Age Diversity at Work](#)
- ▶ [Age Stereotypes in the Workplace](#)
- ▶ [Job Attitudes and Age](#)
- ▶ [Stress and Well-Being: Its Relationship to Work and Retirement for Older Workers](#)

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## Strength and Vulnerability Integration

Susan T. Charles and Joanna Hong  
Department of Psychology and Social Behavior,  
University of California, Irvine, CA, USA

### Synonyms

Aging and Psychological Well-Being; Mental Health and Aging; Emotional Development in Old Age

### Definition

Strength and vulnerability integration (SAVI) is a theoretical model that describes how emotional experience varies across the adult life-span. According to SAVI, older age is related to greater use of emotion regulation strategies and a stronger focus on emotional well-being. As a result, older adults often report even higher levels of well-being than do younger adults. At the same time, however, age-related increases in physical vulnerabilities pose greater problems for older adults when regulating high levels of emotional arousal. Thus, when people can employ emotion regulation strategies to avoid negative experiences, they are more successful than younger adults. When they are unsuccessful at avoiding highly negative experiences that elicit high levels of arousal, however, SAVI predicts that older adults will have more difficulties modulating this experience (Charles 2010). SAVI was formed to explain the patterns of emotional well-being observed in the literature and builds on the work described in other models and theories in psychology and aging (Carstensen et al. 1999).

## An Overview of the Three Main Tenets of SAVI

SAVI focuses on three overarching factors that determine age differences in emotional experience: (1) strengths of aging, (2) vulnerabilities or aging, and (3) current circumstances. The first component includes the thoughts and behaviors that influence how people experience and regulate their emotions. As people age, they increasingly engage in thoughts and behaviors that lead to more positive and fewer negative emotional experiences (Carstensen and Mikels 2005). Older age is related to greater frequency and ability to engage in these processes, so these processes are labeled in SAVI as strengths of aging. Despite these strengths, physiological changes occur with age that may challenge a person's ability to regulate high levels of emotional arousal. Throughout childhood, across adolescence and into adulthood, physiological systems develop that are critical for responding effectively to situations of high-emotional intensity. Across middle age and into late life, however, these physiological systems often experience decline. Physiological changes, then, serve as vulnerability factors for many older adults when regulating emotions that elicit high levels of arousal. The third component encompasses current life circumstances. This context determines the extent to which people can and do employ cognitive and behavioral emotion regulation skills effectively and the extent to which age-related vulnerabilities influence emotional experience. By assessing the demands of the situation, researchers can integrate information about the use of strengths and the impact of vulnerabilities to understand patterns of age differences in emotional experience. Below we discuss each of these components in detail, and how their interplay allows us to predict how emotional experience may vary across adulthood.

### Strengths of Aging

Researchers have long documented the powerful role that thoughts and behaviors have on our emotional experiences. People experience less

negative affect (or emotional feelings) and more positive ones when they select environments that are more positive and less negative, focus their attention on more positive and less negative aspects of the environment they are in, appraise situations more positively and less negatively, and engage in actions that remove themselves from negative situations (Gross 1998). In multiple studies, researchers find that older adults engage in these processes more often than younger adults (Charles and Carstensen 2014). When exposed to negative, neutral, and positive emotional faces, older adults are more likely to focus on the picture showing more positive and least negative expression. When asked to interpret situations in their lives or when interpreting stimuli in the laboratory, older adults often appraise them more positively and less negatively than do younger adults. Finally, when asked to recall what they have seen in the laboratory or events from their lives, older adults often recall more positive and fewer negative aspects than do younger adults.

SAVI further includes the proposition that these strengths of aging are the result of how people perceive time, both time left in their own lives and the time that they have already experienced. This time perspective results in older adults having greater motivation to regulate their emotions (as described by socioemotional selectivity theory). Time lived also provides them with greater expertise to achieve their motivational goals. The importance of time left in life is taken directly from socioemotional selectivity theory, a theory that describes the importance of time perspective on emotional experience and its influence across people of all ages across the life-span (see entry for ► [Socioemotional Selectivity Theory](#)). This theory posits that as time left in life grows shorter, people increasingly prioritize emotion-regulated goals. Older adults, then, prioritize emotion-related goals more so than younger adults (Carstensen et al. 1999).

People are motivated to regulate their emotions given the time left in life, but researchers have also discussed the importance of time lived to explain why older adults often report similar, if not higher, levels of well-being than do younger adults (Blanchard-Fields 2007). Researchers have

posited that throughout years of practice and recognizing the situations that cause them the most distress, people have gained information that allows them to identify and avoid certain negative situations. For example, studies examining social expertise often find that older adults are better at knowing when to disengage from a contentious argument (Blanchard-Fields et al. 2007). Older adults prefer to back away from potentially negative situations, recommend these strategies to others, and report that doing so leads to better outcomes in their own lives. Together, the awareness that time left to live is growing shorter increases people's motivations to maintain enhanced well-being, and the past experiences from time lived provides them with information and knowledge to engage in thoughts and behaviors that enable them to achieve their goals.

## Vulnerabilities of Aging

Across middle age and into late life, people often experience declines in biological and physiological processes. These declines can occur as a consequence of primary aging (genetically programmed biological declines) or from secondary aging (decline resulting from accumulated assaults from exposure or behavior). Secondary aging processes, although related to age, are not caused by biological aging, per se. For example, age is related to decreases in physical activity, and lack of exercise has been correlated with physical decline. Regardless of the source of decline, however, these age-related changes often result in a physiological system that is less flexible. SAVI posits that declines in flexibility will make both rapid responding to and recovering from high-intensity emotional situations more difficult with age.

High-intensity emotional experiences produce a cascade of physiological processes that influence both central and peripheral activity. Researchers have started examining age differences in the association between emotions and biomarkers, defined as physiological indices that often correlate with or predict worse health outcomes. For example, a review of studies has

examined cardiovascular reactivity to stressful experiences that occurred both in daily life and in the laboratory (Uchino et al. 2010). This review found that although older adults show less pronounced increases in heart rate – most likely the result of slower vagal withdrawal in response to the situation – their blood pressure was more reactive to emotional stressors than that of the younger adults.

In studies examining cortisol levels, the hormone biomarker related to stress, people with chronically high levels of negative affect have higher levels of cortisol compared to those with lower levels of negative affect. One study found, however, that the association between chronically high levels of negative affect and high levels of cortisol is greater among older adults than younger adults (Piazza et al. 2013). Specifically, the association between negative affect and cortisol levels was not significant among younger adults; only among people who were in their mid-fifties and older did overall higher levels of negative affect correlate with higher levels of cortisol. A similar age-related pattern is observed when examining the association between trait-like anger expression and metabolic syndrome (Boylan and Ryff 2015). The metabolic syndrome is a medical condition comprised of high levels of triglycerides, cholesterol, blood pressure, and glucose that predispose people to type II diabetes and other problematic health conditions. High levels of anger expression were related to metabolic syndrome among the oldest adults in the sample; levels or greater anger did not predict worse health among the younger adults who were in their mid-30s, 40s, and early 50s.

### **Integrating Current Circumstances**

SAVI posits that by integrating knowledge about the strengths and the vulnerabilities of aging into the context of current circumstances, researchers can predict when older adults will exhibit higher levels of emotional well-being than younger adults, and when older age does not confer an advantage for emotion regulation or well-being. Specifically, in situations where people have the

time and opportunity to engage in strategies that allow them to avoid or mitigate exposure to negative experiences, older adults generally report higher levels of well-being than younger adults. This higher level of well-being reflects not only their actions but also circumstances that allow them to avoid negative situations more often than their younger counterparts. For example, when examining people in relatively good physical health whose financial situation supports their needs, older age is related to exposure to fewer daily stressors. Researchers posit that this reduction in daily stress is partly due to the benefits of retirement and no longer having children living in the house. In addition, however, this reduction is hypothesized to stem from older adults navigating their social environment to avoid potentially unpleasant experiences. When people are exposed to negative social situations, older adults more frequently opt to disengage from these situations by walking away or choosing not to continue the debate, whereas younger adults report continuing with the argument (Luong et al. 2010). These strategies are posited to explain why, when asked to think about life in general or the emotions that they have experienced in the past month, older adults are more likely to report more positive and less negative emotions. Older adults often report high levels of positive emotions in their daily lives, but studies suggest that their memories are even more biased toward positive emotions than their actual experiences and more positive and less negative than the memories of younger adults, as described by socioemotional selectivity theory (Reed and Carstensen 2012). Thus, in circumstances where people are given the time to either avoid negative situations or disengage from them quickly or when given the time to think back on their life and make general appraisals about their situations, older adults often report more positive and less negative emotional experiences than those of younger adults.

The avoidance of distressing situations, however, is not always possible. When confronted with an unavoidable negative situation, people experience high levels of distress and high levels of physiological arousal. At these times, SAVI predicts that older age will no longer confer

benefits to emotional well-being. When people cannot engage in thoughts and behaviors that allow them to avoid negative, highly arousing situations, they cannot benefit from these age-related strengths. At the same time, age-related changes in physiological processes are posited to make downregulating physiological arousal more difficult. Thus, when exposed to an inescapable, unavoidable distressing event where they are unable to use emotion regulation skills, older adults are not posited to show improved reactivity and recovery compared to younger adults. Studies have found, for example, that when faced with multiple stressors from different life domains, older adults report greater cardiovascular and self-reported emotional reactivity than do younger adults (Wrzus et al. 2013). In other studies, researchers have found that when adults report having avoided an otherwise negative social interaction, older adults report less reactivity to this mildly distressing event than do younger adults. When they actually engage in these events, however, older adults report similar if not higher reactivity than younger adults (Birditt 2014).

Stressful situations are unavoidable at all ages, but some types of stressful situations that are inescapable and prolonged increase in prevalence with age. These include living with a chronic condition with unremitting and unpredictable symptoms; caregiving for a spouse with a dementia where the course is sometimes unpredictable and the prognosis is bleak; losing people in your close social circle that provide a sense of belonging and security; having a disease that causes cognitive impairment so that engaging in thoughts and behaviors for emotion regulation purposes becomes more difficult; or facing a terminal illness and the decline in functioning that is often-experienced. These are negative events that can happen throughout the life-span, but often increase in prevalence with age. For people experiencing these unavoidable situations that are associated with high levels of distress and emotional arousal, SAVI predicts that age advantages are attenuated, if not completely absent. For people who are placed in chronically stressful circumstances, emotional well-being will decrease over time.

## Conclusion

SAVI is a theoretical model positing that across adulthood, an increasing awareness that time is growing shorter and a lifetime of experience provides people with the information and the motivation to engage in thoughts and behaviors that benefit emotional experience. This has been used to explain why many older adults report higher levels of happiness and lower levels of negative distress than their younger counterparts. When faced with unavoidable situations that elicit prolonged physiological arousal, however, older adults will have a harder time modulating their response. The importance of current circumstances is vital, then, to predict emotional well-being and particularly age differences in well-being across adulthood.

## Cross-References

- ▶ [Positive Emotion Processing, Theoretical Perspectives](#)
- ▶ [Second Generation Socioemotional Selectivity Theories](#)
- ▶ [Socioemotional Selectivity Theory](#)

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## Stress and Coping in Caregivers, Theories of

Andrés Losada-Baltar

Department of Psychology, Facultad de Ciencias de la Salud, Universidad Rey Juan Carlos, Madrid, Spain

### Synonyms

Diathesis; Life events; Sociocultural stress and coping; Stress process; Vulnerability

## Definition

Providing care to someone in need is usually a lasting situation associated with multiple demands, responsibilities, tasks, and events that have an impact on caregivers' life. All these conditions are considered stressors, as they have the potential to challenge the homeostasis of the caregivers. The degree to which the stressors impact on caregivers' life depends, among other variables, on the way caregivers respond, manage, or act to resolve the challenges associated with caregiving, that is, it depends on the caregivers' coping strategies. The complexities associated with caregiving have led to the development of theoretical models aimed to understand the processes that generate stress on caregivers, in which caregivers' coping strategies play a major role.

## Introduction

Caregiving for an older adult dependent relative, especially those with dementia, is a highly demanding task. Caregivers often devote many years and many hours per day to looking after dependent family members, trying to cope with a wide variety of demands (supervision; behavioral and psychological symptoms in the care recipient; adjustments to one's personal, family, work, and financial circumstances; and so on). The often lengthy period over which caregivers are required to carry out the associated tasks makes it easy to understand why caregiving is considered a prototypical example of chronic stress (Vitaliano et al. 2004) and a natural experiment of extreme stress (Robinson-Whelen et al. 2001). Given the relationship between stress and health, it is not surprising that the majority of research carried out with caregiver populations relate caring for dependent persons with psychological and physical health problems in the caregiver (Pinquart and Sörensen 2003).

As early as the late 1980s it was suggested that the chronic stress to which family caregivers of persons with dementia are subjected had negative effects on the psychological and immunological adaptation of the caregivers (Kiecolt-Glaser

et al. 1987), a finding that would appear to be confirmed by longitudinal studies (Mausbach et al. 2008). Such circumstances may contribute to explaining the results obtained by Schulz and Beach (1999), who found that caregivers subjected to stress are at 63% more risk of death than noncaregivers and caregivers not experiencing strain. Nevertheless, despite the fact that many people experience negative consequences associated with caregiving, these vary from caregiver to caregiver, and some even report positive consequences. Thus, for example, Brown et al. (2009) reported that devoting at least 14 h per week to care was associated with reduced risk of death, suggesting the importance of considering the different psychosocial processes (e.g., coping) that characterize the task of providing care.

The recurrent observation that caregiving does not always affect people subject to similar demands in the same way has led to the development of theoretical models for explaining stress and coping in caregivers, models that try to account for the variability in the consequences of this process in this population. The variety of the models themselves reveals that caregiver stress is a complex and multi-causal phenomenon. Below are presented the principal theoretical models on stress among caregivers. The resulting classification of these models is intended to serve as a heuristic that facilitates a global understanding of the different factors that might be involved in the development and maintenance of caregiver stress. This classification does not pretend to be exhaustive, as there may be other conceptualizations of stress apart from those included here; nor should it be considered exclusive, since the models presented are compatible, and largely complementary.

## **Models with Major Emphasis on Research**

### **Stress and Coping Models**

Stress and coping models propose that the effect of stressors on outcomes (e.g., physical or mental health) varies between caregivers depending on variables such as coping or social support.

Perhaps the most widely accepted and influential theoretical models in the field of stress among caregivers of dependent older adults are Lazarus and Folkman's (1984) Transactional Model of Stress and Coping, adapted to caregiving (Haley et al. 1987), and the Stress Process Model (Pearlin et al. 1990). The two models are essentially similar and highlight the crucial role of people in the stress process, describing factors that mediate between stressors due to caregiving and the consequences of the caregiving for the care providers. Although there are arguments suggesting that looking after dependent persons means that difficult or stressful situations are maintained or accumulate, or even increase in their intensity and frequency over the course of the caring process (wear and tear model (Townsend et al. 1989)), the reality is that there also occur phenomena of adaptation to caregiving, and even improvements in distress levels associated with the effects of variables such as personal mastery (Mausbach et al. 2007a). Adaptation to the caregiver role can occur through the combined effect of the set of factors or dimensions involved in the process.

Stress and coping models identify first of all background and contextual variables such as caregivers' age, sex, kinship (to the care-recipient), or socioeconomic status. Caregiving processes and consequences have been found to vary depending on the sex or kinship of the caregiver (Romero-Moreno et al. 2014a). Second, these models recognize the importance of the stressors themselves, and most of the models differentiate between objective and subjective stress. Although there is no definitive way of distinguishing clearly between objective and subjective stressors, there does appear to be some degree of consensus that among the principal stressors facing caregivers are the behavioral and psychological symptoms associated with dementia (e.g., agitation or repetitive verbalizations). Behavioral and psychological symptoms of dementia or cognitive and functional status of the care-recipient are usually considered objective stressors. These symptoms are a main source of distress for caregivers and contribute significantly to the decision to institutionalize the care-recipient in a nursing home. But not all the behavioral and psychological

symptoms of dementia generate the same levels of distress. In fact, research findings suggest that the most common symptoms (e.g., memory problems) are not those associated with higher distress levels; on the contrary, disruptive behaviors (e.g., verbal aggression), the least frequent, actually cause the greatest distress (Fauth and Gibbons 2014). The scientific literature suggests the use of interventions such as behavior management as evidence-based therapies for reducing behavioral problems in care-recipients and that a reduction in stressful events is, in turn, associated with reductions in caregiver distress (Logsdon et al. 2007).

Pearlin et al. (1990) make a distinction between primary and secondary stressors. Primary stressors have to do with the needs and demands of the care-recipient (e.g., behavioral and psychological symptoms of dementia) and how these are satisfied by the caregiver. The effects of primary stressors on other areas, such as family or economy, are considered secondary stressors. Caregivers' appraisals of the stressors may generate the experience of burden or other feelings indicative of subjective stress, but they may also generate positive feelings such as finding meaning, fulfillment, or love.

The main contribution of the stress and coping models is the recognition that several variables may mediate between, on the one hand, caregivers' stressors and appraisals and, on the other, their psychological or physical health consequences. Social support, coping, and self-efficacy are some of the most widely studied mediators. These variables buffer the effects of the stressors on caregivers' distress and, as such, represent areas that are potential targets of interventions aimed at increasing caregivers' perceptions of mastery or self-efficacy for coping with care.

The last dimension identified by the stress and coping models is that referring to outcomes or consequences. Usually, these are classified in terms of psychological or physical consequences of caregiving, but others including time until institutionalization or family conflicts arising during the caregiving could be considered to fall into this dimension. Research findings are consistent in showing that caregivers, especially if the care-recipient has dementia, present more negative

mental and physical consequences, including those related to physiological health (Pinquart and Sørensen 2003). Although findings from longitudinal analysis, mostly analyzing depressive symptomatology, suggest no reduction in caregiving consequences over time, other studies have found an increase in risk factors for health problems (e.g., cardiovascular health) in caregivers (Shaw et al. 1999). In addition, caregivers' mood state seems to modulate physiological responses (Leggett et al. 2015), increasing the risk for developing physical health problems (Mausbach et al. 2007b).

Even though, as has been mentioned, several dimensions are included in the stress and coping models, feedback loops may be found between these dimensions or variables. For example, the use of maladaptive coping strategies for dealing with caregiving may increase the sources of stress or their intensity; a decline in physical or mental health may increase the appraisal of behavioral and psychological symptoms of dementia as stressful. Intervention studies have shown positive effects of interventions on variables such as caregivers' depression and delaying nursing home placement (Pinquart and Sørensen 2006). It is important to note that there is a general trend to identify caregiving with negative consequences (e.g., depression or anxiety). However, research has also shown that caregiving may be associated with positive aspects or outcomes for the caregiver, some studies reporting that up to 73% of caregivers identify one or more positive aspects related to caregiving (Cohen et al. 2002).

### **Sociocultural Stress and Coping Model**

Although the Sociocultural Stress and Coping Model (Aranda and Knight 1997; Knight and Sayegh 2010) is an extension of the stress and coping models already mentioned, it is considered relevant to highlight it individually given the extensive research carried out showing the influence on the stress process of social and cultural variables, such as race, familism, or the cultural reasons why caregiving takes place (Pinquart and Sørensen 2005). According to this model (Knight and Sayegh 2010), there exists a common core model for different ethnic groups including

stressors and how these are appraised by caregivers, with higher appraisals of burden generating more negative psychological and physical health consequences. Ethnicity and/or cultural values seem to have an important influence on mediator variables such as use of coping strategies or social support. For example, cultural groups with a strong reliance on the family may perceive higher levels of social support than other groups that do not share a salient value of the importance of the family. However, it is also possible to find dark sides of the role of the family in the caregiving process, as perceiving the obligation to care and not seeking help outside the family due to culturally transmitted norms may contribute to caregivers' distress by reducing their chances of using adaptive coping strategies for such a demanding task (Losada et al. 2010). The inclusion of sociocultural variables in studies aimed at understanding caregiver distress is also necessary in order to develop interventions sensitive to the cultural values of specific groups of caregivers that may increase both their interest in participating in the intervention and the likelihood of strengthening the effects of these interventions for improving their quality of life (Gallagher-Thompson et al. 2003a).

### **Vulnerability or Diathesis Models**

A substantial part of the explanation why caregiving is associated with negative consequences focuses on variables previous to the caregiving. Diathesis-stress models propose that negative consequences associated with caregiving result from a combination of prior vulnerability in the carer (personality factors, emotional disorders, etc.) and the stressful event that is caregiving. In this line, some studies show how people with a history of psychiatric disorders prior to caregiving were more likely to experience a recurrence of psychiatric problems after the onset of the care-recipient's illness, as compared to a control group (Russo et al. 1995). A study by Peter Vitaliano and colleagues (2014) shows that caregivers' distress could be partially explained through exposure to caregiving-related, genetic, and environmental factors (e.g., developmental history). Joling et al. (2015) provide longitudinal support for the

fact that predictors of caregivers' anxiety and depressive disorders are not characteristics of the care-recipient (e.g., neuropsychiatric symptoms) but rather of caregivers' mental and physical health at baseline. Personality dimensions, such as neuroticism or optimism, may also act as predisposing variables that can increase or reduce caregivers' chances of suffering distress (Hooker et al. 1998).

### **Life Events Models**

Caregiver stress can be the result of having to cope with major life changes or life events. Caring for dependent persons, especially those with dementia, involves coping with numerous potentially stressful life events, several of which can pose a threat to caregivers through the stress process. The moment of receiving a diagnosis, institutionalizing the care-recipient in a nursing home, or the death of the relative are some of the most distressing events that caregivers can experience. However, research on mental and physical health consequences once care-recipients are institutionalized in nursing homes or caregiving ends due to the death of the care-recipient is not conclusive, with mixed findings having been reported (Knight and Losada 2011). Distress reductions may be explained through reduction in the number of demands or exposure to stressors (e.g., behavioral and psychological symptoms of dementia) associated with the institutionalization of the care-recipient, while increase or maintenance of symptoms may be associated with factors such as feelings of guilt or increase in financial strains associated with institutionalization or unexpected death of the relative (Knight and Losada 2011).

### **Models with Major Emphasis on Interventions**

#### **Behavioral Models**

Behavioral models such as the one developed by Peter Lewinsohn and collaborators (1974) highlight the importance that pleasant activities or leisure have on well-being, by increasing the number of positive experiences (positive reinforcers). Research has shown that engaging in

pleasurable activities reduces caregivers' feelings of depression and chronic stress (Thompson et al. 2002). In contrast, a reduction in the number of pleasant activities or an increase in the number of aversive activities (punishment rates) contributes to distress. As already mentioned, caregiving generates many demands for caregivers, and this means a restriction in the number of activities they get to do. Nieboer and colleagues (1998) developed a model for explaining changes in depression over time, testing the role of activity restriction in this process. Through this model they confirmed that the demands associated with caregiving bring about disruptions in caregivers' life activities, increasing their depressive symptomatology (Nieboer et al. 1998). High levels of activity restriction may also increase cardiovascular risk in caregivers (Ho et al. 2014).

Mausbach and colleagues (2011) have developed a model that considers together the effect of pleasant activities and activity restriction: the Pleasant Events and Activity Restriction (PEAR) Model. According to these authors, the combination of the two dimensions permits better detection of psychological distress than considering them alone. They found that caregivers who reported low frequency of pleasant events and high activity restriction were those who reported higher levels of distress and use of negative coping strategies, as well as lower personal mastery and self-efficacy for obtaining support. Empirical support for behavioral models based on pleasant activities and activity restriction has also been obtained through interventions such as the one developed by Dolores Gallagher-Thompson et al. (Gallagher-Thompson and Steffen 1994). More recently an intervention aimed at increasing caregivers' behavioral activation has shown that, compared with a control group, participants in a behavioral activation intervention showed lower cardiovascular risk, as well as lower levels of depressive symptoms at the end of the intervention (Moore et al. 2013).

### Cognitive Behavioral Model

Cognitive Behavioral Models (CBT) give a central role in the explanation of distress to people's beliefs or schemata. These beliefs or cognitions

are shaped by life experiences (e.g., cultural or family experiences) and determine the way the person perceives or interprets the world. One's emotional and behavioral responses are guided by one's way of thinking. Even though the literature analyzing the influence of caregivers' thoughts or beliefs is sparse, the available studies seem to support the association between dysfunctional thoughts or irrational beliefs and caregiver distress (Losada et al. 2010; McNaughton et al. 1995). CBT models also consider as central the link between thoughts and behavior. These models share with the behavioral models an endorsement of the importance of activities as a way of increasing the availability of reinforcers in caregivers' lives. However, CBT models consider that in order to promote the performance of pleasant activities by caregivers it is necessary to treat the cognitive barriers that prevent caregivers from doing such activities (Losada et al. 2006). For example, it is not uncommon to find caregivers who believe that asking for help is not a good way to cope with caregiving, because they are the ones that know best how to care. Also, doing pleasant activities without the care-recipient may be considered egoistic, and asking for help from one's children may not be considered an option because "they have their own lives and problems." In this context, CBT interventions include exercises for changing rigid thoughts such as those mentioned as a necessary step for promoting the performance of activities (Gallagher-Thompson et al. 2003b; Losada et al. *in press*). The strongest support for the cognitive behavioral model comes from the intervention literature, CBT interventions having been considered empirically based therapies for reducing caregiver distress (Gallagher-Thompson and Coon 2007).

### The Third Wave of Behavioral Therapies

The so-called third wave behavioral therapies includes therapies such as Acceptance and Commitment Therapy (ACT), Mindfulness-Based Cognitive Therapy (MBCT), and Functional Analytic Psychotherapy (FAP). Although they involve clearly different interventions, they share an experiential style and highlight the importance of the context and functions of the problems.

For example, most caregiving intervention research (e.g., on cognitive-behavioral interventions) has addressed the issue of training caregivers in strategies for changing cognitions or behaviors that may increase their chances of coping better with caregiving. However, caring for a relative that has a chronic or deteriorating illness such as Alzheimer's is linked to stressors (e.g., cognitive deterioration), emotions (e.g., sadness), or thoughts (e.g., "why is this happening to me") that are often impossible or very difficult to change. Trying to change, avoid, or control these events may increase caregivers' distress; on the other hand, helping caregivers to accept them may increase their chances of coping in effective ways. Training in acceptance strategies and in commitment to personal values are two of the pillars of ACT interventions (Márquez-González et al. 2010). Interest in these types of therapies has increased enormously in recent years, and although the number of studies in the caregiving field is sparse, research suggests that variables such as experiential avoidance or cognitive fusion contribute to caregiver distress (Romero-Moreno et al. 2014b; Losada et al. 2014; Spira et al. 2007), while interventions involving Mindfulness (Whitebird et al. 2013) or Acceptance and Commitment Therapy (Losada et al. *in press*) seem promising in terms of their positive effects on caregiver distress.

### Systemic and Interpersonal Models

There is a general consensus regarding the link between the family and interpersonal relationships in the immediate context and mental health problems reported by caregivers, and theoretical models based on the importance of the family in the caregiving process have been developed (Qualls 2014). Family structure and communication styles may contribute significantly to the generation of distress. For example, expressed emotion by caregivers, a variable that can increase the chances of interpersonal conflict, is predictive of negative care-recipient behaviors such as being uncooperative or angry (Vitaliano et al. 1993). Watching the suffering associated with the physical or cognitive decline of a loved one is also a mechanism through which caregiving generates mental or physical health

effects in the caregiver (Monin et al. 2010). Adequate adaptation of the family to the changes that occur in their life due to caregiving, through the redistribution of roles or improved communication styles, for example, may be crucial to the management of distress (Qualls 2014). Mitrani and colleagues (2006) found that the inclusion of family functioning in a stress process model contributes significantly to the explanation of caregivers' distress: objective caregiving burden effects on distress were mediated by family function. Considering this, it is not surprising to find family-focused intervention therapies aimed at empowering families, balancing burdens of care, or facilitating the restructuring of family members' roles (Monin et al. 2010). The inclusion of other family members in therapy has also been suggested as an important factor in obtaining positive outcomes in caregiving interventions (Mittelman et al. 2004), and evidence has been found suggesting that family therapy (e.g., Structural Ecosystems Therapy) may reduce caregiver distress but should be complemented with technological resources that help such interventions respond to caregivers' individual needs (Eisdorfer et al. 2003).

### Conclusions

The main contributions of the reviewed models is that they allow an understanding as to why similar stressful or demanding situations do not generate similar mental or physical health consequences in caregivers, and this suggests potential target variables for interventions. The availability of empirically supported models or theories such as those reviewed here may contribute to the identification of factors or processes of special interest or that are key to the development of interventions.

Even though there has been a considerable increase in the number and quality of studies carried out with caregivers, we agree with Peter Vitaliano and colleagues (2014), who stated that "despite 50 years of formal caregiver research, we still need to find optimal ways to identify caregivers at the highest risk for psychological distress." This issue is complicated by the fact that research has provided findings to suggest that the

effect of stressors may vary throughout the caregiving process and that events may be perceived as stressors at some points of the process but not at others. Furthermore, coping strategies that are successful for dealing with demands or stressful situations at certain times in the process may not be successful at others. Research is also required for improving our knowledge of the sources of heterogeneity within ethnic or cultural groups (Pinquart and Sörensen 2005). These issues show that there is a clear need for more methodological sophistication in the study of the variables that influence caregivers' stress and coping resources, which could come in the form of longitudinal and experimental designs, as well as assessment procedures for complementing the use of self-report measures (Knight and Sayegh 2010; Zarit et al. 2014).

## Cross-References

- ▶ Behavioral and Psychological Symptoms of Dementia
- ▶ Challenging Behavior
- ▶ Stress and Coping Theory in Geropsychology

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## Stress and Coping Theory in Geropsychology

Jeffrey Proulx<sup>1</sup> and Carolyn Aldwin<sup>2</sup>

<sup>1</sup>Department of Neurology, School of Medicine, Oregon Health and Science University, Portland, OR, USA

<sup>2</sup>Center for Healthy Aging Research, Oregon State University, Corvallis, OR, USA

### Synonyms

Strain – psychological or physiological distress;  
Stressor – environmental demand

### Definition

Stress refers to person-environment transactions in which environmental demands outweigh the individuals' resources, resulting in psychological and/or physiological dysregulation.

Coping refers to effortful behavioral and cognitive strategies activated in response to actual or anticipated stressful situations that serve to regulate both the stressful context and its negative socio-emotional and physiological consequences.

### Introduction

Stress and coping theory focuses on how people manage the adverse effects of stress (Lazarus and

Folkman 1984). People cope with stress in a variety of ways, depending on personal preferences and/or environmental demands (Carver and Connor-Smith 2010). Coping with stress is a dynamic process that may change from moment to moment, requiring reappraisal as to whether the stressor represents a threat, harm, or challenge, and whether there are sufficient resources to manage it. Therefore, stress and coping processes are not simply causal relationships between environmental threats and responses, but transactions between the individual and the environment.

The study of stress and coping is salient to geropsychology because stress is thought to accelerate the aging process due to the repeated activation of the stress response system across the life span (Seeman and Gruenewald 2006; Almeida et al. 2011; Dallman and Hellhammer 2011). Theoretically, coping strategies mitigate the adverse effects of stress and thus promote a longer health and life span, although most studies suggest that negative coping strategies, such as expressing hostility or religious alienation, increase the risk of mortality. The goal of this entry is to provide a basic primer on stress and coping and their health effects and then discuss how these process affect and are affected by aging.

## Stress

Stress is defined as challenges or threats in the environment that tax a person's resources and may result in socio-emotional, cognitive, and physiological dysregulation (Lazarus and Folkman 1984). However, the effects of stress are not entirely negative and can be positive in both the short and the long term. Stress activates the physiological and cognitive resources necessary for dealing with environmental or intrapersonal demands. In the short term, stress can facilitate cognitive, psychological, or physiological functioning, as when individuals get "psyched up" to do well on a test or in an Olympic race. Dealing with stressors can also lead to long-term growth, if individuals develop better coping skills, which can to greater mastery for future stressors.

However, extreme stress, such as trauma or chronic stress, can rapidly deplete an individual's resources, leading to physiological and psychological dysfunction.

As Aldwin (2011) noted, there have been three ways of defining stress: as physiological or psychological reactions, also called strain; as environmental demands or *stressors*; and as transactions between the person and the environment that result in appraisals of threat, harm/loss, challenge, or benign.

## Physiological Responses to Stress

Physiological strain is characterized by the activation of neuroendocrine stress networks, which are highly conserved across species. These networks mediate responses between stressors and physiology through a cascade of neurochemical signals that function slightly differently depending on the duration of the stressor (Dallman and Hellhammer 2011), which can be categorized as immediate, short-term, and long-term stress response. The immediate stress response system is characterized by rapid activation of the neuroendocrine system resulting in direct enervation of various organ systems. For example, the acting of standing up requires an increase in blood pressure, partially mediated through direct neuroendocrine enervation of arteries and the heart muscle. With aging comes impairment of the catecholamine system, which results in problems such as orthostatic hypotension (a failure of blood pressure to increase quickly enough upon standing), resulting in dizziness. A slightly more sustained neuroendocrine response is mediated through the sympathetic adrenal medullary (SAM) axis that releases catecholamines (i.e., epinephrine and norepinephrine) into the blood stream. For example, being threatened by a dangerous animal requires a burst of energy to either fight the animal or to flee. Catecholamines provide this energy by stimulating increases in respiratory and heart rates and increases in blood pressure. However, catecholamines are toxic and long-term chronic elevations can result in serious harm and even death, as exemplified when individuals go into shock due to extreme stress.

Thus, longer-term stress responses are mediated through the hypothalamic-pituitary-adrenal (HPA) axis. The detection of a long-term threat sets into motion a series of neuroendocrine responses starting in the hypothalamus that leads to successive responses in the pituitary and then the adrenal cortex, where glucocorticoids such as cortisol are released into the blood stream after a few minutes. Glucocorticoids mitigate the harmful effects of the catecholamines and provide a different energy source by releasing glucose from the liver for use by the muscles and brain in order to galvanize an individual for the stress management over a long period. Glucocorticoids also moderate the immune system through the release of cortisol into the blood stream, although long-term activation of the HPA axis can also result in chronic inflammation.

Cortisol fluctuates in diurnal rhythms that are characterized by sharp increases in the morning, called the cortisol awakening response (CAR), which is then followed by a general decline throughout the rest of the day. However, age, personality, and contextual factors may lead to flatter rhythms and higher levels of cortisol across the day, which, if chronically elevated, can also be deleterious to an individual. For example, high levels of cortisol over long periods of time are associated with immune system dysfunction, hippocampal shrinkage, and cardiovascular disease (Almeida et al. 2011). In turn, chronic inflammation may contribute to a host of chronic illnesses in later life, including cancer, heart disease, diabetes, and dementia.

### Stressors

Aldwin (2011) identified four basic types of stressors, based upon severity and duration: trauma, stressful life events, chronic role strain, and daily stressors or hassles.

**Trauma.** Traumatic events include violent or life-threatening situations, which hold the potential of severe harm or death. These include combat, traffic accidents, domestic violence, rape, and natural disasters, such as earthquakes or tsunamis. One example of the long-term outcome of trauma is posttraumatic stress disorder (PTSD) in which individuals may continue to present with the

negative responses to a traumatic event and have altered physiology (e.g., dysfunctional cortisol levels) long after the event has ended.

**Stressful life events.** Stressful life events (SLE) are more common and include problems such as divorce, loss of a loved one, and job losses. Both SLEs and trauma are associated with long-term health consequences and dysfunctional stress responses. Aldwin et al. (2014) showed that older men who have chronically moderate or high levels of stress have about a 50% higher risk of mortality than those with consistently low stress levels.

**Chronic role strain.** Pearlin and his colleagues (2005) defined chronic role strain as enduring stress associated with major roles such as work, marriage, parenting, household maintenance, and chronic health problems. Role strain may be due to competing social roles, such as parenting, career, and caretaking for older relatives, which may lead to considerable distress. Currently, over 43 million Americans are providing care to older adults, and it is not surprising that caregiving, especially to physically or cognitively frail older adults, is a major source of chronic stress for many families (Knight et al. 2011).

**Daily stress.** Daily stressors, sometimes referred to as hassles, are challenges that arise out of everyday living (Almeida et al. 2002). Examples of daily stress include arguments with children, work deadlines, and the delays associated with commuting. Usually, daily stressors do not require major life changes in adaptation although these events may disrupt the normal rhythms of daily life. While traumatic events and stressful life events are known to affect physiology and mental health in the long term, daily stressors are associated with short-term physiological changes such as increases in cortisol levels and heart rate (Almeida 2005). However, the effects of daily stressors are not necessarily restricted to that day's well-being; Aldwin and colleagues (2014) showed that chronic elevations of hassles can also lead to elevated mortality risks. Not surprisingly, daily stressors are more common than SLEs and trauma; Almeida's review indicated that adults experience daily stressors 12 days within an average month (Almeida

2005). Nonetheless, cross-sectional studies suggest that middle-aged and older adults generally report fewer daily stressors than younger adults, but longitudinal studies suggest more complex patterns in exposure to daily stressors (see Aldwin et al. 2014).

### Stress as a Transaction

For Lazarus and Folkman (1984), stress was defined as a transaction between environmental demands and individual resources. Stressful episodes, such as a car breaking down, may be simply a hassle for someone with the resources to fix the car, but a major crisis for a homeless person living out of the car and who simply cannot afford car repairs. Thus, how an individual appraises the stressfulness of the situation, and then copes with it, is not simply a matter of environment or personality, but a transaction between the two.

Lazarus and Folkman (1984) defined *primary appraisal* as an evaluation of the type of the stress, which can be appraised as a threat, a harm/loss, a challenge, or benign (that is, not involving any stress). These are important distinctions because some people may appraise an event as threatening, while others may appraise the same event as simply challenging, thus leading to differences in how one manages the event and the steps he or she will take in the next step of appraisals. Sometimes circumstances may lead a person to more than one type of appraisal. For example, the death of a spouse may involve not only the appraisal of a loss but is also the threat to future financial or social well-being. *Secondary appraisal* is an assessment of resources a person has to manage the stress and thus indicates how stressful the event is to that individual.

Lazarus and Folkman (1984) hypothesized that personality affects appraisal processes, and recent research confirms this (Mroczek and Almeida 2004). For example, neuroticism is associated with a higher likelihood of experiencing stressors, responding more negatively to stressors, and higher levels of stress hormone production as a reaction to stressors (Miller and Pilkonis 2006). However, consistently appraising minor events, or hassles, as highly stressful is associated with increased risk of mortality, independent of

neuroticism (Aldwin et al. 2014). Nonetheless, how individuals cope with stress may be more important to long-term outcomes than simple exposure to stress (Aldwin 2011).

## Coping

Coping is rooted in the understanding that there are individual differences in how people manage stress. However, definitions of and approaches to assessing coping reflect different schools and theoretical assumptions. For example, early approaches from psychoanalysis assumed that adaptation processes were largely unconscious; in general, the evolution of coping theory has gone in the direction of greater flexibility and conscious effort.

### Coping Theory

**Defense mechanisms.** Early psychodynamic theory focused on unconscious and protective defense mechanisms that were seen as attempts to alleviate internal conflicts arising from stress. Further, defense mechanisms were seen as both automatic and enduring aspects of an individual's personality. Defense mechanisms described by Anna Freud (1971) include denial, projection, and sublimation, among others. For Freud, defense mechanisms are inherently dysfunctional because they distort reality in order to decrease psychological threat.

In contrast, Vaillant (1977) found that patterns of defense mechanisms could become more adaptive as people matured. He examined long-term interviews with the Grant Study men, a major longitudinal study which has been following healthy Harvard male sophomores. Vaillant devised a widely used four-level hierarchy that indexed the developmental progression of defense mechanisms. Level I defense mechanisms were considered pathological and characterized by objective breaks from the actuality of a stressor. Level II included defenses such as passive-aggressive behavior, acting out, and projection. The defense mechanisms in Level III were considered to be neurotic and included intellectualization, disassociation, and

repression, which were thought to distort reality less than the defense mechanisms in the previous levels. Level IV defense mechanisms included sublimation and altruism, which were seen as the most mature coping responses. This view of defense mechanisms suggested that they address more than internal conflicts and can be used as strategies for engaging with external stressors. For example, a parent who cannot reconcile the death of a child may use denial or sublimation to convert unacceptable urges (revenge) into useful patterns of behavior, such as devoting time to a group like Mothers against Drunk Driving. However, Cramer (2015) noted that it was difficult to assess how well people used defense mechanisms because it is difficult to report on unconscious processes, casting doubts on the validity of self-report measures of defense mechanisms.

**Coping styles.** Coping styles theories were based on both social cognition and personality theory (Aldwin 2011). From a cognitive perspective, coping styles have traditionally been defined as either *avoiding* or *approaching stressors*. *Avoidance coping* diverts the focus away from stressors, which has also been referred to as suppressing or blunting. *Approach coping* refers to the cognitive process of information seeking to address a stressor and has also been referred to as sensitizing or monitoring.

Avoidance and approach coping were thought to inhabit opposite poles on a coping continuum. This polar relationship may have mapped easily on typical psychological scales and simplified coping measurement and therefore provided an attractive approach for measurement. However, more in-depth investigations revealed that coping was more complicated than polar structure styles suggested. People may use both avoidance and approach in reaction to the same stressor, either sequentially or for different aspects of the problem (Lazarus and Folkman 1984). For example, a woman may initially ignore a lump in her breast, but subsequently undergo a mammogram.

The concept of enduring coping *styles* posited that they are strongly related to personality characteristics. For example, Carver and

Connor-Smith (2010) found that approach styles of coping were associated with conscientiousness, extraversion, and optimism. On the other hand, they found that neuroticism was linked to disengagement coping. The results of these studies showed that coping styles could be more nuanced than polar measures of coping styles imply. For example, the span of time between when a person uses coping and when they report that event affected how people remembered the how they coped with stress. Further, age and stressor severity influenced how people coped with stressful events. These results indicated that coping styles were more variable than early explanations of coping styles hypothesized.

**Coping processes.** Coping processes refer to effortful cognitions and behaviors activated in response to actual or anticipated stressful situations that serve to regulate both the stressful context and its negative socio-emotional and physiological consequences. Coping is thought to be plastic, or responsive to situational demands and personal preferences, as well as sociocultural influences. Note that both problem- and emotion-focused coping can be cognitive (e.g., making plans or re-assuring one's self) or behavioral (e.g., acting to directly affect a situation or using exercise to manage stress).

For Lazarus and Folkman (1984), coping processes reflect primary appraisals which indicate the type of threat. Secondary appraisal involves identification of resources, including coping skills, as well as the level of stress. This is a dynamic process which changes across time, coping efforts may influence stress appraisals (perhaps the problem is easier or more difficult than initially thought), which in turn can lead to modification in coping strategies. Rather than reflecting stable coping styles, coping is plastic, or malleable, and can change depending on variation in situational demands or across time. How one copes with a work problem may be very different from coping with a death of a loved one. Because coping is plastic, it is also open to change – people can and do learn more efficacious coping strategies, either through therapy, stress management interventions, or the experience that comes with age.

While there is little consensus as to the exact number of coping strategies used, five of the more commonly assessed coping strategies assessed are: problem-focused coping, emotion-focused coping, social support, religious coping, and meaning making (Aldwin 2011). *Problem-focused* coping is the process of taking direct action to manage and remove a stressor. Problem-focused coping can also include seeking new information or exploring new options for handling the stressor than one otherwise employs. *Emotion-focused* coping is the process of managing the emotional responses a stressor elicits, which are often negative. These responses can range from ignoring the problem to substance use. Emotion-focused coping is often associated with negative outcomes, especially if this approach leads to rumination, catastrophizing, or engaging in poor health behaviors to handle a stressor. However, Austenfeld and Stanton (2004) showed that emotional processing, in which one tries to understand why one has these negative emotions, may lead to more positive outcomes.

*Seeking social support* is characterized by reaching out for emotional support and instrumental support. *Religious coping* involves turning to God, a higher power, or one's religious community for support, either through intercessory prayer or for understanding and support. *Meaning making* involves cognitively reframing stressful circumstances to come to an understanding of trauma or loss. Meaning making often compels a person to contemplate the reality of a stressor much more deeply, which may lead to more pain in the short term but have positive and adaptive outcomes later on.

Thus, it is important to be able to distinguish between the more immediate outcomes as a result of coping and the outcomes of coping that lead to long-term growth. Coping processes appear to be unrelated from situation to situation, reflecting a flexible approach tailored to different circumstances. However, patterns of coping processes tend to cluster together when data on coping processes are aggregated over time (Ptacek et al. 2006). These results do not necessarily support a personality-based approach to coping as

much as they suggest that adults are better at relying on strategies that have worked well in the past.

Finally, we tend to think of coping as something that individuals do, but coping is not solely a characteristic of the individual, but depends heavily upon contextual and social resources. Individuals, families, and other social institutions provide not only social support, but also influence how we appraise stress, what coping strategies are best suited to the situation, and can facilitate or provide barriers to effective coping.

### Coping and Psychological Health

The effect of stress and coping on mental health is often a product of context and coping choices a person makes. This suggests that the psychological impact of stress and coping is highly variable between individuals, and possibly across ethnic groups. Jackson et al.'s (2010) provocative finding that African Americans who used poor health behaviors as ways of coping with stress, such as smoking and eating high calorie foods, had lower rates of depression than whites but higher likelihoods of poor physical health outcomes. Of course, this does not imply that psychologists and public health experts should promote poor health behaviors as coping choices, but it does illustrate the heterogeneity of relationships people can have with stress and coping and the importance of understanding context and individual differences as predictors of coping outcomes. Palliative strategies may be the only coping options when dealing with uncontrollable chronic stress.

Problem-focused approaches to coping are generally associated with better psychological health, and emotion-focused and support-seeking approaches to coping are associated with poorer psychological health (Aldwin 2011). However, coping outcomes can be more nuanced and have different effects depending on the circumstances. For example, a strong social network is usually associated with good mental health outcomes, but the act of reaching out to the network in times of need may lead to strained relationships and psychological distress. Similarly, Pargament's (Pargament et al. 2004) work shows that religious

coping is often associated with good psychological outcomes. However, negative religious coping, or religious alienation – e.g., blaming God or feeling deserted – can lead to a negative outcome if a person finds estranged from the congregation (Abu-Raiya et al. 2015).

### Coping and Physical Health

How one copes with stress appears to be associated with physical health, yet conclusions as to the extent of these effects are somewhat mixed (Biondi and Picardi 1999). Some coping strategies are associated with direct effects on health, such as calming techniques that may lower blood pressure. Coping may also interact with a stressful event such that the coping strategy will have an effect on physiological outcomes only in the presence of a stressor. For example, calming oneself in a stressful circumstance may have significant effects on heart rate, but there may be little change when there is no stressor. Coping may also mediate between a stressor and health outcome. For example, a stressful experience may lead to a specific type of coping behavior, such as substance abuse, to blunt the emotional toll of a stressor, which leads to poor health. On the other hand, people may exercise when they feel stressed, which can lead to better health long-term health outcomes.

Some coping styles, such as defensiveness and repression, may be associated with higher levels of cortisol, but this association has proven to be difficult to reproduce. However, other data suggest that the effect of coping on the immune system can be very different depending on whether an individual uses emotion-focused coping or problem-focused coping. Patients who were positive for HIV that employed problem-focused coping tended to show increases in CD4+ cells, which are instrumental in immune system signaling but tend to be lower in HIV-positive patients. However, emotion-focused coping in HIV-positive patients was related to a reduction in immune response in an already besieged immune system, but other studies of individuals coping with cancer, e.g., Masters et al. (2009), have shown that emotion processing may be related to better inflammatory outcomes.

Thus, how one copes with illness may be important for well-being and even survival. Given the increased prevalence of chronic illness in later life, stress and coping processes may be of even greater importance for older adults.

### Stress, Coping, and Aging

The following sections will address how stress and coping processes are affected by age and the influence they may have on the aging process.

#### Stress and Aging

Whether or not exposure to stress changes with age varies as a function of which type of stress is being measured (Aldwin 2011). Thus, we will address age-related changes separately for the different types of stressors identified earlier. However, we will first preface our remarks with a general discussion of age differences in vulnerability to stress.

There is little doubt that, in general, vulnerability to *physical* stressors increases with age (Charles 2010). For example, older adults are particularly sensitive to heat stress and new viral and bacterial strains, in part due to changes in the neuroendocrine and immune systems with age, but also due to underlying chronic illnesses such as cardiovascular disease or diabetes which may make them more vulnerable. In general, it appears that older adults are more vulnerable to stressors in laboratory settings, such as being injected with adrenaline or doing stressful tasks. However, older adults appear to be less vulnerable in some field studies – they often report fewer stressors and rate problems as less stressful (Aldwin et al. 2014). Older adults may have learned to distance themselves from stressors, either through taking a larger perspective or as a means of self-protection from the adverse effects of stress. However, this protection may fail if the stressfulness of the situation is too high.

**Trauma and aging.** Younger adults often have a higher prevalence of traumatic events, which tends to be associated with unexpected death and physical and sexual violence (Aldwin 2011). Older adults report fewer traumatic events than

younger and middle-aged adults, but older American adults are more likely to report more trauma associated with combat. However, the experience of trauma tends to be more of a function of cohort than of age, especially in those countries that have experienced war and civil unrest.

**Stressful life events and aging.** Early studies assumed that older age is a difficult and stressful stage of life. However, older adults routinely report fewer stressors on standard inventories. Most SLE inventories are often comprised of items that are more common among middle- and younger-aged adults (e.g., concerns with children, getting married, new jobs). However, even inventories which are more relevant to older adults show longitudinal decreases with age (Aldwin et al. 2011). In general, the types of SLEs change with age, with young adults more likely to report SLEs such as divorce, education, job loss, while older adults are more likely to report deaths of loved ones, health problems, such as chronic illness, and caregiving stressors. Nonetheless, the number of life events tends to decrease with age, with the exception health-related stressors (Aldwin et al. 2011).

**Chronic stress and aging.** It is widely assumed that older adults are more likely to experience chronic stress than younger adults, due to health problems, restricted incomes, and caregiving duties. However, to our knowledge, there are no studies examining age differences in chronic stress. Younger adults may also experience chronic stress, such as taking care of a disabled child, poverty, adverse working conditions, and the like. Thus, studies are needed which examine both types and the level of chronic stress in adulthood.

**Hassles and aging.** There are considerable individual differences in longitudinal patterns of daily hassles (Aldwin et al. 2014). Self-reports of exposure to hassles are highly variable across time and may be more related to cohort and situational factors than due to aging itself. However, the intensity or appraisals of stress ratings of hassles has been shown to follow a clear age-related or developmental pattern, with stress severity decreasing from mid to late life and then increasing again in very late life. Perhaps older adult's greater experience provides perspective on the relevance of stressors, or it may be that their health conditions

may worsen with stress (e.g., high blood pressure), and thus they have learned to appraise things as less stressful to avoid getting upset.

**Appraisals and aging.** There are age-related differences in some appraisals. Compared to middle-aged men, older men are less likely to appraise problems as challenges, but they are also less likely to report being annoyed by daily hassles (Aldwin 2011). Surprisingly, there are few age-related differences in the number of loss or threat appraisals. Thus, older men report fewer stress appraisals overall, which is, in turn, associated with lower reporting of stress ratings.

**Summary.** Clearly the relationship between stress and age is complex, varying by the type and severity of stressors. However, older adults may be adept at self-protective mechanisms, especially among those than are young-old (e.g., 65–75). In part, this may reflect survivor effects – men who consistently report moderate or high levels of stressful life events, or who consistently appraise their hassles as very stressful, are less likely to survive into late life (Aldwin et al. 2014). However, even for those who survive into very late life, those protective mechanisms may begin to fail, as indicated by higher stress appraisals among the old-old (75+). The increase in health problems and cognitive impairment and the decrease in functional health in very late in life may make it more difficult to cope with stressors.

### Coping and Aging

Understanding age-related changes in coping is also complex. Early researchers thought that older adults were more passive copers (Gutmann 1974). For example, Folkman et al. (Lazarus and Folkman 1984) noted that older adults report fewer problem-focused coping strategies. However, there appears to be no differences in coping effectiveness between age groups (Aldwin 2011), and it is possible that older adults may be adept at conserving their resources while maintaining an equal sense of coping effectiveness as younger adults, suggesting greater efficiency. For example, a middle-aged person may address a fallen tree in the yard by assessing the problem and trying to mitigate it. That may mean spending all day chain sawing, disposing of the remains, and cleaning up

the shavings and bark left in the lawn – a very high level of effort. An older adult may be more likely to call a tree service to come and take the fallen tree away, which requires less expenditure of effort. So the older adult is technically using fewer problem-focused strategies, but is still efficaciously handling with the problem.

Other researchers have also identified positive aspects of older adults coping. As Vaillant (1977) indicated, older adults tend to use more “mature” defense mechanisms, allowing them to more graciously deal with stress. Older adults also use more religious coping, although it is unclear whether this is a cohort or an aging effect. Nonetheless, religious coping is often effective at staving off depression (Pargament et al. 2004). There are also indications that older adults may be more efficacious in coping with interpersonal problems (Berg and Upchurch 2007). They may be better able to regulate their own emotions and not accelerate or exacerbate interpersonal problems. We suspect that this may be part of a longer-term perspective. Older adults may understand the importance of maintaining good relations in general and become less upset over specific incidents.

Johnson and Barer (1993) studied coping among the very old (80+) in San Francisco and found that they utilized various strategies to avoid and/or minimize stress in their lives, including routinization and anticipatory coping. Most older adults in their sample had developed comfortable routines which minimized stress, such as eating the same thing for breakfast every morning or doing the food shopping at specific times every week. When faced with a new situation, such as going to an unfamiliar location, they would carefully plan out their route to avoid making a left-hand turn in big city traffic. They also used downward comparisons, acknowledging their own limitations, but using the problems of others to say that, “it could be worse.” Thus, they used a variety of strategies to successfully maintain psychological and social functioning.

## Conclusion

In many ways, asking the question, does stress and coping change with age, is too simplistic and

does not address the substantial interindividual differences in intraindividual change. Further, the answer may vary by type of stressor and/or coping strategy. Nevertheless, we have found that, in general, stressful life events decrease with age, in part due to changing roles. Young people are more likely to get married, divorced, go to jail, etc., although older adults are more likely to report losses due to bereavement and health problems. But older adults also tend to appraise problems as less stressful.

Whether younger or older adults are better copers is also not an easy question to answer. On the one hand, older adults often expend less effort in problem-focused coping, which may seem to be more passive. However, this may actually conserve energy and reflect more efficacious coping. Older adults often have learned that many, if not most, problems solve themselves or can be helped to resolve with subtle encouragements. And there is much evidence to suggest that people use more mature defense mechanisms and are better at emotion regulation and perhaps at managing interpersonal conflict. But not all individuals develop these more sophisticated and nuanced coping strategies, and those with cognitive impairment may have a particularly difficult time managing the environment and regulating their emotions.

It is likely that stress can accelerate the aging process and that older adults are more vulnerable to the negative effects of stress. However, older adults have learned various strategies to avoid and/or minimize stress in their lives, including routinization, anticipatory coping, and taking a broader perspective. Older adults may have also learned what types of coping strategies are effective for them and becoming more efficient copers and achieving goals with less expenditure of energy. Thus, coping with stress can mitigate the harmful effects of stress and is an integral part of both optimal aging.

## Cross-References

- ▶ [Aging and Psychological Well-Being](#)
- ▶ [Mental Health and Aging](#)
- ▶ [Psychological and Personality Testing](#)

- ▶ Resilience and Health
- ▶ Strength and Vulnerability Integration
- ▶ PTSD and Trauma

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## **Stress and Well-Being: Its Relationship to Work and Retirement for Older Workers**

Katey Matthews

CMIST, School of Social Sciences, University of Manchester, Manchester, UK

### **Synonyms**

Effort-reward imbalance; Job demand-control

### **Definition**

Well-being is defined as the overall mental and physical health of the individual. Work is defined as paid employment. The term ‘older workers’ is generally defined as those aged 50 and over, although studies sometimes use the term to refer to individuals of State Pension Age only.

### **Introduction**

Understanding the health and well-being of older workers, and the influence stress may bear on this relationship, is currently an important issue. In response to increasingly aging populations, governments in many developed countries are seeking to increase the age of pensionable retirement to retain as high a proportion of the older population as possible within the workforce in order to overcome the financial and economic burdens arising from older people living healthier lives and therefore spending longer periods in retirement and in receipt of pensions. However, while encouraging longer periods of workforce participation may be of benefit to some older people, there is a high likelihood that extending the working lives of those employed in occupations which are characterized by high levels of stress will lead to a worsening of mental and physical health for those with existing issues or the onset of poorer health among those without.

In addition to the need to extend working lives for economic purposes, evidence consistently suggests that there are benefits to continuation of the working role in later life in terms of health and well-being, financial circumstances, and social integration. Role continuity theories promote the idea that continuing employment may provide a means of promoting good mental well-being by remaining socially productive, feeling valued, having adequate financial security, and maintaining social networks useful for both support and resources. Similarly, these theories suggest longer periods of work help combat the negative effects of role loss in later life, which bring about reductions in social identity, support networks, and feelings of purposefulness. However, again, while some occupations may easily lend themselves to the provision of these personal, social, and economic benefits for workers, others may not, and people continuing to work without these benefits are unlikely to observe any benefit of remaining in the workforce for longer periods of time.

Little is known about the effects of working in general in later life on the health of older people. Previous studies examining relationships between employment and well-being among older populations have produced mixed results, with some suggesting it might be beneficial to well-being, others that it is detrimental, and some that there is no significant relationship. There are many factors which are likely to be contributing to this variation in results, including definitions of “later-life employment” and “retirement” and the wide range of health and well-being outcomes, as well as the various means of measuring them covered by different studies. Studies which consider older workers as a homogenous group are likely to be masking effects which might be observed if workers were stratified on the basis of personal or workplace characteristics. Interestingly, when work is stratified on the basis of measures of stress, results consistently show a negative relationship between employment bearing characteristics of high-level stress and various well-being outcomes, and occupations which are characterized by low levels of stress are consistently associated with better health and

well-being. Additionally, the stress of work in later life has been shown to influence well-being not only in the period of later life employment itself but also across subsequent periods of transition into retirement as well as within early retirement. This work will outline some of the key evidences highlighting these associations and discuss the mechanisms through which work-related stress in older age potentially impacts the well-being and health of older people.

### **Theoretical Models of Stress at Work**

Research concerning the relationship between stress and work across the entirety of the life course has focused on two key theoretical frameworks, both of which aim to reduce the complexity of common workplace interactions into key elements which may have subsequent consequences on health and well-being outcomes. The first of these frameworks uses the demand-control model (Karasek 1979), which refers to the levels of “job strain” to explain the relationship between the working environment and health. The second key framework uses the more recently proposed effort-reward imbalance model (Siegrist 1996) to demonstrate the importance of societal reciprocity within the role of a worker as a means of maintaining good emotional well-being across the working life course and beyond.

#### **The Demand-Control Model**

The job demand-control model aims to explain the relationship between work stress and well-being in terms of the balance between workload and the ability of the worker to handle this workload. The ability of workers to successfully manage their workloads by means of the opportunity to make decisions about the completion of job tasks is associated with positive workplace-based effects in terms of reduced job strain and higher job satisfaction, both of which in turn have beneficial effects on emotional well-being and subsequently on aspects of well-being which may affect the worker both in- and outside of the workplace.

The demand-control model breaks employment down into four key groups on the basis of

the balance between workload and control over workload and considers the effect these differences in balance may subsequently bear on well-being. The model proposes that the worst effects on emotional well-being are observable among those with “high strain” jobs characterized by high workload demands and low control over meeting these demands. The individual experiences increased mental distress which subsequently impacts on physical health through the mechanism of increased cardiovascular tension which increases the risk of further detrimental health outcomes (Karasek 1979). Conversely, individuals with high work demands but also high levels of control to manage these demands see better well-being, probably because these workers are those in good occupational grades and managerial positions with adequate resources to handle their workloads.

#### **The Effort-Reward Imbalance Model**

Critics of the demand-control model focus on the ambiguity of what may comprise the concepts of “demand” and “control,” with difficult workloads potentially characterized by either too small timeframes in which to complete high frequencies of tasks or tasks which are too challenging for the current skills of the worker. Additionally, control may be measured both in terms of the level of decision a worker has over how to handle his workload and his level of learned ability to deal with tasks in an organized and timely manner (Siegrist et al. 2004). Additionally, the model focuses on aspects of work which are specific to the workplace, rather than on aspects of work which may influence the circumstances of the individual outside of the working environment. In response to this, a more recently proposed framework of understanding the effects of occupational stress focuses on the idea of an effort-reward imbalance model (Siegrist 1996). The effort-reward imbalance model builds on the idea that the role of the paid worker is central to adult life and on the notion of social reciprocity on which paid employment is based. Social reciprocity is measured in terms of financial reward, self-esteem, career development opportunities, and job security (“gains”) offered adequately in return

for the effort made in completing the tasks required within the working role (“costs”). The model then proposes that imbalances in these costs and gains lead to emotional distress and impair successful self-regulation, which in turn lead to a higher susceptibility of the worker to further problems with both emotional and physical well-being. These negative effects are likely to be observed the most among workers who suffer lower levels of reciprocity but who are considered “overcommitted” to their job, encompassing a personality-based individual variation within the effect of imbalance on working populations. The effort-reward imbalance model might be especially relevant to older populations if it is considered that older workers are more likely to find certain types of work more physically and mentally effortful and to experience fewer opportunities for promotion, role alteration, or alternative employment if desired, all of which demonstrate examples of an imbalance between effort and reward.

Although the effort-reward imbalance model draws on the relationship between stress and health in terms of the occupational circumstances subsequent to the level of effort or demand required to be put into tasks at work, the reliability of the model may benefit from its inclusion of occupational-related concepts such as salary and job security, which are likely to influence an individual’s well-being in realms outside of those concerning work. For example, levels of salary have subsequent effects on the living conditions of individuals which then further impact on well-being. So, while negative effects of the demand-control model might be limited to time spent within the workplace, negative effects as specified by the effort-reward imbalance model are likely to radiate to wider areas of the individual’s life and therefore offer more persistent and stronger effects on health and well-being. However, both models are useful in identifying a group of workers who are likely to be most adversely affected by work circumstances such as low control and low reward (Siegrist et al. 2004), and as will be discussed in the following section, the literature has found significant associations between these workers and

poorer levels of a range of health and well-being outcomes.

## Empirical Evidence

The majority of recent research into the effects of employment-related stress on the well-being of older workers and retirees draws heavily on the two aforementioned models of work stress. However, definitions of work stress are diverse, and observational data used to conduct such research may be limited in the ways in which it allows the researcher to measure stress at work. While many datasets contain measures to specifically compose scales of demand-control and effort-reward imbalance, this piece additionally considers research which examines well-being on the basis of work stratified by measures of stress such as occupational type, occupational grade, and worker satisfaction, all of which have been shown to demonstrate associations with imbalances between control and demand or effort and reward.

The relationship between stress and work and retirement can be considered from two perspectives. Firstly, work-related stress can be considered as a driver out of the workforce and into retirement, often due to stress-induced poor levels of health and well-being. Secondly, it can be considered in terms of its effects on well-being among the older workers who are still employed in stressful environments as well as on the well-being of the older people who have retired from them.

### Stress as a Driver of Workforce Exit

Evidence has demonstrated that work-related stress impacts older individuals’ decision to leave the workforce early, often because of negative impacts on health and well-being. Siegrist et al. (2007) found an imbalance between effort and reward to be an independent predictor of intention to leave the workforce prior to normal retirement age even after controlling for health problems and physical disabilities which are often considered to have the strongest impact on the decision to take early retirement. Similarly, Elovainio et al. (2005) examined imbalances between job demand and control and again

found these to be significant predictors of early retirement. Furthermore, the relationship between poor demand-control balance and the intention to retire early strengthened with age and was particularly prominent in individuals aged 45 and over.

Another means of measuring stress in the workplace is by means of physically demanding tasks which older individuals might especially struggle to cope with. Banks and Casanova (2003) find a greater propensity for those in physical or heavy manual work to expect to have left the workforce prior to reaching the age of 65 due to disability or health limitations, and a survey by Humphrey et al. (2003) found 11% of men and 16% of women took early retirement because their work had become too physically demanding to manage.

Older people are also likely to be driven into retirement because of mental stress in the workplace. Barnes et al. (2004) found older people were more likely to decide to leave the workforce early because they found their jobs mentally more difficult to manage in their later working years, as a result of both increased time pressure brought about by company restructuring or changes within their own ability to manage tasks and workloads as they became older. Similarly, the aforementioned survey by Humphrey et al. found 8% of both men and women took early retirement because their jobs had become too mentally stressful.

### **The Relationship Between Stress, Work, and Well-Being**

Research which has looked at the associations between work stress and health and well-being has found detrimental effects to exist across the life course on a variety of health outcomes including cardiovascular disease (Bosma et al. 1998), coronary heart disease (Kuper et al. 2002), poor mental health (Pikhart et al. 2004), self-reported health, and type 2 diabetes (Marmot et al. 2006). As mentioned beforehand, although research concerning effects of work among older populations in general provides mixed results, research which recognizes that work should be stratified on some measure of its quality consistently finds the relationship between higher levels

of work stress and well-being observed in midlife to persist into older age. In consideration of the effort-reward imbalance model, McMunn et al. (2009) found paid workers of state pension age (SPA) and over reported higher life satisfaction and quality of life as well as fewer symptoms of depression than those of the same age who were not in work, as long as they felt well reciprocated in terms of effort and reward. Older people who felt poorly reciprocated for their efforts saw no significant differences in well-being than older people who were not in the workforce. Similarly, Matthews et al. (2015) used a sample of workers and retirees of SPA and over matched on the basis of their background characteristics and found those who felt poorly reciprocated for their work had significantly higher levels of depression than both those who worked in well-reciprocated employment as well as those who had taken normal retirement at SPA. Similarly, those who continued to work in well-reciprocated employment saw significantly better self-reported health than those in poorly reciprocated work and those who had taken normal retirement. These findings have important implications for policymakers raising SPA as they suggest retirement would be more beneficial to the well-being of older people than the continuation of work which is stressful in nature. Volkoff et al. (2010) focused on the demand-control model of work stress and found that older workers with the highest levels of time pressure combined with the lowest control over the way in which they could manage their high workloads had the highest prevalence of several health disorders, including sleep disorders, experience of pain, and ability to recover from illness or injury. These workers also experienced stronger feelings of discouragement within the workplace. De Jonge et al. (2000) explicitly compared the demand-control and effort-reward imbalance models of stress and found that high levels of effort-reward imbalance were stronger predictors of poor mental and physical well-being outcomes than low levels of job control to deal with high demands. However, the study also accounted for level of worker commitment and found overcommitted workers with high demands and low control saw the poorest well-being outcomes.

This is consistent with Siegrist's (1996) notion that overly committed workers are likely to experience the strongest negative effects on well-being when there is a mismatch between reward and effort contributed to work-related tasks.

The National Statistics Socio-Economic Classification (NS-SEC) is another means of measuring work stress which relates to the notions implied by the effort-reward imbalance model on the basis of the inclusion of employment characteristics including levels of autonomy and control in the workplace, job security and salary, and the availability of opportunities to further one's career. On the basis of these characteristics, employment types can be described as one of three broad categories (each of which incorporate a range of smaller occupational descriptions): managerial and professional occupations, characterized by high autonomy and control, good job security, and good career prospects; routine occupations, characterized by low autonomy and control, poor job security, and fewer opportunities for career development; and intermediate occupations, which lie somewhere in between. Sacker et al. (2005) found those in routine occupations suffered poorer self-reported health than those in managerial and professional occupations and that differences in health widened with age, so that at age 21 there were no health differences, yet at retirement age the differences were at their greatest. The poorest health was observed among those who had worked in routine occupations throughout adult life, and effects were smaller if the individual's employment in routine occupations was preceded by time spent in occupational types characterized by lower levels of stress, suggesting the effects of work stress are accumulative over the life course and should be considered from a life course perspective. Similarly, Chandola et al. (2007) used NS-SEC and found people from lower-grade occupations saw faster declines in physical health over time than those in higher-grade occupations. For example, the study demonstrated that a 70 year old who had worked in a high-grade occupation prior to retirement saw similar physical health characteristics as that of a 62 year old who had worked in the lowest grade. The study also found that mental health improved

after retirement for all occupational groups, although the rate of improvement was lower for those from the lowest grades than for those from higher grades.

Warr et al. (2004) examined well-being on the basis of individuals' role preference and found those in work with a preference for being in the workforce had higher life satisfaction and affective well-being than those who would rather have been out of work. However, well-being was found to be a function of the working environment rather than just of role membership, and better well-being was observed among those with better control over their work as well as among those with better work-related environmental circumstances, such as job security, financial position, and social networks.

Finally, work stress may be measured by the level of physical activity involved, and this may be particularly relevant in terms of older workers who are likely to demonstrate lower levels of physical functioning ability than younger workforce members and so find occupations characterized by high levels of physical or manual labor particularly stressful. Among older populations, jobs characterized by heavy manual or physical labor might be particularly prone to imbalances between both demand and control, where the individual may struggle with the physical ability necessary to manage his workload, and between effort and reward, where the individual may feel his efforts to carry out physically demanding work are not particularly well reciprocated by means of salary and job security. Often, workers in manual employment are lower skilled and less able to experience promotion or move to alternative employment types despite worsening physical health (Siegrist et al. 2004). A study by Tuomi et al. (1991) used the level of physical activity included in individuals' occupations as a measure of work stress and found that older men in more physically demanding jobs had poorer health and higher disability mortality rates.

### **The Relationship Between Stress, Retirement, and Well-Being**

Again, research which has examined the impact of work-related stress on the retirement experience

of older people consistently demonstrates associations between jobs characterized by higher stress and poorer well-being in retirement and, conversely, jobs which are less stressful in nature and better well-being. Westerlund et al. (2009) used markers of occupational grade, psychological and physical stress, and job satisfaction to determine individuals' working conditions and found the prevalence of suboptimal self-reported health decreased after retirement for all workers apart from those who retired from the highest conditions. Additionally among older people in poorer working conditions, the prevalence of suboptimal self-reported health increased at a faster rate prior to retirement than after despite the fact that suboptimal health is commonly associated with increasing age, suggesting retirement provides a substantial relief of the stress brought about by poor working conditions. Another study by Marmot et al. (2006) found civil servants from the lowest employment grades had more than three times the mortality risk than those in the highest grades before retirement and again that after retirement the impact of occupational grade on mortality lessened and became smaller than the impact of other social measures. Mein et al. (2003) found civil servants who retired from higher occupational grades saw a significant improvement in mental health thereafter, but those from lower occupational grades did not, suggesting the potential beneficial effect of retirement from stressful work on well-being is possibly counteracted by poorer financial circumstances limiting activities available during retirement.

## Discussion

Both the demand-control and effort-reward imbalance models outline the means by which mismatches between certain aspects of workplace characteristics can impact negatively on mental well-being and, through physiological stress responses, subsequently on other aspects of health, and the literature in the field provides plenty of evidence that this is the case. However, it is important to understand the mechanisms

through which stress impacts on well-being and the ways in which these mechanisms might vary among different groups of older workers, not only throughout the later periods of employment but also over the transition into retirement and into the retirement period itself thereafter. If policies to extend working lives and retain as high a proportion of older people in the workforce as possible are to succeed, they need to be based on a knowledge of how different workplace stressors and characteristics are likely to both positively and negatively affect the health and well-being of the older workforce.

The evidence provided by the research outlined in the previous section of this work demonstrated the means by which work-related stress can lead to both early workforce exit and detrimental effects on health and well-being outcomes. Additionally, although the key models of work-related stress focus on imbalances of either demand and control or effort and reward, job stress might also be characterized by work which is too physically or mentally demanding in nature. Although not explicit measures of control or reciprocity, often in these instances, imbalances between control over workload and the gains received for commitment to physically difficult work are likely to be prominent. Overly physically demanding work is likely to be a form of workplace stress that is detrimental to the health of older workers in particular, and older people participating in such jobs are the most likely to have the intention of taking early retirement or actually exit the workforce before state pension age (Humphrey et al. 2003). Furthermore, increasingly physically demanding work among older populations might be particularly detrimental to both physical and mental well-being outcomes for two key reasons: Firstly, if it is considered that those who have worked in manual employment throughout adult life are more likely to have acquired disabilities or health problems as a result of their work, it may be considered that continuation of this type of employment in later periods of life will only exacerbate existing issues. Secondly, considering older people in manual employment are the most likely to want to leave the workforce early (Banks and Casanova 2003), when it is not

possible to do so, for example, because state pension age has not yet been reached and the individual cannot afford to take earlier retirement, the individual is likely to experience negative effects on both mental and physical well-being as an effect of the forced continuation of work which is difficult to carry out.

One of the key points to emerge from the literature is that individual well-being in later life is likely to be associated with the experience of stress over the life course, rather than specifically at the time retirement age approaches. The aforementioned research by Sacker et al. (2005) showed self-reported health to be poorest shortly before retirement age among those who had continuously worked in occupations characterized by higher stress levels, while those who had experienced periods of less stressful employment prior to entering a stressful occupation reported better outcomes as they neared retirement age. This idea is further backed up by the finding within the same study that there were no significant differences in self-reported health between those in high and low stress occupations at age 21, again suggesting the negative effects observed among those who have worked in stressful environments to be the result of cumulative stressful experiences. Similarly, the aforementioned increased rate of early labor market exit observed among those in manual employment due to limiting illness and disability suggests cumulative negative effects on health occur among those who participate in physically demanding work in earlier periods of their lives. This idea is strengthened again by the finding by Chandola et al. (2007) that physical health deteriorated faster among those in lower-grade occupations than among those in higher-grade occupations.

Furthering the life course perspective on the associations between older workers and retirees in relation to stress, there is evidence to suggest that participation in jobs characterized by higher levels of stress is the result of social inequalities which

often stem from childhood and persist throughout adult life. This idea is furthered by work by Dannefer (2003) which states that lifelong employment in good quality occupations and circumstances is usually preceded by high educational attainment which in itself is often associated with higher social status in childhood. Furthermore, as better health is observed across the life course among those with higher incomes and better social positions (Marmot and Shipley 1996; Chandola et al. 2007), this cumulative advantage of higher quality and less stressful work can persist into older age. Those who have worked in lower stress occupations are also those who are more likely to either benefit from prolonged periods of employment in later life, as well as those who are able to enjoy better well-being in retirement due to having a level of health and financial security which allows pursuit of meaningful and enjoyable activities in place of the paid worker role.

## Conclusions

There is increasing importance in understanding the effects on health and well-being of the working environment as state pension ages rise to accommodate the financial burdens brought about by aging populations. Previous research into work-related stress among older people consistently finds detrimental effects on a range of well-being outcomes among those working in stressful occupations. This association is likely to persist across the life course and throughout the transition into retirement, as well as during retirement itself.

## Cross-References

- ▶ [Affect and Emotion Regulation in Aging Workers](#)
- ▶ [Motivation to Continue Work After Retirement](#)
- ▶ [Work to Retirement](#)

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## Structural Neuroimaging in Geropsychology

Thomas J. Farrer<sup>1</sup> and Erin D. Bigler<sup>2,3</sup>

<sup>1</sup>Department of Psychiatry and Behavioral Sciences, Duke University Medical Center, Durham, NC, USA

<sup>2</sup>Department of Psychology and Neuroscience Center, Brigham Young University, Provo, UT, USA

<sup>3</sup>Department of Psychiatry, University of Utah, Salt Lake City, UT, USA

### Synonyms

Brain Imaging; Imaging; Radiology

### Definition

In vivo radiological examination of tissue, including the brain, for the purpose of identifying structural health and disease states.

Older adults are vulnerable to a variety of neurological and neuropsychiatric disorders in which diagnosis is facilitated by contemporary neuroimaging. With clinical presentations, magnetic resonance imaging (MRI) and other imaging techniques can assist in clarifying etiology, progression, and severity of neuropathological states. Given that early and accurate diagnosis is critical to optimizing treatment, imaging is increasingly being used to expedite diagnosis and to rule out other CNS-related conditions or to provide a baseline, since in the beginning of symptom onset for disorders in the elderly, the initial symptoms may be subtle. The following section of this *Encyclopedia* will provide discussion on the role of imaging techniques in older adults, with a particular emphasis on normal aging, acquired brain injury, and dementia.

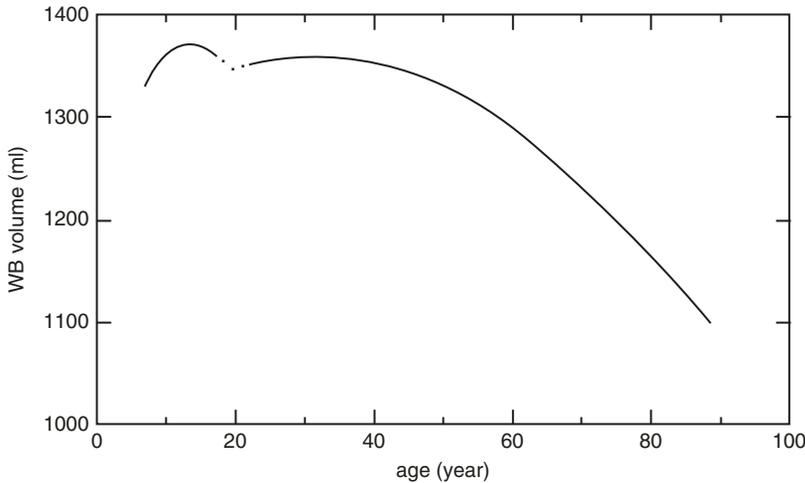
Understanding the utility of neuroimaging among older adult populations first requires a discussion of the natural morphological changes that occur as healthy individuals age. Early development consists of a steady rate of increases in

brain volume, whereas by early adulthood, overall brain volume has reached its apex, which thereafter is associated with a steady rate of brain volume loss (Hedman et al. 2012). As shown in Fig. 1 from a meta-analysis of neuroimaging studies on brain volume and aging, a steady decline becomes rather evident by midlife. Some of this volume loss can be associated with cell death and cellular morphological change. Beginning at the fourth decade of life, adults inexorably experience myelin sheath deterioration, leading to a reduction of white matter volume. Concomitantly, there is also an increased gray matter loss, which is more responsible for driving the overall volume reduction (Mukherjee et al. 2002).

Figure 2 compares magnetic resonance imaging (MRI) linking age-related brain changes from childhood, adolescence, and early and older adulthood with a healthy nonagenarian that can be visualized on a brain MRI. What is distinctly viewable across the age span shown in Fig. 2 is the cortical sulci (the furrows on the surface of the brain) widen and the ventricular system enlarges. The ventricles are filled with cerebrospinal fluid (CSF) and are under pressure. Brain tissue, referred to as the parenchyma, prevents the ventricular system from expanding. Thus, as parenchymal volume is lost, whole-brain CSF increases leading to ventricular expansion and visible changes within the sulci and cisterns of the brain. In a practical sense, this means that every brain has to be assessed in reference to so-called age-typical “normal” aging.

The importance of the “normal” appearance of age-related changes as visualized in a scan is that “normal” atrophy is part of the natural aging process. Atrophy that is beyond what would be expected for someone given their age may implicate an underlying degenerative or some other disease process. For example, compare the two images in Fig. 3, one is from the coauthor (EDB) at age 67 compared to a 67 year old with probable Alzheimer’s disease (AD). Note in particular the hippocampal atrophy associated with AD compared to the author’s control brain.

As shown in Figs. 1 and 3, current MR technology provides excellent image resolution that mimics gross anatomy with the T1-weighted



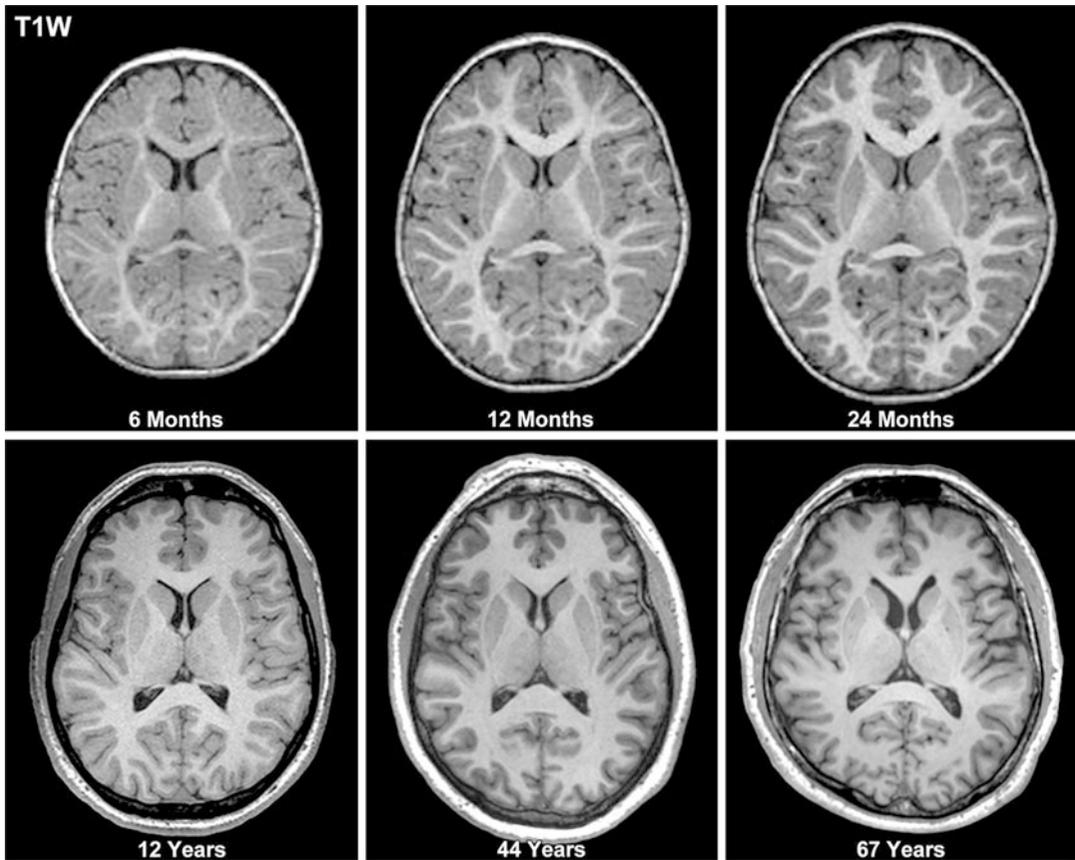
**Structural Neuroimaging in Geropsychology, Fig. 1** Image was derived from a meta-analytic study of brain volume by Hedman et al. (2012). Whole-brain volume is plotted by age in this life span view from age 4 through 88. The curves are dashed around age 18–21, indicating the uncertainty in this area, since only few data were available for fitting this age range. Two separate fits

were calculated for the younger (<19 years) and older (>19 years) group. Regardless of the unevenness of the earlier developmental data due to lack of consistent studies, by early to mid-adulthood, there is general stability in brain volume followed by an inexorable decline. See Fig. 2 for actual visualization of these changes

image. Current automated methods of image analysis also use the T1 image for computational purposes to derive volumes, surface area geometry, thickness, and shape/contour measures. In addition to the T1 anatomical sequence, from a pathology distinction, the other standard MR sequences including the fluid-attenuated inversion recovery (FLAIR), gradient-recalled (GRE) sequence or susceptibility-weighted imaging (SWI), and a T2-weighted sequence constitute the core clinical MRI studies typically performed. There are other MR sequences involving water diffusion especially important in assessing stroke and tumor patients, as well as diffusion tensor imaging (DTI) along with various methods for examining blood flow and contrast infusion, although these are not performed unless there is a specific referral to run such MR sequences.

The T1 images up to this point have focused on a general overall appearance of the brain from a gross anatomical perspective, but the FLAIR sequence is very helpful in identifying white matter pathology with the GRE/SWI sequences sensitive in detecting certain kinds of vasculature lesions. For example, a reduction in white matter integrity is a normal part of aging and in fact

accounts for reduced cognitive efficiency among healthy adults (Voineskos et al. 2012). In addition, normal aging is associated with significant microvascular changes that mitigate physiological and cognitive functioning and results in reduced cerebral blood flow and vascularization of brain parenchyma (Steketee et al. 2016). In the age-typical MR FLAIR sequence, abnormal white matter signals in the form of white matter hyperintensities (WMHs) begin to increase in appearance after the fourth decade of life (Hopkins et al. 2006). While some white matter pathology may just be the normal cost of the aging process, in the presence of vascular disorder, ischemic changes disproportionately affect deep white matter because the penetrating vessels that feed these regions constitute the most distal aspect of the cerebrovasculature and are therefore prone to microinfarction. Excess WMHs, as shown in Fig. 4, is a pathological indicator. When indicators of hemosiderin deposition with brain parenchyma are identified with GRE/SWI sequences, these are objective indicators that hemorrhage has occurred. The presence of WMHs and/or microhemorrhages has been associated with greater likelihood of being associated with



**Structural Neuroimaging in Geropsychology, Fig. 2** Visual changes in the axial view of a T1-weighted MRI scan taken at the level of the anterior

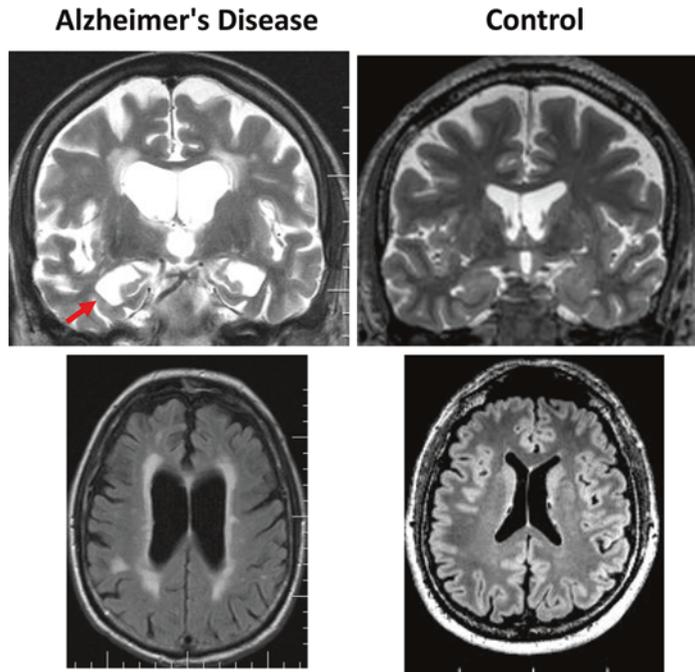
horns from age 6 months to 66 years are depicted (The *top images* are from Vardhan et al. (2014) and reprinted with permission)

neurocognitive and neurobehavioral deficits (Wiegman et al. 2014).

Older adults also experience widespread cortical gray matter reduction with normal aging, which also impacts cognitive functioning (Thambisetty et al. 2010; Fleischman et al. 2014). As shown in Fig. 1, the rate of brain atrophy increases with age (Hedman et al. 2012), which is reflected in a reduction in cortical thickness. A most important image analysis advancement in the last decade is the automated image analyses, including measuring cortical thickness (Bigler 2015). These quantitative techniques for measuring thickness can be applied to any region, like in Fig. 5 that shows the changes in entorhinal cortex over the life span (Hasan et al. 2015). Entorhinal cortex is critically involved in processing short-

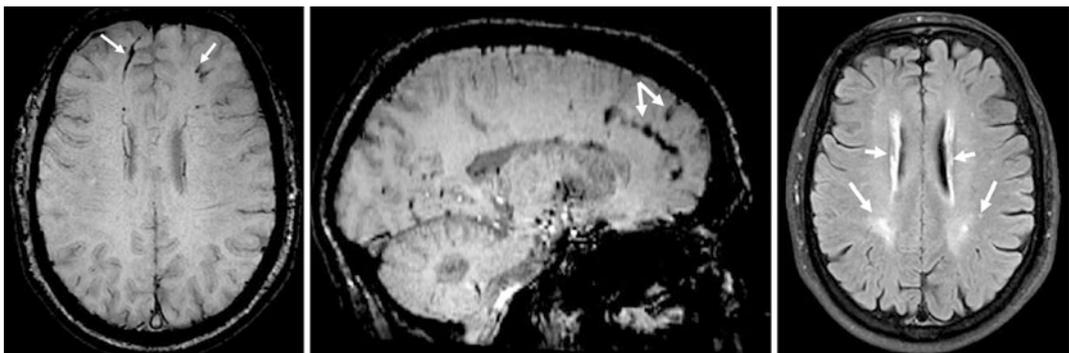
term memory and affected by many disorders, including Alzheimer's disease and TBI, and such quantitative imaging can be helpful in differentiating brain health from disease processes in clinical populations.

The fastest and most common brain imaging method is computed tomography (CT) which capitalizes on x-ray beam technology and tissue density to reconstruct an image of the brain. Because a CT scan can be completed within a few minutes from the time the patient is positioned in the scanner to when images are ready for interpretation, it is a quick screening method for detecting coarse brain pathology. In emergency departments, the CT is often relied upon because of its speed and disorders like brain tumor and stroke can be quickly ruled out.



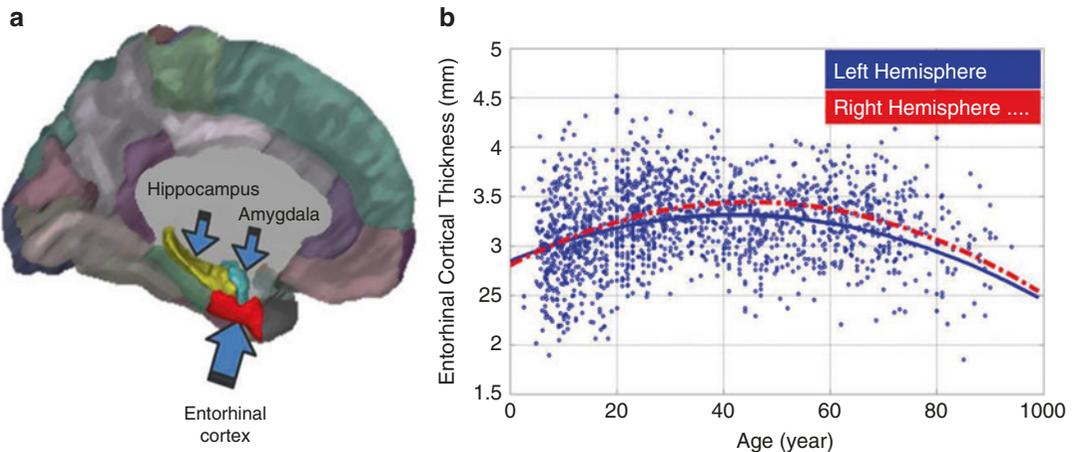
**Structural Neuroimaging in Geropsychology, Fig. 3** The image on the *left* is a T2-weighted coronal MRI through the hippocampus in an 83 year old diagnosed with Alzheimer’s disease. This patient also had a history of cardiovascular disease and hypertension, and the axial fluid-attenuated inversion recovery (FLAIR) sequence shows

extensive white matter hyperintensities characteristic of microvascular disease. The images on the *right* are from a healthy 67 year old. *Red arrow* points to dilated temporal horn of the lateral ventricular system and hippocampal atrophy. Note in the control the fullness of the hippocampus tends to fill the temporal horn



**Structural Neuroimaging in Geropsychology, Fig. 4** The *left* (axial) and *middle* (sagittal) images depicted multiple hemorrhagic lesions from sustaining a severe TBI based on susceptibility-weighted MRI. Note in the sagittal image the depth of the hemorrhagic pathology in the frontal white matter. Some of the hemosiderin deposition may be due to sluggish venous return and dilated

vessels also assumed to be the result of the TBI. The image on the *right* shows generalized white matter pathology. This TBI patient who had been injured approximately 2 years prior not only suffered from the severe traumatic injury to the brain but also extensive blood loss and hemorrhagic shock, which may have contributed to the white matter abnormalities



**Structural Neuroimaging in Geropsychology, Fig. 5** The image shows the region of the entorhinal cortex, how it can be identified using advanced quantitative neuroimaging techniques, and how the entorhinal cortex changes with age. By knowing the normative size of the

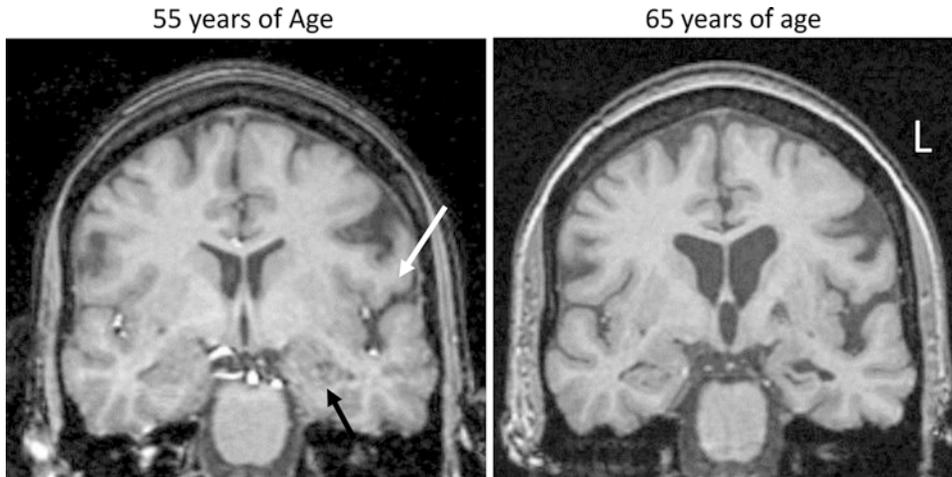
entorhinal cortex, comparison can be made with any individual who may be having symptoms of medial temporal lobe pathology, such as memory impairment (Reprinted with permission from Hasan et al. (2015))

The limitation of CT is considerable, the most prominent being the lack of anatomical detail compared to MRI and CT's lack of sensitivity to certain types of pathologies. However, CT can be adapted for use in several functional neuroimaging techniques including fluorodeoxyglucose positron emission tomography (PET) and single-photon emission computed tomography (SPECT). Both of these techniques examine the uptake of a radiotracer, used to infer if metabolic activity is reduced, such as occurs in degenerative damage or infarction, or heightened, as what might occur at the site of seizure activity. Both CT and MRI can be adapted to examine the vasculature of the brain and various types of blood flow measures. Of particular importance for neuropsychology are the MR-based techniques that are capable of detecting blood oxygen level-dependent (BOLD) changes, such that regional differences in brain activation may be identified during certain cognitive tasks. Currently, this procedure is used most in preoperative cases to best outline regions related to cognitive processes that, if possible, should be avoided during surgical intervention.

Clinical research has examined whether imaging can differentiate between normal aging, mild cognitive impairment (MCI), and more advanced

states of dementia. As mentioned above, normal aging is associated with natural changes in both white and gray matter integrity and volume. Monitoring the rate of volume loss over time is one clinically meaningful approach to differentiate illness from normal aging. Specifically, a dementia process would have an accelerated rate of volume loss relative to non-symptomatic older adults (Thambisetty et al. 2010). In addition, the pattern of atrophy can help delineate different etiologies (i.e., Alzheimer's disease will have a different atrophy pattern relative to Lewy body dementia, frontotemporal dementia, etc.). For example, the case presented in Fig. 6 shows a 55-year-old female with onset of mild complaints of failing memory and language and her baseline scan, which was interpreted by radiology as within normal limits for her age. However, after a 10-year follow-up, there are clear differences, with temporal lobe atrophy, including hippocampal atrophy, more prominent cortical sulci, and ventricular enlargement. The patient's diagnosis is complicated at this stage because of sepsis and probably mild anoxic injury, but the clinical presentation appears to be FTD and the patient continues to be monitored.

Those with AD pathology will show differentially increased atrophy involving the



**Structural Neuroimaging in Geropsychology, Fig. 6** In her mid-50s, this patient began to display cognitive and behavioral changes that raised the suspicion of behavioral variant of frontotemporal dementia. As seen in the image on the *left*, beginnings of left prominence of the Sylvian fissure can be visualized (*white arrow*) with some

early changes in the hippocampus (*black arrow*). A decade later the differences are more apparent; there is ventricular dilation and rather profound hippocampal atrophy on the left. This patient's history is complicated by also experiencing an ischemic infarct in the left globus pallidus

hippocampus and entorhinal cortex relative to other forms of dementia, such as dementia with Lewy bodies (DLB). There is also evidence from serial MRI that the rate of atrophy is increased in AD compared to DLB (O'Brien 2007). When diagnosis is unclear, the use of PET and/or SPECT appears to increase the sensitivity and specificity when comparing AD to other dementias (O'Brien 2007; Palmqvist et al. 2015). The use of MRI is also often used to distinguish vascular dementia from healthy individuals and those with other dementias. That is, those with vascular dementia will often show cerebrovascular disease as seen from multiple infarcts or widespread white matter disease. This is shown in Fig. 4, using the FLAIR MRI sequence. There are limitations to the use of MRI to diagnosing vascular dementia in that there is no consensus on the degree of white matter damage required to warrant a diagnosis, but the combination of prominent white matter pathology on MRI and neuropsychological indication of cognitive decline or frank impairment is the best current indicator (Prins and Scheltens 2015). There is also the observation that white matter damage as seen on MRI does not necessarily correlate to clinical outcomes and that other disease states often present with white matter

damage as well, so by itself white matter pathology is but a nonspecific finding in neuroimaging.

Imaging is able to distinguish AD from frontotemporal dementia (FTD) based on areas and patterns of atrophy; AD typically presents with bilaterally atrophic medial temporal lobes, whereas FTD will present with an anterior to posterior progression of atrophy to both frontal and temporal regions, often beginning unilaterally. Furthermore, there are now PET labeling techniques that assist in making the diagnosis of Alzheimer's disease and other dementias as well as the level of progression of the disease (Mattsson et al. 2014). The use of SPECT and PET demonstrates that FTD is often distinguishable from AD due to a unique pattern of hypoperfusion to frontal and temporal regions (O'Brien 2007). Voxel-based morphometry has been used to demonstrate frontal and anterior temporal lobe gray matter reduction in individuals with possible and probable behavioral variant frontotemporal dementia (bvFTD) relative to controls. Notably, even individuals classified as pre-bvFTD are differentiated from healthy controls in volume to the left superior temporal gyrus, the left medial frontal gyrus, and the right insula (Borroni et al. 2015). Imaging has also been

useful in identifying other rare degenerative processes with unique MRI markers including Huntington's disease, Creutzfeldt–Jakob disease, progressive supranuclear palsy, corticobasal degeneration, and multisystem atrophy (O'Brien 2007).

MRI studies consistently demonstrate that pathological changes occur in the brain even before illness onset. Specifically, MRI has been used to demonstrate that individuals with no cognitive complaints or subjective memory complaints but normal cognitive testing already show signs of atrophy similar to a pattern of atrophy seen in Alzheimer's disease (Peter et al. 2014). In fact, multiple studies have now demonstrated that a pattern of atrophy unique to Alzheimer's disease is seen volumetrically several years before the onset of clinical symptoms. In one longitudinal design (Tondelli et al. 2012), 148 healthy and cognitively normal older adults were measured at baseline and then later stratified by onset of either amnesic mild cognitive impairment (MCI) or Alzheimer's disease (AD). Here, all subjects were assumed to be healthy at baseline because researchers screened out those that were symptomatic four years after enrollment to ensure that subjects did not progress to clinical diagnosis shortly after enrollment. In this study, voxel-based morphometry demonstrated that relative to individuals who remained healthy after 10 years, those who later converted to either preclinical AD or MCI had a reduced gray matter density at baseline with a pattern of atrophy similar to that seen in AD.

Similarly, visual and volumetric analysis of atrophy to the hippocampus of individuals with amnesic MCI can be predictive of conversion from MCI to AD (Fleisher et al. 2008). In one longitudinal study of 130 patients with amnesic MCI, researchers used volumetric and surface morphometry analysis to examine the hippocampus over a three-year period. Relative to controls, researchers found that individuals with MCI had significantly reduced hippocampal volume and that those with reduced volume to the hippocampus and entorhinal cortex were more likely to convert to AD, even when controlling for demographics and cognitive functioning (Devanand et al. 2012).

In summary, although there are limitations, neuroimaging continues to be a powerful tool in both research and clinical settings, especially among older adults, who are uniquely vulnerable to acquired injuries and disease states. Imaging tools provide assessment of biomarkers that allow for early identification of disease, differential diagnosis, and longitudinal monitoring of brain health. Imaging has also provided a greater understanding of how disease states, such as AD and other dementias, develop and progress with time. As the general adult population continues to age, more research will without questions lead to additional advances in geropsychology and treatment of older adult populations.

## Cross-References

- ▶ [Age and Time in Geropsychology](#)
- ▶ [Cognition](#)
- ▶ [Encephalopathy](#)
- ▶ [History of Biomarkers in Geropsychology](#)

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## Subjective Age and Work

Jeanette N. Cleveland, Madison E. Hanscom and  
Lena-Alyeska M. Huebner

Department of Psychology, College of Natural  
Sciences, Colorado State University, Fort Collins,  
CO, USA

### Synonyms

Age identity; Cognitive age; Personal age; Psychological age

### Definition

Numerous measures exist, yet there is little consensus on the definition of subjective age (SA). Subjective age, unlike chronological age, is a multidimensional construct that reflects how old a person feels and into which age group a person categorizes himself/herself (Kleinspehn-Ammerlahn et al. 2008). It is a self-perception of age, and common to most definitions is the notion of how old or young individuals experience themselves to be (Montepare and Lachman 1989). According to the pioneering work by Kastenbaum et al. (1972), subjective age is a person's sense of age based upon: (1) the reflection of their own development and their interpretation of aging or how old an individual feels, looks, and acts, (2) with which age cohort the individual identifies, and (3) how old the person desires to be (Kaliterna et al. 2002). More recently, Diehl and associates conceptualize

subjective age as a specific form of self-knowledge and a part of the processes and conditions of the aging self (Diehl 2006).

## Measures of Subjective Age

Kastenbaum et al. (1972) suggested subjective age largely reflected two components including how old a person looks and how old a person feels, assessed initially with single items. This was later expanded to four dimensions, leading to an often-used method of measuring SA, which was influenced by Barak (1987) and based on Kastenbaum et al.'s (1972) four dimensions of how they feel, how they look, how they act and behave, and what interests they have. Barak labeled this measure "cognitive age," and it has repeatedly demonstrated high levels of reliability (Barak 2009).

Although these four dimensions are important, most SA measures do not necessarily reflect all four dimensions. Rather, SA is often measured in various ways; in particular, using single-item assessments that reflect a global measure, multiple items which are intended to assess a single dimension and more recently multiple items that assess and reflect multiple dimensions or factors.

*One-item measures.* Single-item measures of SA are simple and straightforward, such as items that ask "What age do you feel?" or "Would you say that you feel young, middle-aged, old, or very old?" (Barrett 2005; Cleveland and Shore 1992; Cutler 1982) or using a single item that required employees to rate whether they feel younger, middle age, or older (Cleveland and Shore 1992). Single-item assessments of subjective age continue to be encountered in the research literature today. These items ask one of the following: (1) to specify in years how old respondents feel most of the time and then compute difference scores with actual age (Barnes-Farrell and Piotrowski 1989; Barnes-Farrell and Rumery 2000; Barrett 2003, 2005); (2) to specify what age do [they] feel, or what age do [they] feel most of the time, within a specific time frame (e.g., during the last year or month), or (3) how old individuals experience themselves to be with respect to various

psychological, physical, and social attributes (e.g., a lot younger than my age; Montepare 1991, 2006).

*Multiple item/dimension measures.* One multi-item measure is a 47-item assessment of personal aging experience that includes items relevant to subjective age (Steverink et al. 2001). These items refer to both positive and negative statements regarding aging in a number of life domains (e.g., health, personality, social contacts). Two pilot studies showed that the 47 items reflected three factors: physical decline, continuous growth, and social loss. These findings reinforce earlier conceptualizations of subjective as a multidimensional construct (Steverink et al. 2001). This measure supports Keller et al.'s (1989) structure of subjective age.

Drawing from Levanthal's self-regulation model of health and illness, Barker and colleagues (2007) developed a multidimensional assessment of aging perceptions. In this model, illness is viewed as a stressor, and people's perception and response to this stressor affects subsequent health and longevity. These illness perceptions have a number of facets including time-bound stressors and responses, consequences, and control. The Aging Perceptions Questionnaire (APQ) incorporates this approach and consists of 32 items reflecting seven dimensions: two timeline dimensions perceptions of aging (timeline-chronic and timeline cyclical); two consequence dimensions (positive and negative); two control dimensions (positive and negative); and a seventh, emotional representation that refers to negative emotional reactions to aging. Sexton et al. (2014) developed a short version of APQ, which combined negative control and negative consequences and eliminated the timeline cyclical dimension thereby yielding a 17-item, five-factor model.

*Subjective Age at Work.* Rioux and Mookkolo (2013) argue that subjective age at work is a separate construct from general subjective age. Their study also revealed subjective age at work to be a better predictor of certain outcomes related to work, such as satisfaction with professional life. Their measure includes items assessing specifically how old individuals feel, look, or act when they are at their workplace.

Other measures have taken similar approaches by assessing how old an individual feels in comparison with their work group (Cleveland and Shore 1992).

## Related Constructs and Measures

Subjective age is, of course, related to many other age constructs. Examining these relationships helps to shed light on the precise meaning of subjective age.

*Age identity, Psychological age, and Cognitive age.* Age identity has been used interchangeably with subjective age. However, Kaufman and Elder (2002) suggest that age identity consists of four dimensions including subjective age, desired age, perceived old age, and desired longevity, with a related study tapping subjective age, other age, desired age, and perceived old age. Barak et al. (2001) suggest that age identity is a measure of cognitive age. Other researchers have assessed subjective age identity using subjective age scales (e.g., Montepare 1996; Montepare and Clements 2001).

*Awareness of Age-Related Changes (AARC).* Both AARC (Diehl and Wahl 2010) and successful aging (described below) are two constructs that are enjoying increasing attention in the age and aging literature and may reflect superordinate constructs of which subjective age, age identity, and so forth are subsumed. Diehl and colleagues posit that subjective age is a facet of self-knowledge. Awareness of age-related changes refers to all the experiences that a person encounters (e.g., own behaviors, level of performance or life experiences) that make him/her aware that his or her life has changed as a result of growing older.

*Successful Aging at Work.* A related construct is successful aging at work (e.g., Kooij 2015; Zacher 2015) and draws upon Baltes and Baltes' (1990) work on successful aging in general and extends this important work in important ways. Although its concrete meaning, assumptions, and underlying process remain unclear, successful aging refers to the conditions of the person and situations where an individual obtains a maximum

satisfaction and happiness (Birren 1958; Havighurst and Orr 1955; Zacher 2015). Success can be generally defined as the securing of desired and favorable outcomes. Rowe and Kahn's (1987, 1997) conceptualization of successful aging represented a significant milestone in defining and research of this concept, and they define it as including three largely objective outcomes including a low probability for disease and disability, continued high physical and cognitive performance, and engagement in social and constructive activities. Importantly, Zacher (2015) recently proposed that successful aging at work should have the following four elements: (1) a focus on both subjective and objective outcomes relevant and important to individuals and context; (2) focus on testing intraindividual age-related changes in success aging criteria over time and across life/work span; (3) investigation of age-related mediators, and (4) description of any positive (work) outcomes of older people/employees, regardless of the age-related processes and conditions that lead to an outcome (Zacher 2015).

Often successful aging is measured using both semiobjective assessments including health indicators and more subjective mental and emotional assessments. For example, Freund and Baltes (1998) used subjective well-being, positive emotions, and absence of loneliness as measures. Further, Kotter-Grühn and Hess (2012) used aging satisfaction as a measure of successful aging.

## Theoretical Frameworks

Historically, the construct of subjective age has been theoretically underdeveloped (Diehl et al. 2015), and this may have led to the generation of numerous related terms including psychological age, age identity, self-perceptions of aging, attitudes toward aging, and cognitive age. Further, in the early research on subjective age, there were few instances where subjective age was linked with life span development or human development. However, numerous aging theories can and have contributed to our understanding of subjective age including (1) Bronfenbrenner's (1994) bioecological model; (2) selective optimization

with compensation theory and socioemotional selectivity theory (SST/SSC); (3) stereotype embodiment theory; and (4) life span and life-course theory.

*Ecological model.* Bronfenbrenner's biopsychosocial approach to aging and is an excellent organizing framework for understanding subjective age. According to this model, individuals learn, change, mature, and age by their interactions with multiple ecologies or environments. Four levels are identified in the model: microsystem, mesosystem, exosystem, and macrosystem. Perhaps the two most influential systems in terms of affecting SA are micro- and macrolevels. In terms of shaping SA, the individual's direct interactions with an environment are most influential in shaping SA. These include proximal processes (e.g., family, work) and influence the self-directed attitudes about aging held by an individual, including how satisfied the person is with his or her own aging process, and the awareness of becoming older.

At the mesosystem and exosystem levels, subjective aging is affected through interactions between two or more microsystems (e.g., family system and health care) with the latter involving at least one system that does not directly include the individual (e.g., availability of healthcare services information on aging and quality level of physician training). Finally, the macrosystem level includes each of the previous three systems (micro, meso- and exo-) and encompasses broad age stereotypes and values assigned to "being old," which may be widely held by members of a particular culture (sociocultural perspective on age stereotypes; Hummert 2011), including cultural structures and social policies.

*Selection, Optimization, Compensation, and Socioemotional Selectivity Theory.* The selective optimization with compensation (SOC) model conceptualizes how people cope with age-related changes, adapt throughout their lives, and use strategies to maximize potential for successful aging. The theory emerged from the gain/loss dynamic within life span development. This is the process of how humans both grow (gain) and decline throughout the aging process (e.g., Baltes 1987).

The SOC theory has three main parts that encompass the gain/loss relationship for successful aging: (1) *strategic selection* of focusing one's resources and adapting in terms of contexts, outcomes, and goal structures, which is important because it directs a person's behavior based on their hierarchy of goals, necessary because one's resources are often limited; (2) *optimizing* potential by maximizing the gains possible, and (3) *compensating* for losses (Baltes and Baltes 1990; Freund and Baltes 2002; Baltes 1997). The socioemotional selectivity theory (SSC) focuses upon the premise that as one ages, her/his perception of time shifts (e.g., Carstensen et al. 1999). Among younger people, the future seems more distant than among people who are older; therefore, motivations and goal seeking vary between these groups. For example, younger people are more likely to invest in the future, while older individuals may focus upon enhancing current relationships and events. SSC recognizes that these social interaction goals will not only shift throughout the life span due to distinct time limitations at hand, but the selection of goals will change as well. For example, younger people will be more motivated to have knowledge-related goals, while later in life, as they age, emotion-related goals will be more important. Further, an older person is more likely to reduce their social interactions with new acquaintances while increasing time with people who are more emotionally meaningful to them.

Although both SOC and SST have been primarily assessed in relation to chronological rather than subjective age, the approaches may apply to subjective age in terms of predictions, growth and maintenance orientation, as well as an open future time perspective.

*Life Span Development.* The life span development perspective of aging is concerned with the development of changes across the life span and is not one particular theory; many orientations are connected with these ideas and encompass the approach. Baltes and colleagues rooted their research deeply into the life span perspective (Baltes 1987; Baltes et al. 1980, 1992). They have put forth a number of propositions about the nature of aging. These propositions include

assumptions that (1) major differences occur among normal, pathological, and optimal aging; (2) course of aging shows much interindividual variability (heterogeneity); (3) old age shows much latent reserve capacity; (4) range of reserve capacity or adaptivity shows loss with increasing aging; (5) with age, the balance between gains and losses becomes increasingly negative; and finally, (6) the self in old age remains a resilient system of coping and maintaining integrity.

Accordingly, the age individuals perceive themselves to be (subjective age) involves the experience of time along multiple dimensions – including life-course transitions. The life span perspective illuminates variation across and within life stages by identifying developmental processes and age triggers that drive age identity (Diehl and Wahl 2010). The life-course perspective highlights other temporal issues including social, cultural, and historical factors that influence developmental processes and shape age-related patterns in subjective age.

*Stereotype embodiment.* An emerging prominent psychosocial theory that provides one explanation for the development of subjective age is the stereotype embodiment theory (Levy 2009). Research has shown that among older individuals, negative age stereotypes held earlier in life predicted poorer health (Levy et al. 2009). Based on a series of experimental and longitudinal research, Levy proposed that age stereotypes (1) become internalized across one's life; (2) may be activated and influential unconsciously; (3) develop greater influence or salience as they become more self-relevant (as a person ages); and (4) can influence expectations through psychological, behavioral, and physical means (e.g., via multiple pathways).

### **Antecedents and Outcomes of Subjective Age**

Subjective age is a complex psychological construct and does not always systematically reflect changes in chronological age. One can more fully understand the concept by explicating the antecedents and outcomes of variations in aging perceptions.

### **Antecedents**

To begin, there are general categories or perspectives behind explaining the most salient antecedents associated with subjective age. These more commonly are psychological factors, the social context, or a combination of both (Berg 2007). The first perspective, psychological, is comprised of research supporting the notion that personal factors (e.g., financial stability, personality, cognitive factors) and perceptions are the main antecedents of subjective age. For instance, Arnett (1998) contends that social events do not dictate the way one perceives youth; it is their psychological state. In other words, according to this perspective, the way someone feels about their stage (e.g., financial stability) in life is going to be more indicative of their age perceptions rather than the actual events or roles themselves. It has been shown that subjective age is influenced by certain psychological variables such as life satisfaction (Chua et al. 1990), internal locus of control (Hublely and Hultsch 1994), and so on. Also, within this perspective, it has been shown that certain personality characteristics (i.e., openness to experience) serve as predictors of subjective age irrespective of socioeconomic and health-related variables (Canada et al. 2013).

Many researchers consider health to be an individual difference driving age perceptions, thus falling into this psychological perspective. There is no doubt that many health variables (e.g., general health, physical health, functional health, mental health) and stress are related to subjective age differences (e.g., Bergland et al. 2014; Chua et al. 1990; Kotter-Grühn et al. 2015). Petery (2015) tested the directionality of these health variables and found health to be both an antecedent and an outcome of subjective age. She specifically found that health was an antecedent for subjective age in people older than 50, but not for those younger than 50 years old. Previous research has examined that certain stressors early in life (e.g., sexual abuse, financial hardship) influence subjective aging (e.g., Turner et al. 1999; Johnson and Mollborn 2009). In addition, subjective health perceptions are central predictors of subjective age more than many other influential predictors such as SES and/or education (Barrett 2003; Mutran and Burke 1979).

The second perspective, the social context, is mostly concerned with the environment around the person (e.g., the workplace) and the social roles people hold. Within this perspective, it is surmised that life events and social roles are the most important antecedents to subjective age (Mathur and Moschis 2005). Life events could include moving out of the house, having children, or transitioning into retirement, and these have been shown to influence age perceptions (e.g., Benson and Furstenberg 2003). It is important to note that social interactions are complex and these antecedents might not be consistent across different cultures. For instance, it has been shown that those in Western cultures will have younger age perceptions than those in Chinese cultures (Chua et al. 1990). Additional research is needed on this topic.

It is also important to consider the workplace as a domain that can provide a great deal of influence over age perceptions. Kunze et al. (2015) examine what aspects of the organizational context lead to changes in employees' subjective age. They concluded that perceived meaningfulness of work could shape age discrepancies for workers. In other words, when employees have high work-related meaning, they are more likely to benefit from experiencing a lower subjective age (Kunze et al. 2015) when age-inclusive HR practices are present. In addition, they found that average relative subjective age was negatively related to average individual goal accomplishment in companies, which in turn is related to company performance.

The third perspective acknowledges that both psychological and social variables together play a role in predicting subjective age. Shanahan et al. (2005) highlight that there are social variables and personal qualities that can influence age perceptions. For instance, there are social roles (e.g., being a parent), social domains (e.g., with friends, at work), and traditional transition markers (e.g., marriage) that interact with personal differences (e.g., cognitive maturity) to impact subjective aging.

Finally, chronological age (CA) is a significant predictor of subjective age. Along with one's health, CA shows a stronger relationship with SA than any other predictor (Cleveland and

Shore 1992; Mathur and Moschis 2005), with correlation coefficients between 0.44 and 0.81.

### Outcomes

The subjective age of a person also relates to certain outcomes inside and outside of work. Within a sample of shift workers from a large manufacturing organization, older subjective age was associated with higher perceived stress at work and lower reported presence of support mechanisms (Barnes-Farrell and Piotrowski 1991). A study by Bobko and Barishpolets (2002) found increased physical tiredness in Ukrainian workers with an older subjective age, and workers with a younger subjective age generally reported better physical ability to work; the difference between felt age and chronological age was also related to self-ratings of stress factors. A younger subjective age is also related to the self-perception of achieving higher work performance and less tiredness after work days (Iskra-Golec 2002). Furthermore, Kaliterna et al. (2002) found that workers with a younger subjective age can feel more capable of mastering the mental, physical, and social demands of certain occupations. Organizations that employ workers with a younger subjective age have more beneficial performance if the company operates in a dynamic environment (Kunze et al. 2015). Rioux and Mokoukolo (2013) differentiate between general subjective age and subjective age at the workplace. They contend that both are linked to higher satisfaction with professional life, but specifically an older subjective age at the workplace is also linked to higher attachment to the workplace.

Segers et al. (2014) conceptualized a framework for age perceptions at work, called the Age Cube of Work. It has not yet been empirically tested, and the main purpose of the Age Cube of Work is currently to generate empirical questions regarding work and aging. The Age Cube includes a dimension capturing important work context variables (i.e., job, team, organization, industry, and country). Although it has been demonstrated that subjective age has been studied briefly in the workplace, much additional research is still needed to fully examine all relevant job related variables and outcomes (e.g., retirement timing).

Subjective aging has mostly been studied outside of the work context. The extent to which a person feels younger or older as her/his actual chronological age has shown to influence health outcomes. Barrett and Toothman (2014) found that a younger age identity is generally related to better health (i.e., if you feel young but are chronologically older, that is a predictor of positive health outcomes). Bowling et al. (2005) reported similar results in regard to both physical and psychological health and functioning. Furthermore, their study revealed that participants with a younger subjective age indicated higher self-efficacy and tended to rate their quality of life higher than participants with a lower subjective age. Additionally, Boehmer (2006) examined subjective age in cancer patients and found that patients who reported a younger subjective age, or feeling as old as they really were, perceived themselves to have higher health-related quality of life than patients who felt older than they really were. In another study, Boehmer (2007) also found that cancer patients with a younger subjective age indicated higher satisfaction with recovery after their surgery, as well as a lower perception of personal disability. These results indicate that subjective age is a relevant factor when considering the healing and recovery of people who are fighting with illness.

Other health outcomes of subjective age relate to mental health and depressive symptoms. Choi and DiNitto (2014) found that an older subjective age can have a negative effect on depressive symptoms, and Keyes and Westerhof (2012) demonstrated similar results by confirming that a younger subjective age is related to the increase of flourishing mental health and a decrease in major depressive episodes. Furthermore, a younger subjective age can lead to higher levels of subjective well-being, which is characterized by life satisfaction and positive affect (Westerhof and Barrett 2005). It has also been shown that a younger subjective age and therefore feeling further from death can lead to lower psychological distress (Shrira et al. 2014), and it has also been shown to lead to lower levels of C-reactive protein (CRP). CRP is associated with some physical functional limitations and quicker cognitive decline (Stephan et al. 2015b); a younger

subjective age therefore has positive effects on physical and psychological health.

Other outcomes of a younger subjective age include a higher intention to perform physical activities (Caudroit et al. 2012). Also, Stephan et al. (2013) achieved improved physical functioning measured by grip strength by inducing a younger subjective age in their participants. Teuscher (2009) found correlations between a younger subjective age and higher optimism, self-efficacy, and general satisfaction. Stephan et al. (2015a) also found that people with demonstrated accelerated subjective aging had steeper and nonnormative declines in the personality traits Extraversion and Openness. Participants with slower subjective aging on the other hand showed typical patterns of decline of these personality traits. People with an older subjective age had less tendencies to be sociable, energetic, and enthusiastic. Depending on the age group though, an older subjective age can also have advantages. First-year university students can benefit from an older subjective age in regard to positive and negative affect, particularly students with vulnerable self-esteem. Students with a higher subjective age may report higher positive affect and more self-enhancement and protection against threats to psychological well-being (Fang and Galambos 2015).

While there are several outcomes of SA, it is also important to consider that some of these are mediated by the social status older people hold in society due to their age (Marques et al. 2015). There is a negative relationship between age identification and health in countries where people of older age are devalued in terms of their social status. Mock and Eibach (2011) found that a person's attitude towards aging influences the relationship between subjective age and well-being. Less favorable aging attitudes can lead to lower life satisfaction and increased negative affect when a person demonstrates an older subjective age.

## Cultural Considerations

A review by Barak (2009) showed that subjective age is an appropriate construct to use across

nations and cultures. It translates well and can be measured with reliability and validity in a cross-cultural research context. It was found that there is a generally consistent pattern across 18 different countries that people felt and desired younger ages than their chronological age. In addition, Barak found a consistent pattern of ideal age being younger than subjective age, which was younger than chronological age (as he illustrates as ideal age < subjective age < chronological age). However, additional research is needed to fully explicate these comparisons and compare nations statistically (e.g., Barrett and Montepare 2015), because there are still meaningful and prominent cultural differences that exist. For instance, although both Americans and Germans feel younger than their chronological age, this relationship is stronger among Americans (Westerhof et al. 2003). Also, Barnes-Farrell et al. (2002) revealed differences in age-perceptions, specifically components of psychological age (subjective age, act age, and preferred age) among five nations that were included in their study of healthcare workers. These differences are most likely due to differing cultural beliefs regarding age-appropriate behavior and the differing values that the USA, Ukraine, Brazil, Poland, and Croatia hold for youth and/or age. Furthermore, the relationships between felt age and work strains, specifically physical fatigue, mental fatigue, and tension, differed among all five nations.

Both social roles and the social environment shape an individual's aging experience (Diehl et al. 2015), and these variables are known to differ culturally both inside and outside of work. For instance, social experiences, such as age discrimination or stereotypes, differ across groups of individuals and present important influences on subjective age. Events that serve as social markers that trigger subjective aging perceptions also differ culturally (e.g., rites of passage, sexual maturity, retirement). Subjective age research is not always conclusive. For example, some researchers have found gender differences in subjective age (e.g., Peters 1971), while others have not (e.g., Baum and Boxley 1983). These inconsistent findings can also be found with other

variables such as educational level and marital status with subjective age (Barak and Stern 1986). These differences can be due to ethnic and cultural differences in the samples studied (e.g., Henderson et al. 1995).

Not only are there cultural differences cross-nationally, but there are cultural differences within similar societies. An example of this is generational differences. The cultural influences of someone in a much older cohort might not align with those of a younger cohort. Setterson and Hagestad (2015) illustrate this anecdotally by noting that a younger generation today might greatly emphasize their individuality and autonomy in their aging perceptions, whereas someone from a much older generation would not include this in their interpretation of aging as strongly and be more concerned with concepts such as "human agency." With increasing life expectancy in many countries, society is growing older, and this has implications for subjective age perceptions as well. These demographic shifts help to shape new age-expectations for individuals (Setterson and Hagestad 2015). For instance, people are healthier, family structures are shifting, life expectancy is longer, and people are staying in the workplace longer.

## Future Directions

People in their 20s tend to believe middle and older age begin at a lower chronological age than do older individuals. People in their 60s often consider themselves to be middle age. Further, the gap between chronological and subjective age becomes wider as individuals become older. For example, older individuals often feel younger than their chronological age would indicate (Goldsmith and Heiens 1992). In addition, the gap between chronological and subjective age is wider for middle-aged and older women than it is for middle-aged and older men (Montepare and Lachman 1989).

Further, there is evidence from the gerontological literature that after childhood, where chronological age serves as a reasonable developmental milestone, one's chronological age increasingly

becomes a less useful description of one's "age." Historically, the initial alternatives to chronological age reflected one item or one-dimensional measures of some facet of subjective age. More recently, multidimensional measures of subjective age, awareness of age-related changes, and successful aging are all promising concepts to pursue in relation to understanding the links between age and important work outcomes.

There are a number of research questions that are important next steps. First, there is a need for clearer construct articulation and explication of subjective age or subjective aging. Research in this area is more measurement-focused currently; there is a pressing need to develop the theoretical relations among subjective age and related constructs and determine the convergent and discriminant validity of relevant age measures. Second too little is known about the psychometric properties of subjective age measures, AARC, and successful age measures. Are these overlapping measures and if so, by how much? Does the SA construct add to other constructs? Is it a part of other constructs or are other constructs facets of SA? Each of the many age constructs described here is based on similar core theories from the gerontology literature, although each uniquely draws from other theories as well. Yet few theories, if any, attempt to elaborate on the relationships among these age constructs.

Third, what work and well-being outcomes does each class of age measures predict? What unique contributions do various measures make to such outcomes and how do different measures operate jointly? (Cleveland and Hanscom [in press](#)). Fourth, what proximal (e.g., job, supervisor, coworker) and distal (e.g., stereotypes, climate) variables influence employee perceptions of their own age and the age of their co-workers? Fifth, one of the poorly understood aspects of this key construct is its malleability. The beliefs workers hold about their age and the age of others are important, but the source and determinants of these beliefs are not well understood especially within the work context. Can beliefs be modified to enhance adaptability and successful aging? For example, Diehl and colleagues have developed the AARC construct and initiated research and

pilot interventions to enhance and change people's age self-perceptions. One goal of these interventions is to enhance individual well-being and position health and exercise behaviors. This laudable stream of research is one that should be tested and applied to employee in the workplace, young and old alike.

Not only older people need to be examined, but also younger people to determine whether or not subjective age and well-being can be influenced in order to enhance both one's work and personal lives (e.g., Zaniboni et al. 2014). Given the clear evidence of the increasing chronological age of many members of the workforce, finding out how beliefs about what constitutes an "old" (and a "young") worker develop and change is important.

## Cross-References

- ▶ [Activity Theory, Disengagement Theory, and Successful Aging](#)
- ▶ [Age, Self, and Identity: Structure, Stability, and Adaptive Function](#)
- ▶ [Age Stereotyping and Views of Aging, Theories of](#)
- ▶ [Attitudes and Self-Perceptions of Aging](#)

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## Subjective Memory

Nicholas T. Bott<sup>1,2</sup>, Nathan Hantke<sup>1,3</sup> and Viktoriya Samarina<sup>4</sup>

<sup>1</sup>Sierra Pacific Mental Illness Research, Education, and Clinical Centers (MIRECC), VA Palo Alto Health Care System, Palo Alto, CA, USA

<sup>2</sup>Pacific Graduate School of Psychology–Stanford PsyD Consortium, Stanford, CA, USA

<sup>3</sup>Department of Psychiatry and Behavioral Sciences, Stanford University School of Medicine, Stanford, CA, USA

<sup>4</sup>Barrow Neurological Institute, Phoenix, AZ, USA

## Synonyms

Subjective cognitive decline (SCD); Subjective cognitive impairment (SCI); Subjective memory complaints (SMC); Subjective memory decline (SMD); Subjective memory impairment (SMI)

## Definition

Subjective memory is one's perceived memory ability, independent of objective standards or performance. Subjective memory reflects one's perception about his or her personal memory functioning. It is a construct to be quantified, studied, and understood in clinical practice and can be referred to as subjective memory complaints (SMC), subjective memory decline (SMD), subjective cognitive decline (SCD), subjective memory impairment (SMI), and subjective cognitive impairment (SCI) (Edmonds et al. 2014; Stewart 2012).

## The Construct of Subjective Memory

The precision and utility of the construct of subjective memory performance has been scrutinized since its introduction as a potential variable of interest for older adults at risk of dementia (Stewart 2012). Studies remain mixed regarding its reliability, its value in relationship to objective measures of memory performance, and its prognostic value for future memory or general cognitive decline (Crumley et al. 2014; Edmonds et al. 2014). The reliability of subjective memory has been questioned on the basis of variability in the source, which can include patients, informants, or skilled clinicians (Albert et al. 2011). Moreover, the diversity of terminology used within the construct provides opportunity for conflation of the reported concerns, be those specifically memory related abilities, nonmemory related abilities, or a combination of both (Edmonds et al. 2014).

Nevertheless, the construct of SMC has played a prominent role in the clinical appraisal of cognition, specifically as a diagnostic criterion of mild cognitive impairment (MCI; Diagnostic criteria for MCI include SMC to capture self-reported experience of change in cognitive performance and to exclude individuals with longstanding cognitive difficulties) (Petersen 2004). Edmonds and colleagues (2014) recently questioned the efficacy of SMC as an MCI criterion within a cohort of participants from the Alzheimer's

Disease Neuroimaging Initiative (ADNI) previously labeled as MCI. Using hierarchical cluster analysis they demonstrated that overestimation of self-reported cognitive complaints was more frequent in cognitive cluster-derived normal subgroup, while underestimation of self-reported cognitive complaints was more frequent in an amnesic cluster-derived MCI phenotype, which is associated with progression to Alzheimer's dementia.

To address the dissociation of objective and subjective memory, Dalla and colleagues (2015) recently proposed a cognitive model of subjective memory awareness, whereby memory performance is construed as first-order consciousness or "consciousness in action," and awareness of memory performance is understood as second-order consciousness or awareness of first-order consciousness. Within such a model, congruency between objective memory, performance, and subjective ratings of said performance is mediated by awareness. Poor awareness of memory performance in the context of good objective performance constitutes cognitive dysgnosia; on the other hand, poor awareness of memory performance in the context of impairment objective performance constitutes anosognosia.

Beyond cognition, the relationship between subjective memory function and aspects of well-being has also been investigated. Mol and colleagues (2007) reviewed a small sample of studies ( $n = 5$ ) meeting inclusion criteria for SMC in the absence of objective memory impairment. They reported consistently diminished quality of life (QoL) in older adults endorsing SMC across studies incorporating different methodologies and measures of QoL. Mol and colleagues (2009) also investigated the presence of SMC on measures of QoL (satisfaction, mental well-being, anxiety, depression) over time. Older adults with SMC at baseline reported lower overall QoL and increasing amounts of anxiety over time when compared to those without SMC. More recently, Zuniga and colleagues (2016) found that community-dwelling older adults ( $n = 179$ ) reporting fewer memory complaints endorsed lower perceived stress, fewer adverse physical symptoms, and higher levels of happiness.

On the other hand, as the awareness and accuracy of objective memory deficits diminish over the course of neurodegenerative illnesses, it is accompanied by higher QoL ratings (Trigg et al. 2011; Hurt et al. 2010). The relationship between patient and informant report of SMC has also been shown to be relevant. While healthy individuals without SMC often align with informant report on measures of memory concern, discrepancy between self and informant report is common. Gifford and colleagues (2014) found that among healthy control participants who later converted to MCI/dementia, mutual self and informant SMC was associated with the largest increase in risk for conversion, followed by informant only, and then self only SMC. For participants with MCI, only mutual self and informant SMC and informant only SMC were associated with increased risk of conversion to dementia. Thus, obtaining collateral report of memory complaints is valuable in distinguishing pathological aging trajectories and can play a role in early intervention planning.

### Prevalence in Population

SMC are common among middle-aged adults and elderly. In a sample of 1,971 adults between the ages of 25 and 85 years old, 41% of people between the ages of 55 and 65 and 52% of people between the ages of 70 and 85 years old reported being forgetful (Ponds et al. 1997). Prevalence of memory complaints varied in other community-based studies with older adults, ranging from 22% in adults 65–84 years old (Jonker et al. 1996) to over 50% in adults 65 years and older (Blazer et al. 1997). Fritsch and colleagues (2014) reported that in a sample of 499 community-dwelling older adults aged 65 and older, 27% endorsed SMC. Jessen and colleagues (2007) reported that 30% of healthy older adults acknowledge difficulty remembering recent events, as well as where certain “belongings are kept.” Prevalence of subjective cognitive impairment in community adults 65 years and older ranged from 25% to 56% (Reisberg et al. 2010).

### Relationship to Psychiatric Symptoms

Mood symptoms play an important role in understanding SCI. Self-reports of cognitive problems in older adults are often attributed to depression rather than being reflective of objective memory deficits, such as what would be seen in early neurodegenerative disease. Indeed, SCI is often the primary complaint in older adults with depressive symptoms, and difficulties with memory and attention are commonly reported in those who are depressed (Reid and MacLulich 2006). Several studies indicate that depression is highly correlated with memory complaints, and that SCI, as measured by self-referrals for memory evaluations and self-reported memory concerns, are more likely due to depressive symptoms rather than objective memory problems (Jonker et al. 2000). Several large studies have shown that SCI is not related to performance on objective cognitive measures and instead reflect mood symptoms and personality traits (Jorm et al. 2004; Kliegel et al. 2005). Further, Minett and colleagues (2008) also found that SCI is strongly associated with depressive symptoms in adults aged 50 or older, more so than with poor performance on objective cognitive measures. These findings suggest that mood functioning may be driving concurrent subjective cognitive concerns rather than cognition.

However, the majority of research examining the relationship between SCI and mood are cross-sectional studies or utilize healthy aging samples. Longitudinal studies of older adults suggest a more complicated relationship between mood, SCI, and cognition. While cross-sectional studies suggest that SCI is related to personality traits and depressive symptoms, when examined over time, several studies have shown that baseline SCI predicts which individuals went on to experience cognitive decline (Reid and MacLulich 2006). Similar findings suggest SCI is not just a symptom of depression, but may reflect an individual's realistic observation and self-appraisal of his or hers cognitive status, particularly with respect to the prediction of future cognitive decline (Schmand et al. 1997).

Taken together, these findings suggest an interesting interplay between mood, SCI, and

cognitive decline. There is evidence that depression is associated with worse performance on cognitive measures and SCI. But, depression may also be a by-product of a realistic awareness of subtle cognitive difficulties. Individuals who are aware of declining cognition may feel more depressed, and individuals reporting depression may describe worsening cognition, resulting in exacerbation of both depressive and cognitive symptoms (Schmand et al. 1997).

### **Relationship to Neuropsychological Performance**

SMC may at times reflect very subtle changes in cognitive functioning that may not be recognized by neuropsychological tests. Some research indicates that people who report subjective cognitive changes are “worried well,” and therefore there is no relationship between SMC and objective memory performance on neuropsychological tests (Flicker et al. 1993; Ginó et al. 2010). However, other research has indicated significant relationships between SMC and cognitive performance on objective neuropsychological measures (Reisberg et al. 2010; Amariglio et al. 2012; van Harten et al. 2013). Amariglio and colleagues (2012) found significant relationships between people with SMC and decreased performance on neuropsychological measures of episodic memory, working memory, and semantic information. Longitudinal research revealed that people with SCD demonstrate a more rapid decline on immediate recall tasks (Reisberg et al. 2010).

Several studies have also revealed that SMC in cognitively intact older adults is related to an increased risk in dementia (Geerlings et al. 1999; Reisberg et al. 2010). Reisberg and colleagues (2010) found that healthy older adults reporting SMC are more likely to experience future cognitive decline than healthy older adults who do not have SMC. When controlled for age and other similar factors, older adults with SMC were 4.5 times more likely to develop MCI or dementia than adults who did not report decline (Reisberg et al. 2010).

Additionally, Reisberg and colleagues (2010) revealed that adults with SCI, whose performance on neuropsychological measures were lower, but still within normal limits, were more likely to have cognitive decline than adults whose neuropsychological performance remained stable at follow-up visits.

### **Predictive Value of Future MCI and/or Neurodegenerative Disease**

Subjective cognitive impairment is very often seen in individuals with mild cognitive impairment (MCI). Individuals with MCI function independently on day-to-day tasks, yet show cognitive impairment in specific areas, often memory, that is beyond what would be expected during the process of healthy aging (Petersen et al. 1999). The role of SCI is important in Petersen’s conceptualization of MCI, but corroboration by an informant is also preferred. This is predicated in evidence that 35–75% of individuals with MCI have cooccurring neuropsychiatric symptoms, which also are correlated with subjective cognitive complaints and may not be as predictive as collateral reports, which are thought to be more strongly correlated with objective performance (Apostolova and Cummings 2008). Of course, Petersen’s criteria also call for objective memory deficits. Longitudinal follow-up shows that individuals with MCI convert to Alzheimer’s disease (AD) at differing rates. Fischer and colleagues (2007) reported a 49% conversion rate to AD for individuals with amnesic MCI after 30 months. This rate declined to 27% for individuals with nonamnesic MCI. For cognitively healthy individuals at baseline, the rate dropped further to 13%. Busse et al. (2006) estimated the maximum conversion rate to dementia in individuals with MCI to be approximately 65%. Notably, they reported that conversion rates to dementia are highest during the first 2–3 years of clinical observation (20%).

The combination of mild memory difficulties despite relatively intact general cognition often results in individuals being well aware of their cognitive decline, or even noticing subtle cognitive

changes before evidence is seen on objective measures. In point, individuals are often referred for memory evaluations after reporting subjective memory concerns to their physicians. Empirical findings on the overall accuracy of SCI to predict cognitive decline is mixed. Several studies not surprisingly show higher levels of cognitive complaints in individuals with MCI as compared to healthy older adults (Roberts et al. 2009). Specifically, individuals with MCI are often aware of experiencing decline in their general cognitive abilities, but are poor at predicting their actual memory deficits (Clément et al. 2008). Baseline SCI has been shown to be predictive of objective memory problems at a 3-year follow-up and associated with an increased risk for a future diagnosis of dementia even when baseline cognition was normal (Geerlings et al. 1999; Luck et al. 2014; Schmand et al. 1996; Tobiansky et al. 1995). Even more striking, a recent metaanalysis found that older adults with SCI are twice as likely to develop dementia as individuals who are not reporting SCI, with an annual conversion rate of 2.3% for dementia and 6.6% for MCI (Mitchell et al. 2014). SCI has also been associated with poorer functional autonomy and consistent with daily functioning problems associated with MCI (Clément et al. 2008).

Yet, other studies have shown SCI has little association for either present objective cognitive difficulties or future incidence of dementia, and a recent study found that subjective memory concerns do not predict mortality over an 8-year span (Kliegel et al. 2005; Jorm et al. 1997; Roehr et al. 2016). However, the majority of studies suggest that baseline subjective memory complaints predict future cognitive decline over a 2-year span, particularly for those already carrying a diagnosis of MCI (Jonker et al. 2000). The inconsistencies in extant literature for SCI to portend cognitive decline may be partially attributed to variance in individual's level of cognitive awareness (Roberts et al. 2009). There are also differences in sensitivity to change, with some being hyper aware to any changes in cognitive status, overestimating dysfunction and falling more in to a category of "worried well." Others may be less attuned and be unaware or nonchalant of deteriorating cognitive abilities. Further, an individual's

self-awareness of cognitive deficits likely depends on the level of objective cognitive difficulties. Individuals may report cognitive deficits in proportion to objective findings, but insight may deteriorate as cognitive deficits become more severe, resulting in a bell-shaped curve of self-awareness in relation to cognitive difficulties (Mitchell et al. 2014). Such variance in personality and self-awareness are difficult to control for within subjective cognitive constructs, making reliance upon SCI as both a research and clinical entity difficult. Nevertheless, while individual differences in subjective cognitive awareness may contribute to these mixed findings, the significant inconsistencies in defining the construct of SMC, along with how MCI has been operationalized, are likely the strongest contributor to the discrepancy among study findings.

### Proposals for Established Criteria Informing the Construct of SMC

Concerns surrounding the definition and underlying framework of subjective memory have prompted proposals to establish uniform criteria for this construct. Abdulrab and Heun (2008) detailed the lack of consistency in current descriptions of SMC among 44 papers providing definitions of the construct. They outline essential criteria, course-specific criteria, and nonessential supportive criteria detailed in the table below (Table 1).

More recently, Jessen and colleagues (2014) have outlined a framework for studies investigating SCD in preclinical AD specifically, offering research criteria for pre-MCI SCD and features that increase the likelihood of preclinical AD in individuals with SCD (*SCD plus*). Pre-MCI research criteria include: (1) self-reported persistent decline in cognitive capacity compared to previous normal status and (2) normal normed performance on standardized cognitive tests. Both of these criteria must be present. *SCD plus* criteria that can be applied to collected data include: specific subjective decline in memory, onset within past 5 years, age of onset of SCD >60, worries and concerns associated with SCD, and subjective worse performance compared to

**Subjective Memory, Table 1** Proposed criteria for subjective memory impairment (Abdulrab and Heun 2008)

Essential criteria	Course specific criteria	Nonessential supportive criteria
<ul style="list-style-type: none"> <li>• Age at presentation (e.g., &gt;50 years)</li> <li>• Presence of memory complaints in a specified length of time (e.g., past 6 months)</li> <li>• Belief that memory is worse compared to earlier periods of life (e.g., when one was in high school or college)</li> <li>• Valid example of memory problems in everyday life</li> <li>• Frequency of memory problems (e.g., at least every week)</li> <li>• Normal objective memory performance (not-demented)</li> </ul>	<ul style="list-style-type: none"> <li>• Gradual onset (may indicate AD)</li> <li>• Sudden or staggered onset (may indicate vascular dementia)</li> </ul>	<ul style="list-style-type: none"> <li>• The belief that memory is worse than others of similar age</li> <li>• Memory worsening affirmed by an informant (close relative or friend who is in contact with subject at least monthly)</li> <li>• Subject spontaneously mentions memory problems if asked about any general medical concerns</li> <li>• Seeking medical help for memory problems</li> </ul>

others of the same age group. In addition, confirmation of cognitive decline by an informant, presence of *APOE* e4 genotype, and biomarker evidence for AD are suggested as conferring additional likelihood of preclinical AD in individuals with SCD. Each of these recent proposals provides much needed specificity to the construct of subjective memory and offer specific criteria for more reliably assessing self-reported memory performance.

**Conclusions**

Subjective memory remains a construct of great interest to clinicians, researchers, and individuals

themselves. While the utility of self-reported memory performance always received some scrutiny, it remains a useful clinical tool to characterize patient experience and awareness and critically is a part of the diagnostic criteria for. Recent proposals offer recommendations for narrowing the definition of self-reported memory difficulties and parsing out symptoms that may be more associated with specific neurodegenerative diseases such as AD. These proposals provide much needed clarification and definition to the construct of subjective memory and if adopted may help advance the clinical utility of this construct, which has proven difficult to grasp.

**Cross-References**

- ▶ [Aging and Quality of Life](#)
- ▶ [Attitudes and Self-Perceptions of Aging](#)
- ▶ [Cognitive and Brain Plasticity in Old Age](#)
- ▶ [Effects of Stress on Memory, Relevance for Human Aging](#)
- ▶ [History of Cognitive Slowing Theory and Research](#)
- ▶ [Process and Systems Views of Aging and Memory](#)
- ▶ [Psychological Theories of Successful Aging](#)

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## Substance Use and Abuse

Alexis Kuerbis<sup>1</sup>, Paul Sacco<sup>2</sup> and Alison A. Moore<sup>3</sup>

<sup>1</sup>Silberman School of Social Work, Hunter College of the City University of New York, New York, NY, USA

<sup>2</sup>University of Maryland School of Social Work, Baltimore, MD, USA

<sup>3</sup>Division of Geriatric Medicine, David Geffen School of Medicine at UCLA, Los Angeles, CA, USA

## Synonyms

Illicit drugs; Prescription drugs; Problem drinking; Substance use disorders; Unhealthy substance use

## Definition

A substantial proportion of older adults use and misuse alcohol, tobacco, illicit drugs, and prescription medications, and there are several risk factors that increase an older adult's likelihood of engaging in such health behavior. Due to their particular life stage, assessing older adults for substance use or misuse presents unique challenges. Few existing treatments have been tested on older adults; however, treatments are known to be more effective when they are tailored to the older adult and take into consideration any learning difficulties or disabilities.

## Background

Thirty percent of the adult US population is comprised of baby boomers, a generation of individuals turned 65 starting in 2011 (Kuerbis et al. 2014). Longer life expectancies and the size of this group contribute to estimates of the number of older adults almost doubling in size from 40.3 to 72.1 million between 2010 and 2030. In past generations, older adults reduced their substance use as they aged (Moore et al. *in press*). This trend was reflected in the shrinking prevalence rates of substance use disorder (SUD) across the life span. Indeed, current prevalence rates of SUD among older adults remain lower than their younger adult counterparts. Additionally, few older adults present to formal treatment programs. These two facts lead many to assume that older adults do not generally use substances and subsequently do not require in-depth assessment or treatment.

Unlike previous generations, baby boomers came of age at a time when attitudes toward alcohol, tobacco, and drug use were more permissive and accepting, leading to greater rates of alcohol and drug use overall and subsequent SUD (Kuerbis et al. 2014). SUD among this generation have remained high as they age, with a seemingly slower rate of aging out of alcohol and drug use than their predecessors. Both the increased numbers of the individuals within this population and their greater rates of use contribute to higher estimated prevalence rates. Numbers of individuals 50 and older with SUD are estimated to more than double from 2.8 million in 2006 to 5.7 million in 2020. While older adult prevalence rates are lower than their younger adult counterparts, differences between the groups are slowly shrinking. This closing gap is even more of concern when taking into account the special vulnerabilities (biological, psychological, and social) of older adults to the effects of mood-altering substances.

## Terms and Diagnostic Challenges

Relying solely on formal diagnosis of SUDs and treatment utilization paints an incomplete picture

of the effects of substance use among individuals 65 and older. Given their vulnerabilities with even limited substance use, older adult substance use requires expanded description. As a result, there are a variety of terms describing various forms of substance use.

Alcohol use that exceeds limits recommended by the National Institute of Alcohol Abuse and Alcoholism (NIAAA) (i.e.,  $\leq$  seven standard drinks per week, no more than three on any one occasion; a standard drink is defined as a 12 oz beer, 4–5 oz glass of wine, 1.5 oz of 80-proof liquor) (National Institute on Alcohol Abuse and Alcoholism 2013) has been termed *unhealthy use* (Moore et al. *in press*). Currently, there is no recognized safe limit for tobacco or illicit drugs. Use of these substances would be considered unhealthy regardless of amount. *At-risk* drinking refers to drinking beyond the safety guidelines and includes identifiable risks such as drinking with comorbid health or mental health disorders but has yet to result in harm. *Problem drinking* refers to drinking patterns that result in identifiable harm but are subthreshold for the *Diagnostic and Statistical Manual*, 5th edition (DSM-5), alcohol use disorder (American Psychiatric Association 2013). *Nonmedical use of prescription-type drugs* relevant for older adults is use without a prescription, in greater amounts, more often or longer than prescribed, or for a reason beyond the parameters of the prescription given by the doctor.

The term *substance use disorder* refers to the diagnostic criteria using DSM-5, of which an individual must meet or endorse at least 2 or more of 11 criteria in at least 12 months (American Psychiatric Association 2013) (see Table 1).

Criteria for SUD may not be relevant to older adults, due to specific biological and social factors unique in late life (Center for Substance Abuse Treatment 1998), potentially interfering with accurate diagnosis. Age-related physiological changes increase the effects of substances in older age, resulting in a reduction in tolerance to these substances. Thus, increased tolerance, one of the primary indicators of SUD, cannot be used to determine SUD in older adults. In addition,

**Substance Use and Abuse, Table 1** Substance use disorder (formerly substance abuse or dependence) criteria, from the *Diagnostic and Statistical Manual, Fifth edition*, p. 491

DSM-5 criterion for SUD	Consideration for older adult
A substance is often taken in larger amounts or over a longer period than was intended	Cognitive impairment can prevent adequate self-monitoring. Substances themselves may more greatly impair cognition among older adults than younger adults
There is a persistent desire or unsuccessful efforts to cut down or control substance use	Same as a general adult population
A great deal of time is spent in activities necessary to obtain the substance, use the substance, or recover from its effects	Consequences from substance use can occur from using relatively small amounts
Craving or a strong desire to use the substance	Same as a general adult population. Older adults with entrenched habits may not recognize cravings in the same way as the general adult population
Recurrent substance use resulting in a failure to fulfill major role obligations at work, school, or at home	Role obligations may not exist for older adults in the same way as for younger adults, due to life stage transitions such as retirement. Role obligations more common in late life are caregiving for an ill spouse or family member, such as a grandchild
Continued substance use despite having persistent or recurrent social or interpersonal problems caused or exacerbated by the effects of the substance	Older adults may not realize the problems they experience are from substance use
Important social, occupational, or recreational activities are given up or reduced because of substance use	Older adults may engage in fewer activities regardless of substance use, making it difficult to detect
Recurrent substance use in situations in which it is physically hazardous	Older adults may not identify or understand that their use is hazardous, especially when using substances in smaller amounts
Substance use is continued despite knowledge of having a persistent or recurrent physical or psychological problem that is likely to have been caused or exacerbated by the substance	Older adults may not realize the problems they experience are from substance use
Tolerance, as defined by either of the following: 1. A need for markedly increased amounts of the substance to achieve intoxication or the desired effect 2. A markedly diminished effect with continued use of the same amount of the substance	Due to increased sensitivity to substances as they age, older adults will appear to have lowered rather than increase in tolerance
Withdrawal, as manifested by either of the following: 1. The characteristic withdrawal syndrome for the substance 2. The substance or a close relative is taken to relieve or avoid withdrawal symptoms	Withdrawal symptoms can manifest in ways that are more “subtle and protracted” (Barry et al. 2002). Late onset substance users may not develop physiological dependence or non-problematic users of medications, such as benzodiazepines may develop physiological dependence

Table adapted from Barry et al. (2002), p. 109 (Reprinted from (Kuerbis et al. 2014))

reduced or restricted social and vocational roles that change as a result of life stage, such as retirement or mortality of age-group peers, may mask the consequences of or changes related to drinking and drug use. Finally, many older adults may misattribute problems resulting from substance use to aging. Thus, the criterion “continued use despite persistent problems” may not apply. While the new criteria may capture a greater proportion of substance-using older adults to be diagnosed

with SUD (Kuerbis et al. 2014), many will remain unidentified.

### Prevalence Rates of Use and Substance Use Disorders

Alcohol continues to be the most commonly used substance in later life (Moore et al. in press). As described previously, the prevalence of abstinence



increases and the amount of alcohol consumed decreases as individuals age. Still, about 50% of older adults in the USA consume alcohol (Moore et al. 2005). Prevalence rates for unhealthy older adult drinkers are estimated to be 10% for women and 12% for men (Blazer and Wu 2009a). Only about 1–2% of persons aged 65 years and older have a current diagnosis of alcohol use disorder, according to DSM-IV abuse and dependence definitions, which are more conservative than DSM-5 criteria (Kuerbis et al. 2013). Prevalence rates are lower than younger cohorts due in part to a mismatch of diagnostic criteria, older adults maturing out, increased mortality among those with lifelong AUD, and difficulty with accurate diagnosis.

Tobacco use is a marker of vulnerability for older adults, and 12–14% of individuals over the age of 65 report using tobacco (Moore et al. [in press](#)). About 4% have a tobacco use disorder. It is common both in the general population and among older adults to use tobacco and alcohol simultaneously. For this reason, it is not surprising that 6% of older adults report using both. In fact, older adults who use tobacco are twice as likely to report binge drinking (Wu and Blazer 2011).

Illicit drug use is historically minimal among older adults compared to their younger counterparts. With the aging of the baby boom generation, however, prevalence rates of illicit drug use are increasing (Moore et al. [in press](#)). Between 2002 and 2012, use of illicit drugs in the past month among individuals aged between 50 and 65 years doubled to 7.2%. In 2012, 19% of adults 65 years and older reported ever having used illicit drugs, compared to 48% of those aged 60–64 that same year (Wu and Blazer 2011). Of those individuals who report ever using illicit substances, 12% meet criteria for an SUD in the past year. Cannabis is the most commonly used illicit substance (3.9% of those aged 50–64, 0.7% of those aged 65 years and older), followed distantly by cocaine (0.7% aged 50–64 years, 0.04% of those aged 65 years and older). With increasingly relaxed restrictions on the sale and use of marijuana, the prevalence rate of use among older adults may increase (Kuerbis et al. 2014).

Because older adults take more prescribed and over-the-counter medications than younger adults, they are at increased risk for harmful drug interactions, misuse, and abuse (Kuerbis et al. 2014). Nonmedical use of prescription medication is common among older adults. Many older adults do not view using a prescribed medication in ways it was not prescribed (i.e., for extended periods or in larger doses) to be a problem; nonmedical use of prescription medications is still generally thought to be underreported. In 2012, just fewer than two million adults 50 and older reported using prescription drugs nonmedically in the past year (Moore et al. [in press](#)). The current estimate of prescription medication misuse among older women is 11%. A national epidemiological study reported that 1.4% of adults aged 50 years and older used prescription opioids nonmedically in the last year, a rate higher than sedatives, tranquilizers, and stimulants (all < 1%) (Blazer and Wu 2009b). Despite contraindications for older adults, benzodiazepines are disproportionately prescribed to older adults (Kuerbis et al. 2014). Rates of benzodiazepine use among older adults range from 15% to 32%, potentially impacted by overprescription, misdiagnosis, or polypharmacy rather than intentional misuse or abuse.

### Unique Vulnerabilities to Substance Use for Older Adults

While prevalence rates of use and SUDs are lower for older adults than their younger cohorts, there are specific risks for harm from substance use for older adults (Kuerbis et al. 2014). Some risks are due to aging itself, such as changes in substance metabolism and distribution in the body. Other risks are due to specific patterns of use (e.g., 1 drink a day for 7 days vs. 7 drinks on 1 day) (Moore et al. [in press](#)) or mixing prescription drugs and alcohol, or cognitive impairment, gait disorder, or another comorbid medical problem.

**Alcohol.** Due to biological changes to the body in late life, alcohol has a differential impact on older adults compared to their younger cohorts (Kuerbis et al. 2014). As the body ages, lean

body mass and total body water decrease, and the liver also loses the ability to process alcohol as well as it did in earlier age. The permeability of the blood-brain barrier and the neuronal receptor sensitivity to alcohol also increase. As a result of these biological changes, an older adult who imbibes the same amount of alcohol as a younger or middle-aged adult will experience higher blood alcohol concentration and greater impairment than the other two will experience, and with less awareness of that impairment. Thus older adults experience a greater vulnerability to the ill effects of alcohol even at moderate amounts. Furthermore, older adult at-risk drinkers are more likely to experience alcohol problems as well as impaired instrumental activities of daily living, such as shopping and cooking for oneself. Complications of drinking alcohol also arise with comorbid medical and psychiatric conditions that can occur in late life. Medication interactions increase the vulnerability of an older adult's health, even when he or she may be drinking at moderate levels.

It should be noted that despite this increased vulnerability to the negative effects of alcohol consumption, older adults can experience positive health effects from moderate alcohol consumption, such as drinking within the NIAAA safety guidelines. Drinking alcohol at moderate levels is associated with decreased morbidity and mortality among older adults (Center for Substance Abuse Treatment 1998), and moderate drinking older adults often experience better health (e.g., fewer falls, greater mobility) than their abstinent and heavy drinking peers. Positive benefits of alcohol consumption among older adults are limited to very specific conditions and in some cases have negative trade-offs. For example, with moderate drinking, the risk of ischemic stroke may decrease for an older adult, but his or her risk of hemorrhagic stroke may simultaneously increase. Thus benefits of drinking must be weighed against the individual's risk factors for such conditions, as well as his or her unique biopsychosocial context, age, gender, genetics, and comorbid illnesses.

**Tobacco.** Perhaps due to historical factors and level of cultural acceptance over time, older adults are less likely to perceive that smoking harms

health (Moore et al. *in press*). In fact, older adults who use tobacco have higher mortality, lung disease, coronary events, and overall physical functioning compared to younger adult tobacco users or their non-tobacco-using counterparts. Tobacco-using older adults also experience more smoking-related cancers, chronic obstructive pulmonary disease, greater decline in pulmonary function, development of osteoporosis, risk of hip fractures, and greater loss of mobility than their non-tobacco-using counterparts (Duru et al. 2010). Treatment for each of these conditions is further impaired or inhibited by continued tobacco use.

**Medications and Illicit Drugs.** Biological changes during the aging process also affect the impact of prescription medications and illicit drugs on the older adult body (Kuerbis et al. 2014). Benzodiazepines and opiates are processed much more slowly in an older adult body compared to a middle-aged or young adult. They should be prescribed and used with caution. Certain benzodiazepines are contraindicated for use with older adults as they tend to cause excessive sedation and the effects last far longer than for younger adults. An additional complication is that due to the sheer number of medications older adults tend to take, an older adult may not have an accurate list of the medications they are taking, including supplements. They may also see multiple doctors, each of whom is prescribing medications (often without knowing) that may interact poorly with the others or with alcohol or illicit drugs. An older adult who is prescribed a benzodiazepine, a barbiturate, or an opiate for a medical condition can expect to experience increased sedation with the simultaneous use of alcohol or marijuana. Finally, older adults may innocently or accidentally misuse a medication (e.g., taking another person's medication, confusing pills, or taking more than intended).

Cannabis' increasing acceptance, both medically and recreationally, may also pose unknown risks for older adults. In the general population, marijuana causes impairment of short-term memory; an increased heart and respiratory rate, as well as elevated blood pressure; and a fourfold increase in the risk of heart attack the first hour

after smoking (Kuerbis et al. 2014). For those older adults whose cognitive or cardiovascular systems are already compromised, cannabis may pose a notable risk. It is not yet clear which of the abovementioned conditions associated with tobacco use will emerge for marijuana.

### Factors Associated with Late Life Substance Use and Abuse

Existing research on older adult risk factors for substance use and abuse is almost exclusively focused on alcohol use (Kuerbis et al. 2014). It is reasonable to assume that the factors associated with late life unhealthy drinking may also contribute to use of other substances; however, unique factors that may contribute to use of substances other than alcohol remain relatively unknown. Table 2 lists some of the potential risk factors associated with older adult unhealthy use of alcohol and, when known, other substances.

**Demographics.** Several demographic characteristics are associated with unhealthy drinking in

late life. Male gender, affluence, and Caucasian race are the most prominent characteristics associated with late life drinking (Kuerbis et al. 2014). Age is also associated with unhealthy drinking – such that those below the age of 75 are more likely to be unhealthy drinkers than those above 75. None of these factors are demonstrated to predict an increase in late life drinking except for wealth. Having more affluence, more financial resources, and longer financial horizons are predictive of increased alcohol use among older adults. For other substances, female gender is associated with misuse of prescription drugs. Finally, having no or little religious affiliation is associated with a greater quantity and frequency of alcohol use.

**Medical and Psychiatric Morbidity.** Both alcohol use and unhealthy drinking are associated with overall better health in older age (Kuerbis et al. 2014). This is likely not a causal relationship but instead suggests that those older adults in good health are more likely to drink more than their counterparts in poor health. It has been observed that as hospitalizations, disabilities, or depression increase, drinking tends to decrease among older adults. Poorer physical and mental health also has been observed at greater rates among older adult heavy drinkers compared to their moderate drinking counterparts. Finally, pain is a key long-term predictor of alcohol use in late life (Moos et al. 2010).

Co-occurring psychiatric (e.g., anxiety, mood disorders, and personality disorders) and substance abuse disorders are assumed to occur in late life, as they do often in earlier life (Kuerbis et al. 2014); however, little to no research has explored the prevalence rates of these comorbid disorders in late life. Within the studies that examined an older adult population, high correlations have emerged between specifically alcohol use and depression and other affective disorders. This co-occurrence can complicate diagnosis and treatment for both. Aside from the common co-occurrence of tobacco and alcohol use, there is almost nothing known about polysubstance use among older adults.

Many older adults experience sleep disturbance or sleep disorders (Kuerbis et al. 2014).

**Substance Use and Abuse, Table 2** Risk factors related to substance use in late life

<b>Physical risk factors</b>
Male gender (for alcohol); female gender (for prescription drugs)
Caucasian ethnicity
Chronic pain
Physical disabilities or reduced mobility
Transitions in care/living situations
Poor health status
Chronic physical illness/polymorbidity
Significant drug burden/polypharmacy
<b>Psychiatric risk factors</b>
Avoidance coping style
History of alcohol problems
Previous and/or concurrent substance use disorder
Previous and/or concurrent psychiatric illness
<b>Social risk factors</b>
Affluence
Bereavement
Unexpected or forced retirement
Social isolation (living alone or with non-spousal others)

Reprinted from Kuerbis et al. (2014)

Older adults commonly use alcohol as a sleep aid, despite the fact that alcohol is known to interfere with sleep cycles overall. Older adults who combine alcohol and additional prescription or over-the-counter sleep aids are also likely to experience excessive sedation and/or cross-tolerance. Furthermore, older adults who use prescription medications with abuse potential or have had a history of a SUD or mental health disorder are more likely to misuse or abuse prescription medications. Finally, cognitive impairment and a variety of dementia types tend to be prevalent among older adults with an alcohol use disorder.

Style of coping with stress or tension may also predict having a late life alcohol use disorder (Kuerbis et al. 2014). Specifically, avoidance coping is associated with a drinking problem in later life. Similarly, older adults who report using alcohol to relieve tension or stress or to relax are also associated with late-life drinking problems.

**History of Alcohol Problems.** Not surprisingly, individuals who report having had an alcohol use disorder before age 50 and do not abstain from alcohol in late life are much more likely to drink at unhealthy levels in older age (Moore et al. *in press*).

**Social Factors.** While there may be gender differences, generally, divorce, separation from a spouse, or being single are associated with increased or unhealthy drinking in late life (Moore et al. 2009). Within a retirement community, having a larger social life with friends and family may increase one's risk of heavy or unhealthy drinking in later life (Kuerbis and Sacco 2012). While having sustained or increased social interactions from midlife into older age, particularly post retirement, tend to increase alcohol use in general, and in some cases problem drinking, social isolation is associated with prescription drug abuse among older adults. Late life transitions and events may also increase an older adult's vulnerability to substance misuse or a SUD. Loss in many forms has been shown to be associated with substance use among older adults. Loss can take the form of bereavement for a spouse or friends, living arrangement changes,

declining overall health, or loss of employment (Center for Substance Abuse Treatment 1998). Caregiving for a chronically or terminally ill spouse may increase the stress and subsequent vulnerability to substance misuse, and it may signal the loss of the relationship as it once was. Retirement can also impact substance use, depending upon preretirement conditions (Kuerbis and Sacco 2012). Preretirement job satisfaction, involuntary retirement, and workplace stress can negatively impact how the older adult copes with retirement and have been shown to increase alcohol use in general as well as drinking problems.

## Screening and Assessment

Older adults are far less likely to be screened for substance use than their younger adult counterparts (Kuerbis et al. 2014). Older adults tend to be more private about their substance use than a younger cohort. As a result, often the first point of contact with an older adult substance user is within primary care. Several barriers may interfere with identification of unhealthy, at-risk, or problem use. In cases where an older adult may present with symptoms of substance use or abuse, physicians and the older adults themselves may be more inclined to identify those symptoms as a part of natural aging or another health problem. Clinicians may have insufficient time to fully assess the older adult who comes in with a clear presenting problem that may not be immediately relevant to substance use; they may avoid asking the older adult about substances for fear of embarrassing them or causing them to anger; and finally, the symptoms themselves may share similarities with other conditions. Finally, older adults tend to view their substance use behavior as normal rather than risky. They may be particularly reticent to discuss this behavior as they themselves see it as irrelevant to the problem at hand and potentially their "last pleasure." This perspective is known to be reinforced by some health care professionals, such as in nursing homes, where the substance use may be enabled to the detriment of the older adult's health.

## Overall Approach to Discussing Substance Use with Older Adults

As with any person, older adults should be treated with respect. The overarching goal for any assessment should be the overall health and well-being of the older adult (Sacco and Kuerbis 2013), thus reducing shame and stigma around any particular behavior. Older adults are known to respond more fully to a supportive, nonconfrontational approach to assessment and intervention. Confrontation is not helpful or efficient in engaging an older adult to provide information about their substance use or to provide an intervention for such behavior. Efforts to identify a drug abuser rather than to assess substance use as a part of one's total health tends to cause defensiveness on the part of and stigmatization of the older adult. Questions about substance use should be asked matter-of-factly while keeping in mind that these questions may feel sensitive or intrusive to the older adult. Questions about quantity and frequency of drinking, any medications (prescription, over-the-counter, and those obtained from friends), and illicit drugs (e.g., marijuana) should be asked in a gentle, respectful manner with the assumption that the information is important whether the behavior itself is problematic or indicative of a SUD.

During assessment and intervention, it is important to keep in mind the potentially central role that substance use may play in the life of an older adult. For an older adult whose life is otherwise quite limited, he or she may view using a substance as the final vice – his or her last pleasure. Indeed, this may be reinforced by families, friends, or other health care professionals. A foreshortened sense of the future among older adults may also prolong substance use. Older adults have been found to be less motivated to change their habits around mood-altering substances compared to younger counterparts as they do not view their use as particularly severe or a problem – even when advised otherwise by a physician. In addition to differential motivation levels, a lack of self-efficacy may also be particularly problematic for an older adult. Self-efficacy is observed to decline with age when an individual perceives his or her life less and less in his or her

**Substance Use and Abuse, Table 3** Potential indicators of substance misuse and abuse

<b>Physical indicators</b>
Falls, bruises, and burns
Poor hygiene or impaired self-care
Headaches
Incontinence
Increased tolerance to alcohol or medications or unusual response to medications
Poor nutrition
Idiopathic seizures
Dizziness
Sensory deficits
Blackouts
Chronic pain
<b>Cognitive symptoms or potential indicators</b>
Disorientation
Memory loss
Recent difficulties in decision making
Overall cognitive impairment
<b>Psychiatric symptoms or potential indicators</b>
Sleep disturbances, problems or insomnia
Anxiety
Depression
Excessive mood swings
<b>Social symptoms or potential indicators</b>
Family problems
Financial problems
Legal problems
Social isolation
Running out of medication early
Borrowing medication from others
Reprinted from Kuerbis et al. (2014)

control (Kuerbis et al. 2014). When older adults perceive the negative consequences of substance use to be a natural part of aging, this can also greatly affect self-efficacy to change. For many older adults, changing substance use habits may feel too late.

Potential indicators or symptoms of problematic use of mood-altering substances among older adults are reviewed in Table 3. Because older adults tend to dismiss use of mood-altering substances as problematic, assessment must focus specifically on behavior rather than the older adult's opinion (e.g., do you believe you have a drinking problem?) (Sacco and Kuerbis 2013). Questions should be included in a

nonjudgmental way. An important gateway to additional information about the older adult's use of substance is asking about whether he or she runs out of medication early, borrows medication from others, or takes an extra pill to fall asleep or cope with pain. It is also important to ask about any history of use or SUDs, as these may increase an older adult's risk for cognitive decline or psychiatric disorders in late life whether or not he or she is currently abstinent.

## Screening Tools

Biological screening measures are not only intrusive but can also be misleading, as any damage to the liver (a common tool used to indicate heavy drinking or overuse of benzodiazepines) may be the product of prescribed medications. Thus, the best screening tools among older adults are those that are self-report.

**CAGE-Adapted to Include Drugs (CAGE-AID).** The CAGE-AID is a brief screening tool, adapted from the CAGE (Kuerbis et al. 2014), to indicate potential substance misuse across the general adult population. It contains four questions: (1) Have you ever felt that you should Cut down on your drinking or drug use? (2) Have people Annoyed you by criticizing your drinking or drug use? (3) Have you ever felt bad or Guilty about your drinking or drug use? (4) Have you ever had a drink or used drugs first thing in the morning to steady your nerves or to get rid of a hangover (Eye opener)? One or more positive responses to the four questions indicate the potential for a SUD. While there are no reported studies on the CAGE-AID's efficacy with older adults, the CAGE was demonstrated to have 86% sensitivity and 78% specificity for an alcohol use disorder among older adults (Kuerbis et al. 2014). The drawbacks of the CAGE are that it does not identify older adult heavy or binge drinkers, it does not perform as well within a psychiatric population, and it does not differentiate between current and lifetime use. Clearly, the CAGE or CAGE-AID, while useful, should not be a substitute for a thorough assessment.

**The Alcohol Use Disorders Identification Test (AUDIT).** The AUDIT is a 10 item, self-report questionnaire that assesses for current alcohol problems (Babor et al. 2001). Items ask about quantity and frequency of alcohol use, diagnostic criteria, and other consequences of alcohol use or abuse. Scoring on the AUDIT ranges from 0 to 40, with potential for an alcohol use disorder starting at a score of 8. Hazardous or problematic alcohol use among older adults can be detected using the AUDIT; however, a lower threshold of 5 is recommended.

**The Comorbidity Alcohol Risk Evaluation Tool (CARET).** The CARET (Moore et al. 2002) is a screening tool that identifies not only older adults who are at risk due to their alcohol consumption but also vulnerable due to comorbid diseases, risky behaviors (i.e., drinking and driving), and drinking while taking medications. Due to its broad focus, the CARET tends to be more sensitive to identifying hazardous, at-risk, or problem drinking among older adults than other measures.

## Interventions for Older Adult Substance Users and Abusers

To match the spectrum of intensity of SUDs, there is a spectrum of treatment options available to older adults to help them achieve healthy moderation or abstinence from mood-altering substances. While popular assumptions that older adults are too entrenched in old patterns to make change persist, older adults at times demonstrate treatment outcomes as good or better than younger cohorts for the treatments that have been tested. Access to treatment remains a problem in the USA, as less than 20% of the substance abuse treatment programs offer tailored treatments to an older adult population (Kuerbis and Sacco 2013). Additional barriers to treatment for older adults include geographic isolation, difficulties with transportation, inability to pay, or stigma and shame around development or maintenance of a SUD in late life. As a result of these barriers, nontraditional settings provide unique opportunities for intervention with older adults, such as

emergency rooms, senior centers, and primary care offices (Sacco and Kuerbis 2013). There is a continued, relative absence of knowledge and research on older adults with SUD and treatments that are most effective for them. Interventions discussed below are based on initial empirical support within the substance abuse field or in other fields that have demonstrated efficacy.

**Brief Interventions.** Brief interventions that focus on alcohol and prescription medication misuse or abuse and vary in length from 15 min to an hour are shown to be effective for older adults (Kuerbis and Sacco 2013). They are usually performed in primary care, and they tend to focus on psychoeducation and normative feedback (i.e., levels of alcohol consumption by peers) about alcohol use or proper administration of medication. Interventionists, who include nurses, social workers, physicians, or other medical staff, provide the older adult with information about potential harms and consequences of substance use, attempt to enhance motivation to change, and, where needed, refer to more intensive services. These interventions, even at their most minimal intensity, are shown to be effective among individuals in late life.

**Motivational Interviewing (MI) or Motivational Enhancement Therapy (MET).** MI and MET are two very similar interventions that can be implemented as a part of a brief intervention, a stand-alone intervention, or a supplement to longer-term or more intensive substance abuse treatment (Kuerbis and Sacco 2013). Both are client-centered interventions that encourage a nonconfrontational, supportive approach to encouraging healthy changes, making it in this way an ideal approach for older adults. The primary focus of MI and MET is to reduce ambivalence to change by exploring with the client his or her ideas about the pros and cons of both making a change to one's substance use and sustaining current behaviors as they are (Sacco and Kuerbis 2013). Older adults may share motivations with their younger counterparts, and they may also have uniquely strong motivations related to their life stage, such as optimal health and mental capacity (Barry et al. 2001). Despite the seemingly natural fit of MI and MET with older adults,

very few empirical studies have been performed to explore whether it works with older adults in a similar fashion to younger adults. Most studies on MI or MET have excluded individuals over 65. A few studies have utilized MI with older adults addressing other health behaviors with some success (Kuerbis and Sacco 2013). However, no rigorous randomized controlled trials have tested how MI works with older adults.

**Pharmacology.** Pharmacological treatments used for SUD are growing for the population at large. Few medications currently approved by the Food and Drug Administration in the USA are thought to be safe for use with older adults. Disulfiram is a medication that is used as an aversive agent (Kuerbis et al. 2014). It increases the negative effects of alcohol, such that when alcohol is ingested it makes the person extremely ill. Thus the medication is only useful with rigid adherence to the prescription. Disulfiram has been used with adults 50 and older with some success, but it can also place additional strain on the cardiovascular system. Therefore it may be contraindicated for older adults. Naltrexone is an opioid receptor antagonist originally designed for treatment of opioid use disorder that has been applied to alcohol and other substances in the general population. It is thought to work by reducing craving or the pleasurable effects of the substance when it is administered. Initial research findings demonstrate a positive effect of naltrexone among older adults (Kuerbis and Sacco 2013). A major drawback of naltrexone is that it blocks the effects of opiate pain medications, limiting its application to older adults. In addition, it may enhance depressive symptoms or preexisting depressive disorders. Older adults taking this medication should be monitored closely.

**Case Management.** Case management models are services provided by primary care or community-based agencies that are useful and advantageous in engaging older adults with unhealthy substance use (Kuerbis et al. 2014). This comprehensive approach provides the older adult with more opportunities to address the full extent of medical and psychiatric complexities, rather than focusing solely on substance use reduction. It engages the older adult in working

toward what presumably he or she wants most: overall better health for higher quality of life. Due to the more holistic approach the older adult can feel less stigmatized for his or her substance abusing behaviors and feel that all of his or her problems are being addressed, not just the problems identified by the health care professional (Center for Substance Abuse Treatment 1998). These models are excellent for improving overall health and well-being of older adults and key in maintaining older adults in treatment.

**Formal Substance Abuse Treatment.** For the older adult willing to participate in the general treatment system, services range in intensity from detoxification and residential treatment to outpatient and aftercare, depending on the severity of the SUD and any comorbid medical complications (Sacco and Kuerbis 2013). Treatment and treatment settings are recommended to be tailored to the potential special physical and mental needs of older adult patients. In the relative absence of such treatments, older adults entering programs with patients of all adult ages should receive special attention when constructing treatment plans and services. For example, services should accommodate stamina for learning and physical abilities. While group treatment is often the modality of choice among treatment programs, as it serves to reduce isolation and shame, group therapy may instead enhance these feelings. Older adults may feel particularly intense shame at having these types of problems in later life, uncomfortable with speaking to persons younger than them about their personal problems, and may feel increasingly alone, such as in the case where he or she is the only older person in the group. Individual therapy should be provided in addition to providing a space for the older adult to explore issues related to recovery that are unique to him or her.

**Psychotherapy.** Only two types of psychotherapies have been empirically investigated in the context of substance abuse treatment with older adults: supportive therapy models (STM) and cognitive behavioral therapy (CBT) (Sacco and Kuerbis 2013). While now widely accepted that confrontational approaches to substance abuse treatment are less effective and in some

cases harmful for any group, STM grew out of the acknowledgment that older adults appeared to do particularly poorly in traditional, confrontational treatments. As a result, STM was developed as a psychotherapy that utilized a nonconfrontational, supportive approach to substance abuse treatment and also incorporated psychoeducation and support around issues observed to be more common among older adults: serious physical health conditions or disease, high rates of co-occurring depression, and social isolation (Center for Substance Abuse Treatment 1998). The focus of STM is to concentrate on helping build social support for the older adult's recovery, improve self-esteem, and similar to a case management model, take a holistic approach to treatment addressing all aspects of the older adult's life. While research is still quite limited in investigating the efficacy of this approach in comparison to traditional treatments, the studies that have been done demonstrate that older adults tend to have better outcomes when treatments have been tailored to their particular life stage as opposed to those settings in which those adaptations have not been made (Sacco and Kuerbis 2013). CBT is a type of psychotherapy that focuses on identifying faulty or self-destructive sequences of thinking, feeling, and behaving within the individual that lead to problem drinking or drug use (Kuerbis et al. 2014). CBT has empirical support for its efficacy and effectiveness across all ages and most population subtypes, including older adults. CBT has been used with older adults for smoking cessation and alcohol use with stronger, more positive outcomes than the comparison treatments (Kuerbis and Sacco 2013). CBT interventions are thought to be effective with older adults because of the structured nature; presenting topics that are particularly relevant to older adult life (e.g., coping with grief); and using written materials for all education levels, taking into account slower learning capabilities, cognitive impairment, memory difficulties or visual impairments; and a slower pace of treatment.

**Self-help Groups.** Twelve-step programs, such as Alcoholics or Narcotics Anonymous, and other mutual aid groups can help the older adult to reduce isolation, shame, and stigma

(Sacco and Kuerbis 2013). There are no formal studies of older adult participation in such groups; however, older adults may experience shame and stigma of dealing with addiction in late life with a younger generation – similar to what can happen in formal treatment settings. Previous generations of older adults may feel more discomfort with younger polysubstance abusers, as they may present primarily to a mutual aid group for alcoholism. Baby boomers may not experience this tension. Due to the variety of mutual aid groups, some may be better suited for older adults than others, depending on pace of the group, its general focus, or physical accessibility. Older adults, like their younger counterparts, should be encouraged to try more than one meeting before deciding whether it is right for them.

## Cross-References

- ▶ Behavioral Analysis
- ▶ Clinical Issues in Working with Older Adults
- ▶ Cognitive Behavioural Therapy
- ▶ Comorbidity
- ▶ Interpersonal Psychotherapy

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## Subsyndromal Psychiatric Disorders

Nathan Hantke

Sierra Pacific Mental Illness Research, Education, and Clinical Centers (MIRECC), VA Palo Alto Health Care System, Palo Alto, CA, USA  
Department of Psychiatry and Behavioral Sciences, Stanford University School of Medicine, Stanford, CA, USA

### Synonyms

Minor psychiatric disorder; Subthreshold disorder

### Definition

Subsyndromal psychiatric disorders (SPD) are characterized by the presence of elevated psychiatric symptoms that do not meet full diagnostic criteria for a specific disorder. Also commonly known as subthreshold or minor psychiatric disorders, SPD are difficult to qualify and quantify given the current categorical taxonomy of mental health disorders. By definition, they are not formally recognized as a diagnosis yet share many common features with their formal diagnostic counterparts (e.g., major depressive disorder). SPD are best viewed within a dimensional approach, with symptoms being present yet falling slightly below clinical cutoff within a diagnostic spectrum, often due to not meeting diagnostic criteria for level of symptom severity, duration, or frequency of symptoms despite causing significant distress.

Subsyndromal symptoms are fairly common in the general population, as well as in older adults, and are associated with a variety of negative factors including high cost to health care, poor physical health, poor quality of sleep, and a negative impact on the family. SPD is most commonly characterized and studied for depression- and anxiety-related symptoms, which will be the focus of this section. Description of psychological disorders and their associated criteria can be found in the *Diagnostic and Statistical Manual of*

*Mental Disorders, Fifth Edition* (DSM-5) (American Psychiatric Association 2013) and the *International Classification of Disorders, Tenth Revision* (ICD-10) (World Health Organization 2004).

### Presentation and Prevalence

Subsyndromal psychiatric disorders are often described in terms of depression and anxiety symptoms. Subsyndromal depression (SSD), recognized in the DSM-IV-TR's Appendix B (criteria sets and axes provided for further study) (American Psychiatric Association 2000) as minor depressive disorder, is defined as one or more periods of depressive symptoms that are identical to major depressive disorder (MDD). However, these periods involve fewer symptoms, less impairment, and do not meet full diagnostic criteria for another psychiatric disorder. The DSM-5 has reclassified the proposed minor depressive disorder as other specified depressive disorder: depressive episode with insufficient symptoms (American Psychiatric Association 2013).

The occurrence of SSD in late life ranges from 8% to 30% depending on the setting and definition of SSD (Edelstein et al. 1999). A recent US representative sample of older adults found that 13.8% of individuals have experienced subsyndromal depression over his or her lifetime. In comparison, 13.7% of the sample met criteria for lifetime MDD, suggesting a similar prevalence rate between the subsyndromal and clinical disorders (Laborde-Lahoz et al. 2014). Even this high rate may be an underestimate, as another epidemiological study reported a 31.1% prevalence for SSD in adults over the age of 65 (Judd and Kunovac 1998).

Older adults with SSD are at higher risk for developing more severe levels of depressive or other psychiatric symptoms in the future and are at a higher risk for meeting criteria for MDD or an anxiety disorder both at 1-year and 2-year follow-up, with respective conversion rates of 10% and 25% (Laborde-Lahoz et al. 2014; Meeks et al. 2011). Conversion rates from SSD to MDD

are thought to be even higher in long-term care settings, displaying a 23% conversion rate at 1-year follow-up (Meeks et al. 2011). A multitude of factors are believed to increase the likelihood of an older adult developing depressive symptoms, such as low socioeconomic status, social isolation, recent loss of spouse, poor physical health, and serving as a caregiver. Remission rates for SSD vary widely based on the setting. Longitudinal epidemiological research suggests SSD has an 18–26% remission rate over a 3–6-year period, while primary care settings show approximately 50% remission rate at 1-year follow-up. Overall, SSD appears to have a fairly chronic course with intermittent improvements in symptoms, with 61–68% of individuals diagnosed with SSD showing some level of consistent chronic depression, often fluctuating between subthreshold depression and MDD over time (Meeks et al. 2011).

Similar problems are seen across other psychiatric disorders. Anxiety in particular is one of the most common types of psychiatric conditions seen in older adults with prevalence estimates between 1% and 15% in community samples (Bryant et al. 2008). The prevalence of subsyndromal anxiety is substantially higher, with rates between 15% and 52%. The onset of anxiety symptoms when examined over the lifespan appears to be a bimodal distribution, with two-thirds of individuals developing symptoms in adolescence and the remaining one-third of individuals developing symptoms for the first time in older adulthood (Lenz and Wetherell 2009). The etiology for the emergence of anxiety-related symptoms in older adults is likely multifactorial. The degeneration of brain regions associated with inhibiting anxiety, increases in life stressors, cardiovascular changes, and increased utilization of medications, some of which have secondary anxiogenic effects, may all contribute to new onset anxiety in older adults. Many of the risk factors associated with late-life anxiety are similar to those for depression and include being female, experiencing early-life stressors, and having a chronic disability (Lenz and Wetherell 2009).

Subsyndromal generalized anxiety disorder (GAD), also sometimes referred to as minor GAD, is another relatively common psychiatric disorder seen in older adults, characterized by chronic excessive anxiety or worry that is not due to the physiological effects of a medical condition. In older adults, subsyndromal GAD may present as concentration difficulties, poor sleep quality, irritability, muscle tension, and fatigue (American Psychiatric Association 2013). The focus of the worries varies by individual, but common themes include concerns about finances, health, or the well-being of family. As older adults are often faced with multiple anxiety-provoking life stressors (e.g., chronic health issues), when making a diagnosis, clinicians should consider the difficulty the individual has with controlling worry and the level of anxiety-related impairment. Subsyndromal GAD in older adults is associated with many of the problems seen in SSD, including a higher severity of health problems and disability as compared to those who report minimal generalized anxiety symptoms. Subsyndromal levels of panic disorder, social phobia, specific phobia, and obsessive-compulsive disorder are also seen in older adults, although with less frequency. Similar to SSD, the DSM-5 captures subsyndromal anxiety as other specific anxiety disorder, stating that the category applies to a presentation in which anxiety-related symptoms are causing significant distress and impairment in functioning, yet do not meet full diagnostic criteria for a specified anxiety disorder (American Psychiatric Association 2013).

Less is written about other subsyndromal psychiatric conditions in older adults, although they may be noted or recognized as clinical issues in an older patient. Trauma-related disorders, eating disordered behavior, subthreshold bipolar disorder, and subthreshold psychotic disorders are all seen in older adults and may warrant clinical attention. While older adults may not meet full criteria for a disorder at the time of assessment, symptoms may still cause significant distress and be clinically relevant. Older adults may experience cycling or fluctuations in symptom severity which influence the level of disruption in the life of the older adult. Subthreshold disorders, when

co-occurring with other disorders, are also likely associated with worse outcome. For some disorders, such as posttraumatic stress disorder, older adults may experience a spike in symptom severity correlated with major life adjustments, such as retirement or cognitive decline.

Also, little has been written on the impact of subthreshold personality disorders in older adults. Research examining middle aged adults suggests that subthreshold levels of borderline personality disorder (PD) are associated with many of the same symptoms seen in diagnostic levels of borderline PD (e.g., suicidal ideation), stressing the importance of utilizing a dimensional rating system during assessment and symptom monitoring, even when symptoms are at a subsyndromal level (Zimmerman et al. 2013). These findings do not necessarily generalize to other PDs, such as subthreshold levels of paranoid PD, avoidant PD, and obsessive-compulsive PD, which show variable correlations between subthreshold and threshold symptoms severity (Morgan et al. 2013).

### Psychosocial Outcomes

While SSD often does not meet the clinical severity of MDD, it is frequently associated with increased risk for similar issues, such as higher rates of medical comorbidities, greater difficulty adjusting to co-occurring medical diagnoses, increased utilization of health-care services, and worse functioning on other aspects of successful aging as compared to nondepressed older adults (Laborde-Lahoz et al. 2014; Vahia et al. 2010). SSD is also associated with increased functional disability in older adults, slower recovery time among patients in inpatient rehabilitation, generally decreased levels of activity, and greater levels of impairment in activities of daily living (Meeks et al. 2011). Further, recent research suggests that depressive symptom influence on quality of life is not static and is associated with functional decline over a 6-month period (Charlson et al. 2008).

Depressive symptoms are associated with a lower general quality of life across multiple domains, including physical functioning, general health, vitality, satisfaction with life, and social

functioning (Diefenbach et al. 2012). Anxiety symptoms, which often co-occur with depressive symptoms, are not surprisingly associated with similar functional outcomes. Activity avoidance and anxiety symptoms are associated with increased levels of subjective pain and decreased physical functioning (Hermesen et al. 2014). There is likely interplay between psychiatric symptoms and general functioning in older adults, suggesting a cyclical relationship of increased depressive and anxiety symptoms correlating with decreased ability to function autonomously and lower levels of activity. Increased psychiatric symptoms also often lead to increased social isolation, lower levels of physical activity, and decreased frequency of participating in pleasurable activities, all which likely exacerbate mood problems.

### Cognitive Correlates

Subsyndromal disorders are frequently associated with multiple negative outcomes. Elevated anxiety or depressive symptoms in older adults are often linked with poor sleep quality, increased rate of mortality, and a variety of unhealthy behaviors, such as smoking and substance abuse, which carry their own set of associated health problems. Research suggests a correlation between cognitive functioning and psychiatric symptoms, as depression and anxiety symptoms are believed to be associated with worse cognitive functioning and increased risk for future cognitive decline, nearly doubling the risk of conversion from mild cognitive impairment to dementia (Beaudreau and O'Hara 2008; Palmer et al. 2007). Similarly, depression and anxiety symptoms are common in individuals with even mild cognitive difficulties and often increase in prevalence in parallel with the severity of cognitive deficits. One possible explanation for this correlation of cognitive decline and psychiatric symptoms is that an increase in SPD symptoms is a by-product of early neurodegenerative processes and disruption of neural networks. It is also possible that depressive and anxiety symptoms may precede cognitive decline, with increases in psychiatric symptoms

resulting in a decrease in cognitive resources, thus leading to cognitive impairment.

Depressive symptoms in older adults are associated with worse performance on measures of episodic memory and executive functioning. In particular, depressive symptoms in older adults may interfere with the learning of new material. Anxiety symptoms in older adults are also associated with worse executive functioning, particularly in the context of set shifting and the utilization of executive skills to facilitate learning and memory (Yochim et al. 2013). Several other studies report consistent findings, with high levels of anxiety being associated with difficulties in memory (Lenz and Wetherell 2009). These cognitive deficits may be mediated by the type of anxiety symptom, with affective symptoms (e.g., irritability) being associated with memory difficulties, while cognitive symptoms (e.g., worry) are associated with difficulties in response inhibition (Yochim et al. 2013). These two symptom constructs may be associated with different cognitive deficits and represent dysfunction in different networks.

## Clinical Considerations

The assessment and differential diagnosis of subsyndromal psychiatric disorders is difficult and especially complicated in older adults. For example, older adults have a high incidence of chronic health problems. Medical disorders common in older adults may present similar to, exacerbate, or even precipitate mental health concerns. Cardiac arrhythmias, hypothyroidism, cardiovascular problems, Parkinson's disease, and a variety of other neurological, gastrointestinal, and general medical conditions may present very similar to psychiatric symptoms. Common mood-related symptoms, such as decreased libido and changes in weight, are often seen in medical disorders and even in healthy aging, leaving the clinician in the difficult position of attempting to parse the etiology of specific symptoms. Related to medical problems, older patients are often on multiple medications and are increasingly susceptible to adverse side effect (e.g., sedation) and

drug-to-drug interactions, which may cause symptoms often seen in psychiatric disorders, such as poor concentration.

Further complicating the diagnostic picture, mood symptoms are often common in patients with medical diagnoses. Adjustment to a medical condition, bereavement, and changes in physical ability and quality of life may all result in an increase in depressive symptoms. These mood-related symptoms may be interpreted differently depending on the clinician and the age of the patient. For example, depression in younger adults may manifest through somatic symptoms, such as low energy, decreased sleep, or changes in appetite. In older adults, a clinician or patient may attribute the same symptoms to medical problems or the general process of aging, resulting in a misattribution of depressive symptoms (Edelstein et al. 1999). Older adults may not recognize their symptoms as psychiatric in nature or may be disinclined to accept mood issues as an etiology. Clinicians should not immediately attribute changes in mental health status to normal aging, especially in psychiatric changes that are subsyndromal. Older adults may have a strong, coherent sense of self that does not easily integrate with acknowledging mental health symptoms or need for treatment (Cohen and Eisdorfer 2011).

The life circumstances of many elderly individuals may also complicate the accurate diagnosis of a mood or anxiety disorder. Older adults are often faced with a variety of life stressors and existential concerns including, but not limited to, increased mortality salience, adjustment to retirement, assimilation of aging into his or her self-concept, and changes in level of autonomy. Conceding changes in physical and mental health may be difficult for many patients and may be a stark reminder of the aging process and a loss of youth. Some older adults may be inclined to underreport symptoms due to cognitive dissonance with the aging process and self-concept and concern about diminishing autonomy. The potential of losing driving privileges or the ability to live alone may be on the forefront of a patient's mind and causing significant distress. Determining if realistic concerns about health problems or financial stressors

cross a threshold into specific diagnostic and statistical manual of mental disorders-5 (DSM-5) diagnostic criteria may be difficult. For example, it may be challenging for a clinician to determine if a patient's level of worry is "excessive" to a level that would indicate generalized anxiety disorder or more parsimoniously explained as a natural reaction to profound life stressors.

## Conclusions

In summary, the differential diagnosis of SPD in older adults is complex, particularly when considering the prevalence and clinical import of subsyndromal presentations. For instance, SPD may lead to negative outcomes such as increased psychiatric symptoms severity, decreased physical functioning, and lower reported quality of life in older individuals. Given the strict diagnostic criteria for psychiatric disorders, older adults experiencing subsyndromal symptoms may not seek treatment and may not be referred for follow-up mental health care by their primary care provider.

## Cross-References

- ▶ [Anxiety Disorders in Later Life](#)
- ▶ [Comorbidity](#)
- ▶ [Eating Disorders and Eating Disordered Behaviors](#)
- ▶ [Late Life Transitions](#)
- ▶ [Mental Health and Aging](#)
- ▶ [Psychological and Personality Testing](#)
- ▶ [PTSD and Trauma](#)
- ▶ [Schizophrenia and Other Psychotic Disorders in Older Adults](#)

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## Suicide in Late Life

Amy Fiske<sup>1</sup>, Elizabeth C. Price<sup>1</sup> and Jeffrey J. Gregg<sup>2</sup>

<sup>1</sup>Department of Psychology, West Virginia University, Morgantown, WV, USA

<sup>2</sup>Durham Veterans Affairs Medical Center, Durham, NC, USA

### Synonyms

Lethal self-harm; Self-inflicted death

### Definitions

A well-accepted definition of *suicide* is: “a self-inflicted death with evidence (either explicit or implicit) of intent to die” (Silverman et al. 2007). Suicidal behavior with a nonfatal outcome is known as a *suicide attempt*. The term *suicide-related ideations* refers to thoughts about suicide, with or without intent to die. This category encompasses *suicidal ideation*, which refers to thoughts of taking one's own life, as well as *death ideation*, which refers to thoughts of death and dying without considering taking one's own life.

## Introduction

Suicide, which claims the lives of nearly a million individuals globally each year, is a major public health problem. It is a problem of particular significance for geropsychology, as older adults, and especially older men, are at elevated risk of suicide. Although suicide risk increases with age, suicide is not a normal part of aging. The majority of older men and women who die by suicide suffer from depression or another mental health disorder.

Late-life suicide is a neglected topic. Suicide in late life, as at other ages, has profound negative consequences, including complicated grief for surviving family and friends. Nonetheless, surveys show that the suicide of an older adult is generally viewed as less serious than the suicide of a younger individual. Furthermore, resources for suicide-related research and prevention programs are generally targeted to younger populations, neglecting the problem of late-life suicide. Nevertheless, suicide in late life differs in many ways from suicide among younger individuals, including epidemiology, theory, risk factors, and protective factors. Thus, the need for age-specific research is especially important.

## Epidemiology

Throughout the world, suicide rates tend to increase with age and peak in old-old age (age > 85 years). Older adults tend to be disproportionately affected by suicide compared to the general population. For instance, in 2013, individuals over the age of 65 comprised only 14.1% of the population in the United States, but represented 17.5% of all deaths by suicide (McIntosh et al. 2013). Though suicide rates are generally elevated in older adulthood internationally, significant variability has been noted between nations. For example, suicide rates are highest in adults over the age of 85 in Australia and the United States, whereas peak rates in Japan occur in middle age.

Elevated rates of suicide among older adults appear to be largely driven by men rather than women. In most countries throughout the world,

men are more likely to die by suicide than women across all age groups; however, this gap becomes even greater in old age. For example, men over the age of 65 in the United States are approximately five times more likely to die by suicide compared to women of the same age group. On the other hand, women's risk of suicide tends to decline after the age of 60. Notably, in the United States, the suicide rate among White men over the age of 85 represents the highest risk among any age-gender-race demographic.

Late-life suicide rates in most nations also differ as a function of rural versus urban residence. For instance, in China, suicide rates in older adults are significantly higher among rural-dwelling individuals compared to urban-dwelling individuals.

The epidemiology of suicide attempts versus deaths by suicide in older adulthood also is noteworthy. Estimates suggest a ratio of 25 suicide attempts per death in the United States' general population. Among older adults, however, this ratio is drastically lower, with only four attempts per death. Nonfatal suicide attempts are three times more likely among women compared to men. The increased lethality of attempts found in older adults is likely attributable to the more prevalent use of firearms in this demographic. Older adults also exhibit greater planning in fatal suicides compared to younger adults. Thus, the lower attempt-to-death ratio may also reflect greater intent to die among older adults versus other age groups.

## Theory

Several prominent theories of suicide have been applied to the understanding of suicide among older adults (Fiske et al. 2015). These include sociological theories as well as psychological theories focused on cognitive, behavioral, and interpersonal factors. A few theoretical frameworks also incorporate a life span developmental perspective.

Durkheim's classic sociological theory explains suicide as a function of social integration and regulation (Durkheim 1897). According to

this theory, individuals with weak ties to society, described as having low levels of integration or regulation, are at risk of suicide primarily because they lack a feeling of belonging and are not bound by social norms. Excessively strong ties to society are also linked to suicide, through subordination of one's own interests to those of the society, but these cases are thought to be rare. Research on older adults confirms that lack of social connectedness is related to suicide in late life (Fässberg et al. 2012; Duberstein et al. 2004).

Cognitive theories by Beck and others explain suicide as a result of an individual's interpretation of events that are experienced (Beck et al. 1975). Pessimistic cognitions lead to a form of depression characterized by hopelessness, which is strongly linked to suicidal ideation and behavior in older adults as at other ages (De Leo et al. 2013).

A prominent recent theory of suicide, which incorporates social, cognitive, and behavioral components, is Joiner's interpersonal theory of suicide (Joiner 2005). According to this theory, suicide occurs only when an individual has both the desire to die by suicide and the capability of enacting lethal self-harm. The desire to die is conceptualized as stemming from a thwarted sense of belonging as well as the perception that one is a burden on others. Research generally supports the notion that perceived burdensomeness and thwarted belongingness are associated with suicidality in older adults, as in other age groups. Joiner's interpersonal theory also posits that the capability of engaging in suicidal behavior is a function of an individual's ability to tolerate pain and overcome the fear of dying, both of which are acquired through exposure to painful and provocative events. Given the fact that exposure to painful and provocative events is cumulative across the life span, the theory would predict greater capability of enacting suicide as one ages, consistent with the elevated suicide rates that are observed in late life.

There are other theories of suicidal behavior that have garnered empirical support among younger adults that may also be applicable to older adults. For example, suicide has also been conceptualized as an escape from unbearable

psychological pain by several theorists (e.g., Schneidman, Baumeister). Nonetheless, these theories remain to be evaluated in older adults.

The most relevant theoretical perspectives for explaining late-life suicide are those that integrate life span developmental theory with suicidal theory. Clark proposed a model in which certain behavioral predispositions are adaptive in youth and middle age, but maladaptive in late life, leading to suicidal behavior (Clark 1993). Specifically, this theory predicts that a heavy emphasis on independence may become problematic only in late life, when it may interfere with an individual's ability to adapt to age-related stressors such as a decline in functioning and lead to a suicidal crisis. Empirical findings in older adults are consistent with this theoretical perspective (O'Riley and Fiske 2012; Kjølhseth et al. 2009).

Caine and Conwell also proposed a developmentally informed theoretical model to explain changes in suicide risk across the life span and into late life (Caine and Conwell 2001). In this framework, some distal risk factors (such as inflexible personality or childhood trauma) influence suicide risk throughout the life span. Other distal risk factors (e.g., change in role status) may emerge for the first time in late life. Mental health problems serve as proximal risk factors for suicide.

## Risk and Protective Factors

There are several well-established risk factors for death by suicide, some of which are specific to older adults. Because of the relatively low base rate of death by suicide, large prospective studies or psychological autopsies (thorough investigation including a review of records and interviews with family and health-care professional after a death by suicide) are typically necessary to identify predictors. Current theory proposes that risk factors can be divided into factors likely to influence *desire to die* by suicide and factors likely to influence the *ability to enact* lethal self-harm (Joiner 2005). Factors that influence desire to die will be discussed first, followed by factors that

may increase capability to engage in self-harm behaviors.

Among factors that increase the desire to die are mood disorders and related negative mood states. The vast majority of older adults who die by suicide meet criteria for a diagnosable mental disorder, especially mood disorders (Kiosses et al. 2014). Presence of a mood disorder is one of the strongest predictors of suicidal behavior (Conwell et al. 2011). Compared to younger and middle-aged adults, substance use disorders, anxiety disorders, and schizophrenia are less predictive of suicide in older adults (De Leo et al. 2013). Hopelessness is an affective state that also increases risk for suicide, even after resolution of a depressive episode (Kiosses et al. 2014).

Studies using twins have shown that genetics play a significant role in eventual death by suicide (Fiske et al. 2015). In older people, higher levels of neuroticism, lower levels of extraversion, and lower levels of openness to experience are personality traits that have been found to be related to death by suicide (Conwell et al. 2011). Poor emotion regulation and negative emotions such as anxiety are also risk factors for suicidal behavior (Kiosses et al. 2014). Physical illness, disability, and pain have also been linked to suicide in late life (Conwell et al. 2011). Physical health problems can also contribute to depression, which may explain part of the link (Fiske et al. 2015). Low social connectedness, or thwarted belongingness, is believed to increase the desire to die by suicide among older adults (Joiner 2005).

Among factors associated with the ability to enact lethal self-harm, history of suicide attempt is a consistently strong risk factor for death by suicide. Exposure to death and dying should also lead to habituation and thereby increase a person's capability of enacting lethal self-harm, although this proposition remains to be tested directly in older adults (Fiske et al. 2015). The availability of readily lethal means, especially firearms, will increase the individual's ability to enact lethal self-harm. Men's greater rates of suicide may be partially explained by their use of more lethal means (i.e., firearms). In addition to increasing desire to die, social isolation may increase suicide

deaths by reducing the likelihood that someone would be present to intervene.

Considering cognitive functioning, older adults in the beginning stages of cognitive decline may be most at risk for death by suicide because they are still capable of planning and carrying out highly lethal behavior, especially in the presence of a depressive disorder (Kiosses et al. 2014). However, older adults who attempt suicide show impaired decision-making, compared to other groups (Kiosses et al. 2014). The relations among aspects of cognitive functioning and suicidal behavior continue to be explored.

Protective factors for older adults include social connectedness and support, an absence of the above risk factors, and any personal “reasons for living” (Fässberg et al. 2012). These reasons may include religious beliefs, ties with loved ones, a desire to continue to accomplish or experience events (e.g., a grandchild’s graduation), and a view of suicide as morally wrong (Fiske et al. 2015).

## Assessment

Given the high prevalence of suicide among older adults, the availability and use of accurate, practical assessment methods and tools represent critical public health issues. One avenue for increasing the accuracy of clinical assessment of late-life suicidality is to utilize contemporary, empirically supported models of suicidal behavior, which incorporate well-established risk and protective factors. The fluid vulnerability model provides a useful framework for suicide case conceptualization (Rudd 2006). Specifically, the fluid vulnerability model posits that an individual’s suicide risk at any given time is comprised of both chronic, baseline risk factors (e.g., male gender, mental health diagnosis) and acute risk factors (e.g., recent death of spouse, feelings of hopelessness). Protective factors (e.g., religiosity, positive social support network) are also important for consideration. In light of the fact that there are both developmental and cohort differences in risk and protective factors, it is widely considered crucial

that suicide assessment with older adults be tailored as much as possible to this specific population.

Though unstructured, informal clinical interviews are frequently used to assess for suicide risk in later life, specialized assessment instruments exist that can greatly enhance clinical decision-making. Such tools can assist in providing a more comprehensive understanding of an individual’s current suicide risk and protective factors. Further, a wealth of research has demonstrated the benefits of administering brief depression screening tools in settings frequented by older adults in order to identify depressed (and potentially suicidal) older adults who might otherwise go unrecognized. Primary care is an especially important example of such a setting, as three-fourths of older adults who die by suicide visit their primary care provider during the year prior to suicide (Luoma et al. 2002). Almost half visit primary care within the 1 month prior to suicide (Luoma et al. 2002). Available late-life suicide assessment instruments consist of both clinician-administered tools and self-report tools, including some tools that directly assess suicidal thoughts and behaviors and others that measure factors known to be related to suicide (e.g., hopelessness, reasons for living, depression).

Because suicide differs in later life compared to earlier life in many important ways (e.g., risk factors, protective factors, lethality), it is essential that assessment instruments exhibit adequate psychometric properties, particularly content validity, in older adult populations. For example, the Geriatric Suicide Ideation Scale (GSIS) is a 31-item self-report measure that assesses both direct suicidal thoughts and behaviors (e.g., suicidal ideation), as well as factors known to be associated with late-life suicide (e.g., death ideation, meaning in life; Heisel and Flett 2006). The GSIS has demonstrated promising psychometric properties among older adults, including internal consistency and construct validity. Instruments that indirectly assess suicide risk via related factors (e.g., hopelessness) also may be especially useful with older adults, considering that older adults are less likely than younger adults to endorse overt

suicidal ideation and, yet, more likely to enact lethal self-harm. A critical review of individual assessment methods and instruments for late-life suicidality is beyond the scope of this entry. However, the interested reader is directed to Dennis and Brown (2011) for assessment recommendations.

There are a number of factors that represent barriers to the accurate assessment of suicidality in later life. Many individuals are hesitant to discuss suicide with older adults due to concerns about potential iatrogenic effects (i.e., discussing suicide might lead to an increase in suicidal thoughts and behaviors). However, a plethora of research has discounted this myth. In addition, many clinicians lack training in managing the care of older adults with heightened suicide risk. Finally, ageism and age-related biases can impede accurate assessment of late-life suicidality. For example, individuals may be more likely to attribute suicidal ideation to normative aging processes in older adults and, thus, less likely to facilitate connecting suicidal older adults with adequate treatment services.

## Intervention

There are relatively few empirically supported interventions for late-life suicide (LaPierre et al. 2011). In general, suicide prevention may be described as falling along a continuum of universal, selected, and indicated strategies (Erlangsen et al. 2011).

Universal strategies are applied to the entire populations. For example, legislation that restricts access to firearms in certain US states has been shown to reduce suicide deaths among older adults (Conwell et al. 2011). Several large-scale screening programs have been evaluated with respect to reducing suicidal behavior in Japan and Europe (Fiske et al. 2015; LaPierre et al. 2011). These programs involved screening of older adults for depression and then treating with combinations of psychosocial and psychiatric interventions. Existing evidence suggests that universal approaches can prevent suicides in older adults, but that older men may require psychiatric

intervention, not just psychosocial intervention, in order to reduce suicide deaths.

Selected preventive interventions are used for individuals at risk for suicide, before the occurrence of suicidal behavior, but are not specific to suicide-related outcomes. It may be difficult to identify and reach older adults in need of treatment. One way to identify older adults in need of intervention is to use gatekeepers. In the case of older adults, “gatekeepers” may be primary health-care providers, mail carriers, individuals delivering meals, clergy, or other workers who might be in a unique position of contact with older persons (Conwell et al. 2011). Other preventative interventions could be to encourage church or other community activities and to promote access to medical care to relieve disability and pain (Conwell et al. 2011). Telephone-based outreach programs have been shown to reduce suicide and suicide-related outcomes in older adults with psychiatric and medical problems (LaPierre et al. 2011). Because depression is strongly related to suicidal behavior, several large studies have shown reduced suicide-related ideation with the use of depression care managers in primary care (LaPierre et al. 2011). Pharmacological treatments, in particular lithium and antidepressants, are associated with reduced suicide deaths among older adults (Fiske et al. 2015). However, no pharmacological treatment has been developed to specifically target suicidal behavior.

Indicated preventative interventions are used to directly intervene with an individual who is deemed to be at high risk for death by suicide, based on the presence of suicide-related ideation or a suicide attempt (Erlangsen et al. 2011). Indicated interventions for older adults should include multimodal strategies that provide the ability to reach a provider during a time of crisis or for support and the involvement of significant others in treatment as well as address a range of social, emotional, and medical needs (Erlangsen et al. 2011). Because older adults tend to make highly lethal suicide attempts, intervening before an attempt (at the universal or selected levels) is desirable.

Psychotherapy that directly addresses suicidal behavior has generally been developed and tested

with younger samples. However, cognitive and cognitive-behavioral therapies, dialectical behavior therapy, and problem-solving therapy are effective for reducing depression among older adults and show promise for reducing suicidal behaviors (Fiske et al. 2015). Interpersonal therapy is another type of psychotherapy that may be useful for older adults because of its focus on relationships and role transition and has been shown to reduce suicide-related ideation and depressive symptoms among at-risk older adults (LaPierre et al. 2011).

Safety plans are often used with adults who report suicide-related ideation. Safety plans consist of a list of steps that the individual agrees to take if he or she is having thoughts of suicide. These plans generally include coping strategies that the individual has found helpful, phone numbers of supportive family and friends, phone numbers of providers, and contact information for crisis lines and emergency services. Safety plans should not be confused with no-harm contracts (i.e., oral or written agreements by which patients promise not to hurt or kill themselves), which have not been shown to be effective and are not recommended.

Overall, the evidence supporting interventions for suicidal behavior among older adults is minimal but building. Multimodal and comprehensive strategies are recommended in order to identify, support, and treat older adults at risk for suicide (LaPierre et al. 2011).

## Conclusions and Future Directions

Suicide is an important issue in geropsychology, considering the elevated risk, particularly among older men. Late-life suicide is best understood by integrating theories of suicidal behavior with a life span developmental perspective. The interpersonal theory of suicide, which proposes that suicide can be understood as a joint function of desire to die and capability of enacting lethal self-harm, appears to have particular relevance for explaining late-life suicide. Risk factors for suicide in late life include genetics, depression and other mental disorders, certain personality traits,

poor emotion regulation, hopelessness, history of suicide attempt, impaired decision-making, and social isolation. Protective factors include social connectedness. Further research is needed to distinguish between factors that influence desire to die and factors that influence capability to enact lethal self-harm.

There are reliable and valid methods of assessing suicide risk in older adults, to include self-report and clinician-rated measures of suicidal ideation as well as instruments that assess depressive symptoms and hopelessness but can predict suicide. Because a majority of older adults who die by suicide present to primary care shortly before the death, it may be particularly useful to introduce suicide risk assessment into this setting. Training for professionals may be helpful in reducing barriers to accurate assessment of suicide risk in this population.

There is emerging evidence supporting several types of interventions to prevent suicide in late life. Universal preventive strategies with some empirical support include means restriction (especially related to firearms, such as laws implementing background checks and waiting periods) and large-scale screening for suicide risk. Selected approaches with empirical support include outreach programs (e.g., telephone outreach or gatekeeper training) and treatment for depression and other disorders. Indicated preventive strategies also show promise, but further research is needed.

Additional research on late-life suicide is urgently needed (Szanto et al. 2013). Discovery-related research that distinguishes between risk for suicidal desire and risk for acquiring the capability of engaging in self-harm would be particularly useful. Research is needed to provide additional well-validated, age-specific assessments of suicide risk, including measures that distinguish between normal thoughts of death and suicidal ideation (Szanto et al. 2013). Research is also needed to evaluate the feasibility of conducting large-scale screening and intervention for suicide risk, especially at care transition points within the health-care system (Szanto et al. 2013). Intervention-related research is needed to establish the efficacy of universal,

selected, and indicated preventive strategies within this age group. Finally, additional training is needed to prepare clinicians and others to detect and intervene when an older adult is at risk of suicidal behavior. Suicide is not a normal part of aging, but suicide prevention is part of the job of everyone who works with older adults.

## Cross-References

- ▶ [Clinical Issues in Working with Older Adults](#)
- ▶ [Depression in Later Life](#)
- ▶ [Interpersonal Psychotherapy](#)
- ▶ [Loneliness and Social Embeddedness in Old Age](#)
- ▶ [Mental Health and Aging](#)
- ▶ [Problem-Solving Therapy](#)
- ▶ [Training Psychologists in Aging](#)

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## Survey of Health, Ageing and Retirement in Europe (SHARE)

Axel Börsch-Supan

Munich Center for the Economics of Aging, Max-Planck-Institute for Social Law and Social Policy, Munich, Germany

### Overview

The Survey of Health, Ageing and Retirement in Europe (SHARE) is a unique multidisciplinary and cross-national panel database of ex ante harmonized microdata on health, socioeconomic status, and social and family networks covering most of the European Union and Israel. To date, SHARE has collected five waves of data in 2-year intervals since 2004, including current living circumstances and retrospective life histories. A sixth wave is currently (2015) in the field. Four additional waves are planned until 2024.

More than 230,000 interviews conducted so far give a broad picture of life after age 50, measuring physical and mental health, both objectively and subjectively; economic and noneconomic activities, income, and wealth by sources; intergenerational transfers of time and money within and outside of the family; as well as life satisfaction and well-being. The data are available to the scientific community free of charge at [www.share-project.org](http://www.share-project.org) after registration.

SHARE is harmonized with the US Health and Retirement Study (HRS) and the English Longitudinal Study of Ageing (ELSA) and has become a role model for several aging surveys worldwide. SHARE's scientific power is based on its panel design that grasps the dynamic character of the aging process, its multidisciplinary approach that delivers the full picture of the individual and societal aging, and its cross-nationally ex ante harmonized design that permits international comparisons of health, economic, and social outcomes in Europe and the USA.

Due to their harmonization, the SHARE data and their international sisters encompass a worldwide “historical laboratory” to assess the effects

of different policies on health, socioeconomic status, and well-being after age 50. To date (May 2015), more than 1,200 SHARE-based publications assess the chances and challenges of individual and societal aging by exploiting the links between health, economic, and social conditions over the life course observable in SHARE.

Among the key findings is a European North–South gradient in many more dimensions than previously documented. In addition to the well-known income gradient, the health and well-being differences between North and South contradict mortality data and folklore about healthy Mediterranean lifestyle. SHARE has sparked an entire new area of research by revealing a strong correlation between early retirement and the loss of cognitive abilities, social contacts, and well-being. Equally impressive are findings that the large international differences in the uptake of early retirement and disability benefits are more strongly correlated with economic incentives than with health and age.

### Background and Development

Population aging is one of the great societal challenges of the twenty-first century. Beginning in the 1990s, this trend mostly affected wealthy countries but is coming up in poorer nations due to their declining fertility rates. According to Eurostat, the rate of older people (65 years and above) in Europe, in relation to persons in their working age, is expected to almost double from 17% in 2010 to 30% in 2060. This is unparalleled in human history and poses big challenges to the welfare state. In 2060, for every one working person, there will be one retired person.

While the demographic trends and its two main causes (low fertility and increasing life expectancy) are clear, not enough is known about consequences and implications of population aging and its manageability through public policy. Understanding how the aging process will affect all of us and disentangling the influences of different cultures, histories, and policies is an important task for researchers in anthropology, demography, economics, epidemiology,

gerontology, history, and sociology in order to turn the challenges of population aging into opportunities.

In response to the European Commission's strong interest in obtaining scientific evidence on population aging in its member states, SHARE was created as a longitudinal survey infrastructure by and for researchers from multiple disciplines (Börsch-Supan et al. 2005). While its development started only in 2002, SHARE has already become one of the crucial pillars of the European Research Area. Since 2012, it is the first ever European Research Infrastructure Consortium (ERIC), with a new legal status and many of the advantages of major international organizations, as well as a long-term perspective up to 2024. The ultimate goal is to provide high-quality microlevel panel data of economic, social, and health factors that accompany and influence aging processes at the individual and societal level. In addition to its multidisciplinary and longitudinal nature, SHARE was set up to be a cross-national enterprise to enable researchers investigating how different European welfare state regimes moderate and mediate consequences and implications of population aging. The data from Europeans aged 50 and over from 18 European countries and Israel are provided free of charge to the scientific community.

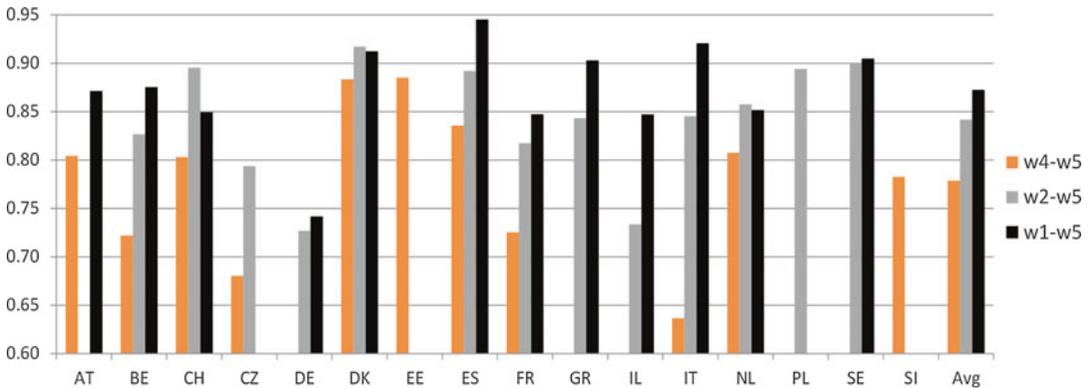
Two more features make SHARE a highly valuable source for genuine cross-cultural comparisons. First, SHARE is closely modeled after and constantly harmonized with its sister studies HRS in the USA and ELSA in the UK. This model has sparked and informed exciting new survey research on aging all over the world, e.g., Japan (JSTAR), China (CHARLS), Brazil (ELSI), South Korea (KLOSA), and India (LASI) which puts SHARE into a truly global perspective. Second and as opposed to these global sister surveys, SHARE in itself is a multinational survey. The SHARE interview is *ex ante* harmonized, and all aspects of the data generation process, from sampling to translation, from fieldwork to data processing, have been conducted according to strict quality standards. Maintaining this *ex ante* harmonization in spite of national differences and decentralized funding poses great scientific and governance challenges.

## Participation and Population Coverage

After five waves of SHARE, more than 230,000 interviews have been conducted with about 86,000 respondents aged 50 and over and their potentially younger partners in 20 countries (Austria, Belgium, Croatia, Czech Republic, Denmark, Estonia, France, Germany, Greece, Hungary, Ireland, Israel, Italy, the Netherlands, Poland, Portugal, Slovenia, Spain, Sweden, and Switzerland). A person is excluded if she or he is incarcerated, hospitalized, or out of the country during the entire survey period, unable to speak the countries' language(s), or has moved to an unknown address. In addition, current partners living in the household are interviewed regardless of their age. All SHARE respondents that were interviewed in any previous wave are part of the longitudinal sample. They are traced and reinterviewed if they moved within the country (for more information see the SHARE methodology volumes (Börsch-Supan and Jürges 2005; Schröder 2011; Malter and Börsch-Supan 2013)).

SHARE is a multinational survey, which involves differences in sampling resources between countries. Consequently, sample frames are chosen in accordance with the best available frame resources in the country to achieve full probability sampling. Most SHARE countries have access to population registers. SHARE provides sampling design weights to compensate for unequal selection probabilities of the various sample units. Without such weights it is not possible to obtain unbiased estimators of population parameters of interest.

Despite the complexity of the survey instrument and partially decentralized funding, most countries managed to stick to the schedule of having a SHARE data collection every second year. The major exceptions are the later fieldwork periods in Israel in Wave 1 and 2 and, due to funding problems, in Poland in Wave 4. Also, due to lack of sufficient funding following the economic crisis, Greece could not take part in the fourth and fifth waves but is joining again in Wave 6. After merging the Irish SHARE study with TILDA, the Irish Longitudinal Study on Ageing (Kearney et al. 2011), there will be no



**Survey of Health, Ageing and Retirement in Europe (SHARE), Fig. 1** Average 2-year retention rates by sample and country

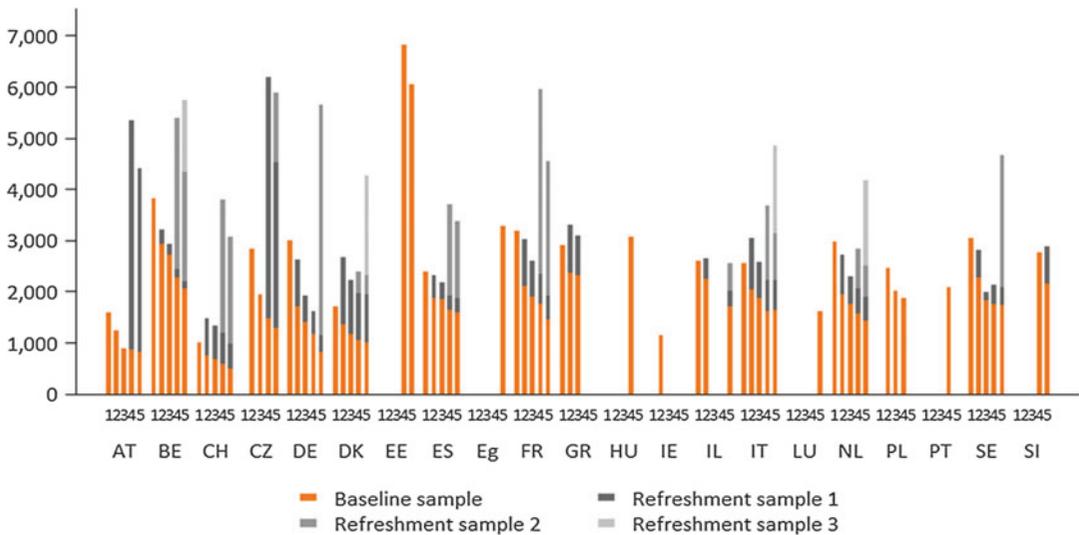
stand-alone SHARE in Ireland after Wave 3. However, TILDA has taken over substantial parts of the SHARE questionnaire into their study.

The gross samples for the initial wave in 2004 were locally drawn in each of the 12 participating countries. They have been based on sampling frames which acknowledged country-specific circumstances such as the availability of register information, need for screening, expected response rate, etc. This has resulted in more than 50,000 addresses overall. Response rates in the first wave, defined as the proportion of selected households including at least one eligible person from whom an interview was successfully obtained, were about 62% on average. In total, 31,115 interviews were conducted. Existing variation in performance over countries was for the most part consistent with previously known patterns from other international surveys. Cooperation at the individual level was only slightly lower than at the household level. Conditional on household participation an interview could, on average, be obtained from more than 85% of eligible household members.

In the second wave of SHARE, three new countries entered the study. Response rates for the new countries were on average very similar to Wave 1 (about 61%). Additionally, refreshment samples were drawn to increase net sample size and compensate for attrition in the longitudinal sample. Here, response rates were on average a

little lower than in the first wave (54%). Individual retention with regard to the longitudinal part of the sample was about 73%. Starting in Wave 2, end-of-life interviews on deceased respondents were administered to relatives or other close persons to the deceased. In total, 34,415 Wave 2 interviews plus 533 end-of-life interviews (EOL) were released, including 18,742 longitudinal interviews. For the third wave, the SHARELIFE study with retrospective life history interviews, no additional households were sampled. 26,836 interviews and 1,139 EOL interviews were conducted in panel households, including 1,158 first interviews with new or previously noncooperating spouses. The resulting individual retention rate was about 77%. In Wave 4, net sample size was substantially increased by including four new countries and drawing refreshment samples in most of the established countries. Altogether, 58,489 interviews, of which 21,566 were longitudinal, and 1,110 EOL interviews were released. Response rates in the baseline (56%) and refresher samples (49%) were on average lower than in previous waves. In this respect SHARE is no exception to the general decline in response rates in face-to-face surveys in Europe and worldwide (Matsuo et al. 2010).

Figure 1 depicts the average retention rate of panel members. It varies a great deal across countries. The average retention rate across all countries and waves is 81%, for the most recently



**Survey of Health, Ageing and Retirement in Europe (SHARE), Fig. 2** Data released in SHARE by country and wave

sampled persons 77%. For those interviewed for the first time in Wave 1 (Wave 2, resp.) and reinterviewed in Wave 5, this rate reaches 87% (84%). This reflects the high retention of long-term panel members including the recovery of those respondents who missed a wave. Actually, for every person lost between Wave 4 and Wave 5, almost one person could be recovered from previous waves.

Since 2005, 11 scientific data releases of the SHARE data were compiled. Figure 2 gives an overview of the released interviews by country, wave, and sample.

## Variables Collected

SHARE consists of normal panel waves (Waves 1, 2, 4, 5, and 6) and retrospective life histories (Waves 3, repeated for all new respondents in 7).

*SHARE panel.* Covering the key areas of life, namely, health, socioeconomics, and social networks, SHARE includes a great variety of information: health variables, physical measures and biomarkers, psychological variables, economic variables, and social support variables as well as social network information (see Table 1 for more details):

- **Health variables** include self-reported health, physical functioning, physical measurements such as grip strength, walking speed, peak expiratory flow, chair stand, and body mass index (BMI); health behaviors; and the use of health-care facilities. Wave 6 will add biomarkers extracted from capillary blood such as glycated hemoglobin (HbA1c), a marker of diabetes; C-reactive protein, a marker of cardiovascular disease; cytokines such as TNF-alpha, IL-6, and BDNF, involved in low-grade inflammation, frailty, and cognitive function; and Vitamin D.
- **Psychological variables** include mental health components such as depression, several tests of cognitive functioning, well-being, life satisfaction, and control beliefs.
- **Socioeconomic variables** include current work activity, job characteristics, job flexibility, opportunities to work past retirement age, employment history, pension rights, sources and composition of current income, wealth and consumption, housing, and education; in some countries linkage to administrative data on employment, labor income, and pension claims.
- **Social support variables** include assistance within and beyond families, transfers of income and assets, social networks including

**Survey of Health, Ageing and Retirement in Europe (SHARE), Table 1** Information collected in the SHARE panel Waves 1, 2, 4, 5, and 6

Questionnaire modules	Examples
Coverscreen	Year and month of birth, sex, household composition
Demographics	Education, marital status, country of birth and citizenship, parents and siblings
Physical health	Self-rated health, diseases, weight and height, (I)ADL limitations [(instrumental) activities of daily living]
Behavioral risks	Smoking and alcohol, nutrition, physical activity
Cognitive function	Self-rated reading and writing skills, orientation, word list learning immediate and delayed recall, verbal fluency and numeracy
Mental health	Depression scales (Euro-D and CES-D), quality of life (CASP-12)
Health care	Doctor visits, hospital stays, surgeries, forgone care, out of pocket payments
Employment and pensions	Employment status, individual income sources (public benefits, pensions), job, work quality
Children	Number and demographics of children
Social support	Help and care given and received
Financial transfers	Money/gifts given and received
Housing	Owner (mortgages, loans, and value), tenant (payments), type and features of building
Household income	Income sources all household members
Consumption	Expenditures for food, goods, services, ability to make ends meet
Assets	Bank and pension accounts, bonds, stock and funds, savings
Activities	Voluntary work, clubs, religious organizations, motivations
Expectations	Expected inheritances, life expectancy, future prospects
Interviewer observations	Willingness to answer, understanding of questions, type of building, neighborhood
<i>New modules after Wave 1</i>	
<i>Since Wave 2: end of life</i>	Death reasons and circumstances
<i>In Wave 4: social networks</i>	Ego-centered network, contact, emotional closeness, geographical distance, satisfaction with network

ego-centered network size and intensity, and volunteer activities.

The interviewers used computer-assisted personal interviewing (CAPI) to collect most of the data in all waves. In addition self-administered questionnaires (drop-off) were handed out in Waves 1, 2, and 4 after completion of the CAPI. If respondents deceased, EOL interviews were conducted face to face (CAPI) or by telephone (CATI) with a proxy, collecting the information regarding the respondent's last year of life. Proxy interviews were also used when respondents were not able to do an interview, for example, due to health reasons.

Even though SHARE is a panel survey with a stable core questionnaire over time, innovative research questions, physical measurements, or modules have been incorporated in each wave. For example, in Wave 2, two physical measurements – peak flow and chair stand – were added (see next section for details). In Wave 4 a completely new module – the social networks module based on a name-generator approach – has been implemented to learn more about the social connectedness of respondents. In Wave 6 dried blood spots were taken to measure blood sugar, C-reactive protein, and cholesterol.

To assure an easy and fast entry into cross-national data and high convenience while working with the data, it is necessary that certain variables are readily provided, especially those that allow a valid comparison between countries, such as the International Standard Classification of Education (ISCED). Besides internationally standardized variables, SHARE datasets provide further generated variables that ease or enhance working with SHARE data as well as different kinds of weights and multiple imputations (see the documentation at [www.share-project.org/data-access-documentation/](http://www.share-project.org/data-access-documentation/)).

*SHARELIFE retrospective life histories.* In SHARELIFE, retrospective data with respect to childhood living circumstances, partners, children, accommodation, employment, and socio-economic and health conditions were collected with the help of a “Life History Calendar” similar to the one applied in ELSA (Schröder 2011). The combination of the SHARELIFE with SHARE

and ELSA data thus gives a detailed picture of the current status of individuals in Europe with a view across their entire life courses (Börsch-Supan et al. 2011). Table 2 provides more details.

*Physical measurements and biomarkers.* Until today, physical measurements and biomarkers were mostly taken in smaller, nonrepresentative clinical studies. In the last couple of years, more and more large-scale surveys added physical measurements and biomarkers to their program since standard health questions in surveys are often subject to the respondents' own interpretation (of the question), own evaluation or perception (of health status), and own knowledge (of health status). The value of subjective health measurements is undeniable, but some research questions require objective measurements. Biomarkers enable researchers to validate respondents' self-reports and therefore to study the amount and determinants of under-, over-, and misreporting in large-scale population surveys. Biomarkers can help to understand the complex relationships between social status and health and allow identification of predisease pathways, since physiological processes are often below the individual's threshold of perception. From the first wave on, SHARE combined self-reports on health with physical performance measurements. Dried blood spots have been collected in Germany during Wave 4, and a full-scale collection of dried blood spots in all countries is taking place in Wave 6.

*Linking survey and administrative data.* Survey data can cover a wide range of topics. However, the information provided by respondents is often incomplete or inaccurate. Administrative data on the other hand are much more complete and accurate since they are process generated. The disadvantage of administrative data is that the information is limited to certain topics only. Linking survey data with administrative data is a way to combine the best of both worlds. SHARE thus cooperates with the German Pension Fund (DRV) and has linked the German survey data with administrative data held by the DRV in a pilot study in the third wave of SHARE. The administrative data consists of two parts: The first part is longitudinal and includes sociodemographic characteristics (such as age, sex, number and age of

**Survey of Health, Ageing and Retirement in Europe (SHARE), Table 2** Retrospective information collected in SHARELIFE (Wave 3)

Questionnaire modules	Examples
Start of the interview	Year and month of birth, sex
Children history	Pregnancies, births, children characteristics, maternity leave
Partner history	Living arrangements, marriages, divorces
Accommodation history	Residences (country, region), moves, types of accommodation, ownership
Childhood circumstances (Age 10)	Accommodation features, number of books, school performance
Work history	Employment status, job characteristics, income
Work quality	Effort, demand, control, job circumstances
Disability benefits	Disability leaves, work reduction, disability pension
Financial history	Investments in stocks, funds, insurance uptake, retirement savings
Health history	Hospital stays, illnesses, diseases, current self-rated health
Health-care history	Vaccinations, doctor visits, preventive checkups, health behaviors
General life	Periods of happiness, stress, financial hardship, hunger, persecution, oppression
Interviewer observations	Willingness to answer, understanding of questions, type of building, neighborhood

children, and education) and detailed information about the working history as well as all activities which generate public pension entitlements. That data is implemented as a panel database beginning at age 14 which provides that information on a monthly base. The second part is cross sectional and only available for retirees. Included is information on the calculation of the pension benefits. The two datasets are updated every year (Korbmacher and Czaplicki 2013).

## Data Usage

Access to the infrastructure via two data archives is free for all scientists globally, subject to European Union data protection regulations: <http://www.share-eric.eu>.

The scientific power of SHARE is based on three elements: its panel design which grasps the dynamic character of the aging process, its multidisciplinary approach which delivers the full picture of the aging process, and its ex ante cross-national harmonization which permits rigorous benchmarking and policy evaluation across countries. Such a data set takes time to build up. Since 2004, when SHARE was started, the number of countries almost doubled from 11 to 20.

SHARE has succeeded surprisingly fast to create a large user community. Since the first public release of SHARE data in April 2005, SHARE has attracted more than 4,300 registered users with an unbroken, more than linearly increasing trend. Since we count registrations not including work students and students in class, we estimate an approximate number of 10,750 actual users. While users include mainly scientists from Europe, researchers from the USA are now the second largest user group after Germany, before Italy and the Netherlands. We interpret the acceptance of SHARE by so many researchers, and particularly in the USA, as an indicator of SHARE's high scientific value.

Arguably the best indicator for the success of a research infrastructure is the number of published findings emanating from it. In addition to four comprehensive volumes of first results from the

SHARE baseline, longitudinal, and retrospective waves (2004–2012) which have been complemented by several national collections of findings, more than 50 books and 1,000 articles in peer-reviewed journals and volumes have been published based on SHARE data. This is the current state. Based on the experience of other panel data, their usefulness and thus user and publication numbers will increase steeply with the number of future waves.

SHARE has generated some surprising findings which have received wide-spread attention. Three examples may show the breadth and quality of successful SHARE-based research:

- Already the first wave of data revealed a European North–South gradient in many more dimensions than previously documented. While the income gradient was known, thanks to earlier Eurostat data, the health and subjective well-being differences between the North and the South of Europe were a surprise because they contradict mortality data and folklore about healthy Mediterranean lifestyle. These findings pose new fundamental questions, e.g., about the economic, social, and medical causes for a divergence between mortality and morbidity.
- Another surprising finding from SHARE has sparked an entire new area of research and a lot of controversy: SHARE data revealed a strong correlation between early retirement and the loss of cognitive abilities both within and between European countries. A fruitful cooperation between cognitive psychologists, gerontologists, economists, and sociologists has begun to identify the causes for this finding which range from the cognition-stimulating effect of work even if it is unpleasant to the social isolation experienced by many retirees. It sheds new light on the EU's strive for active aging.
- Equally surprising is the finding that the large international differences in the uptake of disability benefits are not at all correlated with health or demographic differences in Europe, such as those mentioned above between the North and the South. Rather, they are almost

completely explained by the different rules and regulations of the various disability insurance schemes in the member states and document how powerful economic incentives are for retirement behavior.

Many of the SHARE findings have strong policy implications for aging societies, such as tighter targeting rules for disability insurance or a stricter handling of early retirement pathways. SHARE has been successful in providing help for evidence-based policy making, both at the European Union and the member state level. SHARE is also intensely used by the Organisation for Economic Co-operation and Development (OECD) and the World Health Organization (WHO).

## Acknowledgments

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acknowledge these as well as all national funding sources (see [www.share-eric.eu](http://www.share-eric.eu) for a full list of funding institutions). This article is based in parts on an updated version of Börsch-Supan et al. (2013).

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## Sustainable Employability and Aging

Beatrice Van der Heijden<sup>1,2</sup> and Ans De Vos<sup>3,4</sup>

<sup>1</sup>Institute for Management Research, Radboud University, Nijmegen, The Netherlands

<sup>2</sup>Open University of the Netherlands, Heerlen, The Netherlands

<sup>3</sup>Antwerp Management School, Antwerp, Belgium

<sup>4</sup>University of Antwerp, Antwerp, Belgium

### Synonyms

Adaptability; Career potential; Sustainable careers

### Definition

Employability is the capacity of continuously fulfilling, acquiring, or creating work through the optimal use of competences. Sustainable careers are the sequence of an individual's different career experiences, reflected through a variety of patterns of continuity over time, crossing several social spaces, and characterized by individual agency, herewith providing meaning to the individual.

Over the past decades, substantial evolutions have taken place in the world of work which has important implications for the nature of careers. Careers have become more insecure, both from an organizational and an individual viewpoint. Employability has become a critical condition both for the sustainability of employees' careers and for organizations, which for their performance depend on the employability of their workforce. The aging of the workforce has brought these challenges even more to the forefront. Employees will have to work longer and thus will need to safeguard their employability also at older ages. For organizations, investing in employability of their aging workforce requires a shift in mindset which requires a different stance toward the meaning of age in careers. The goal of this entry is therefore to examine the role of age in employability models and to address the notion of sustainable careers.

### Overview of This Entry

This entry consists of six main parts. First, we define the concept of employability. Second, we discuss the process of self- and other appraisal of employability and the challenges for organizations to overcome common age-related stereotypes about employability and performance. In the next two parts, we summarize empirical findings on the role of age in the relationships between employability, on the one hand, and career success and job search intensity, on the other hand. In the fifth part, we take a closer look at the notion of sustainable careers and its meaning from the perspective of employability throughout the life span. We close this entry by highlighting some important reflections on future research and practice in the domain of sustainable careers.

### Defining and Operationalizing the Concept of Employability

Employability is a concept that is studied from different angles and defined on more than one level (individual, organization, industry, society). The concept came into use from about 1955 (Versloot et al. 1998) and has acquired different meanings over time. The particular context in which employability is used influences its definition. There has been a lack of studies integrating the different perspectives adopted in employability research. Business and management studies, HRM, HRD, educational science, and career theory are each examples of the use of the concept on different levels and the different meanings that are attributed to employability. This has led to the concept of employability remaining rather abstract and vague. Apart from the great variety in employability definitions, one could consider the concept as useful in pointing to certain historical work and organizational developments in Western countries. More specifically, one may detect a relation between the conceptualization and the transition of an industrial to a postindustrial society. Employability in that sense is a symbol to address work-related problems related to this transition.

Scholars have described the development of the concept from the 1970s to the 1990s (time span not the same for each country), and this development is characterized by a shift of ‘government’ to ‘organization’ to ‘employees’ as the most important party responsible with regard to employability concerns, here defined as deployment. Three time periods correspond to three different definitions of work from the perspective of those different parties, namely, full employment (government), putting people to work with a match between supply and demand (organizations), and attractive paid work (individual) (Thijssen 2000). A parallel shift in studied target groups occurs from “population groups” to “internal organizational segments” to “very specific target groups,” such as employees in their thirties.

Definitions of employability at an individual level are abundant (e.g., Versloot et al. 1998; Forrier and Sels 2003), each emphasizing different as well as similar career aspects on the part of individual employees, but all with employment as outcome: physical suitability, cognitive suitability, (career) development, learning, de-specialization, flexibility, adaptation to (fast) changes, and mobility (both external and internal). Employability is believed to accommodate several or all of these aspects, depending on the angle from which it is studied and consequently cannot be seen as a unidimensional construct.

In search of the core of the concept, various attempts have been made to capture and to categorize its constituent dimensions. We define employability as the capacity of continuously fulfilling, acquiring, or creating work through the optimal use of competences (Van der Heijde and Van der Heijden 2006). This definition is compatible with definitions like “the chance for employment on the internal or external labour market” (Forrier and Sels 2003) and “a form of work-specific active adaptability that enables workers to identify and realise career opportunities” (Fugate et al. 2004). It implies a permanent acquisition and fulfillment of employment within or outside the current organization, for present or new customer(s), and with regard to future prospects (Van der Heijden et al. 2009).

Several studies in the field of employability have used a thoroughly validated measurement instrument (Van der Heijde and Van der Heijden 2006), with high psychometric qualities, wherein domain-specific expertise (occupational expertise is defined as domain-related knowledge and skills.) is complemented with four more generic competences: (a) anticipation and optimization (anticipation and optimization is defined as preparing for and adapting to future changes in a personal and creative manner and striving for the best possible results), (b) personal flexibility (personal flexibility is defined as the capacity to adapt easily to all kinds of changes in the internal and external labor markets that do not pertain to one’s immediate job domain), (c) corporate sense (corporate sense is defined as the participation and performance in different work groups, such as organizations, teams, occupational communities, and other networks; sharing responsibilities, knowledge, experiences, feelings, credits, failures, goals, etc.), and (d) balance (balance is defined as compromising between opposing employers’ interests as well as one’s own opposing work, career, and private interests (employee) and between employers’ and employees’ interests). The first two dimensions are flexibility dimensions, discernible as one proactive/creative variant and one more passive/adaptive variant. Corporate sense represents the requisite increase in social competence. The dimension of balance is added, taking into account the different elements of employability that are sometimes hard to unite and which require fine-tuning, such as current job goals and career goals, to give an example (Van der Heijde and Van der Heijden 2006).

In the remainder of this entry, we will go into the role of age in the relationships between employability, on the one hand, and career success and job search intensity, on the other hand, and on the meaning of sustainable careers from the perspective of employability throughout the life span. However, in order to better understand the possible impact of employee age upon multisource ratings of employability (self-ratings versus supervisor ratings), it is of utmost importance to understand the phenomenon of age-related

stereotyping in performance ratings and possible ways for organizations to combat this.

### **Age-Related Stereotyping in Appraisals of Employability: Self-Other Disagreement in Performance Ratings**

Age-related stereotyping is an important phenomenon where assessments concerning quality and performance assessments about the employee's current functioning or about his or her future career potential (employability) are made by supervisors. Every human being forms stereotypes in order to make his or her world more orderly and predictable, with supervisors in working organizations being no exception. However, many stereotypes are based on cognitive errors. These errors are most likely to occur where people do not have extensive contact with the subject in question and where they do not have any additional information about the individual members of a group. In judging employees whom we do not know very well, we may see them all mainly as members of one and the same group with a common set of attributes. The outcomes of previous research indeed confirm that supervisors have a more negative opinion of the functioning of the over fifties compared with that of starters and mid-aged employees (e.g., Van der Heijden 2001).

Moreover, the nature of the rater, self, supervisor, colleague, or customer (multisource ratings or 360° feedback methodology) produces very different information about the employee. One manager's idea of, for example, the worker's employability may be concretely quite different from another's. After all, any rating is only an indication of how the person (often the manager) applies a fuzzy criterion. Especially in the case of a poor operationalization of the performance indicator in question, rating systems give people a false sense of security, protection, and objectivity. Yet all assessments, of whatever kind and in whatever context, occur in the cognitive processing of an individual human being. As assessment occurs "in the head," it is always, necessarily, and by definition subjective (Van der Heijden and Nijhof 2004). Now, of itself, this is neither good nor bad.

That is just how it is. The important question here is how we respond to the inevitable subjectivity of assessment and to the fact that judgment depends on values and accordingly is subject to response sets, for example, due to stereotyping.

The accurate interpretation of differences in appraisal by different sources requires that one can assume that each set of raters uses the same metric. If, for whatever reason, one group of raters interprets the text of an item or a set of items differently from another group, the resulting differences in the ratings may be the result of not only the observations of the raters but also of the interpretative difference elicited by the item (Penny 2001). The findings of previous empirical studies on occupational expertise, being an important indicator of employability, indicate that employees "think" somewhat better of themselves than supervisors do or at any rate they give a rosier image (Van der Heijden 2001). The scale ratings given by the employees themselves are all significantly higher than the corresponding ones made by their supervisors. This is not thought to be caused by the measurement instrument itself, because the scale reliabilities and discriminant validity are high, both for the self-ratings and for the supervisor ratings. The tendency to present oneself positively, the so-called leniency effect, is common in performance ratings (Golden 1992).

Nonetheless, that an item can function differently for different groups of raters suggests the existence of a degree of measurement inequivalence between the rater groups, and this inequivalence may be indicative of systematic bias in ratings between particular groups of raters. This outcome raises important questions about the reliability and objectivity of performance ratings in general. It might be that self-ratings reflect a reliable but somewhat more differentiated self-image. Supervisors are more consistent in answering. If they are asked to account for their employee's performance, it seems that they are inclined to give unanimous answers, meaning that the scores for items are more accommodated to each other. That is to say, the ratings made by supervisors are more colored by the ratings for other items and, also, for other dimensions of the attribute that is to be evaluated.

Possibly, the supervisor ratings are strongly influenced by a response set, for instance, the degree to which they like or dislike the employee in question as a person. It is well known that such liking–disliking factors, or the “halo effect,” can have a strong effect where persons are required to give valid and dependable judgments of other persons, but are not well informed enough to base their judgment on observations of real-life behavior of these people or on relevant real-life events that they are involved in. Ratings by supervisors are based on a much smaller amount of information, leading to the so-called effect of under-sampling. The effect of under-sampling arises because of the fact that supervisors tend to be more superficially acquainted with their employees, due, for instance, to a lack of communication between the two parties (employee and supervisor), especially in the case of higher-level employees, whose work is highly independent and often solitary even. The effect of under-sampling is thought to give rise to the occurrence of response sets. An example of a response set that can be highly influential is stereotyping, for example, on account of age (Rosen and Jerdee 1976).

Based on the outline given above, we conclude that it is not sound from a statistical point of view to aggregate the scores from different sources: for example, the employee and the supervisor. In fact, this procedure may be very misleading. We should rather spend much more time in analyzing the exact meaning of data on performance assessments emerging from the 360° feedback methodology. If we do not take the time to do so, we are in danger of conducting “sophisticated” analyses before understanding the exact nature of perceptions about the employee’s current functioning or about his or her future career potential (employability), that is to say, before having established the measurement equivalence.

Specifically, there are two aspects of measurement equivalence: (a) conceptual equivalence, the comparability of constructs, and (b) psychometric equivalence, the comparability of psychometric properties of measurement scales (Cheung 1999). *Conceptual equivalence* exists when, for example, employees and their supervisors use the same conceptual frame of reference for

evaluating, for instance, the worker’s employability, that is, in case raters use the same items to represent dimensions and assign similar weights to items, appearing from factor form equivalence and factorial invariance. As regards *psychometric equivalence*, there have been many studies that examine the properties of self-rated performance, and response bias, such as measurement errors, low variability, and leniency error, to mention some frequently found aspects. When comparing self-ratings with supervisor ratings, response bias not only attenuates the power of statistical analyses, but non-equivalent psychometric properties (unequal response sets) also lead to biased results.

The same would apply to ANY appraisal instrument, whether one uses multiple sources or just a single manager. The fact is that we do not think about this as a problem where a single manager carries out the performance appraisal. However, if we consider five managers rating the same employee, we would run into the same problem of poor psychometric qualities. If the appraisal system that we use to make decisions on mobility, firings, promotions, pay raises, etc., can be demonstrated to have low psychometric qualities, for instance, due to age-related stereotyping, it may even confront the company with a variety of problems, like lawsuits and accusations of discrimination on the basis of illegal criteria. Lawsuits apart, decisions that are perceived as unfair will have negative consequences on the motivation, loyalty, and extra-role behavior of employees (e.g., Nijhof et al. 2000). Earlier research in the field of organizational justice theory shows that this kind of procedural unfairness indeed has strong effects on the performance and citizenship behavior of subordinates (e.g., Rutte and Messick 1995).

In order to truly make use of knowledge of perception differences and to openly share the information, employee and supervisor should have an elaborate base of information to talk about the differences in perception. Supervisors should do their utmost to gain greater insight into the potential of one’s workforce and should therefore bridge the gap that exists between them and their subordinates, especially as the supervisor’s opinion is to a great extent influential upon the

career of the individual employee. We also advocate more interaction between supervisor and employee, and in fact between all parties involved, given the expected buffer function of increased interaction in the light of stereotyping (*unknown ... unloved; known ... loved*), for instance, on the base of age.

However, ratings on their own do not convey sufficient information for people to improve. In order for staff to develop and learn, they need to know what they should change, where (specifically) they have fallen short, and what they need to do. In some cases, a personal coach may be the key to deal with the inherent discrepancies found in multisource ratings. Moreover, expert behavior is something that has to be learned on the work floor with feedback from supervisors and close colleagues. When skills are developed “on the job,” staff members function as codevelop partners, and the chances that self-perceptions of performance appraisals do not correspond with the perception of other parties will diminish (Stoker and Van der Heijden 2001).

Employees should not just learn by means of courses or training programs, but by working together with their supervisors. Supervisors can be “sponsors” of several assignments throughout these courses. In this way, they can help facilitate the development of their subordinates. Implementing 360° feedback for developmental purposes centers on communicating evaluation information to the focal employee. This process is aimed at increasing employees’ self-awareness, helping them to set goals, focusing on areas of development, and, ultimately, altering their behavior to improve job performance and to stimulate greater dialogue between all parties involved (Stoker and Van der Heijden 2001).

In the next two parts of this contribution, we will go into the role of age in the relationships between employability and two important outcomes (career success and job search intensity). Although age has often been included as a covariate or confounder in previous employability research, few researchers have explicitly studied age differences in the relationships between model variables.

## The Moderating Role of Age in the Relationship Between Employability and Career Success

Career success refers to real or objective, and perceived or subjective accomplishments of individuals in their work lives (e.g., Judge et al. 1995). From an objective perspective, career success is evaluated using external reference points or norms and is operationalized by means of quantifiable employment history criteria that include promotion rate, income or salary, and attained organizational level. Obviously, performance appraisals about current or future functioning of individual employees play a major role in decision processes regarding their objective career outcomes.

Therefore, it is likely that employability (or career potential) is positively associated with career success (Van der Heijde and Van der Heijden 2006). Moreover, as decisions about career mobility appear to depend heavily on career and life stage considerations (Feldman and Ng 2007), it is expected that employee’s age moderates this relationship in case supervisor ratings are used.

Few career researchers have studied differences in relationships between model variables for distinguished age groups. However, differences in self-reported and supervisor ratings of employability and subsequent career outcomes, depending upon employee’s age, are plausible considering the prevalence of age-related stereotyping (Van der Heijden et al. 2009) and increased person–environment (P–E) fit for older workers (Wright and Hamilton 1978). Negative stereotypical beliefs about older workers may stem less from their current performance levels, yet more from fears of their supervisors as regards their future prospects. And equally distressing, just as immediate supervisors make relatively negative assessments of the “pay-off” period for career investments, older workers themselves also deliberately take into account whether the investment is worth the effort (that is to say, a self-fulfilling prophecy occurs; see also Van der Heijden 2001). As such, they confirm the negative differential treatment they receive in their work environment, and we may therefore expect a

stronger positive relationship between supervisor-rated employability and career success of the youngsters versus the over forties.

As regards the increased P–E fit for older workers, earlier career development theories focused on the idea that one’s self-concept becomes more clearly defined with age, and that career choice is a process of matching one’s self-concept with images of the occupational world (Watkins and Subich 1995). Similarly, the “job change” hypothesis (Wright and Hamilton 1978) states that due to experience, seniority, and skills, a selective group of active older workers will have obtained a relatively better P–E fit and higher occupational levels with more job control compared to their younger colleagues. The increased P–E fit for older workers may result in a relatively stronger relationship between self-rated employability and career success for the over forties, compared to their younger counterparts.

Indeed, in previous empirical work, it was found that for the younger workers self-reported employability contributes to both overall promotions and current gross income, while supervisor ratings appeared only to contribute to current gross income (Van der Heijden et al. 2009). For the over forties, on the other hand, highly different results have been found. Self-reported employability appeared to be positively related to overall promotions, while in case the supervisor ratings of employability were used, the relationship was negative (Van der Heijden et al. 2009). Possibly, our results reconfirm the prevalence of age-related differences in supervisory attitudes (e.g., Van der Heijden 2001). Moreover, it is conceivable that for the over forties in particular, the previously discussed “instrumental style of leadership” plays an important role (Van der Heijden 2001).

### **The Moderating Role of Age in the Relationships Between Occupational Expertise, Self-Perceived Employability, and Job Search Intensity**

Job search intensity refers to the frequency with which job seekers engage in job search behaviors or activities (Blau 1994). One of the factors

leading employees to search for another job on the external labor market is their self-perceived employability. While employees’ perceptions of *internal* employability (i.e., the idea that there are alternative jobs available for them in their current organization) might reduce the likelihood of external job search, their perceptions of *external* employability (i.e., the idea that there are alternative jobs available for them in the external labor market) might increase the likelihood of external job search. Notwithstanding the opposing effects of internal and external self-perceived employability on job search intensity, both are likely to be positively affected by occupational expertise. Occupational expertise may strengthen employees’ labor market value, so that they become more employable, not only in the internal but also in the external labor market (Forrier and Sels 2003).

Although these relationships make sense from a theoretical viewpoint and can be supported with earlier empirical work, the question remains to what extent age may play a role in affecting these relationships. Most studies tend to focus on the main effects of age on outcomes like occupational expertise, employability, or job search. It is equally important however to understand whether the relationships between these variables hold across different age categories. For instance: Will an employee aged 55 plus be as likely to engage in job search when he or she has low perceptions of internal employability in comparison with an employee aged 25? There are several theoretical reasons to expect different dynamics depending on age which can be deduced from theories on life-span development, motivational theories, and literature on opportunity structures. More specifically, one can expect that these relationships will become weaker with increasing age.

An empirical study among employees working in private sector firms provides mixed support for the moderating role of age (De Vos 2009). In accordance with socio-emotional selectivity theory which posits that older employees are less driven by growth motives and more by socio-emotional motives (Carstensen et al. 1999), older employees were less likely to engage in job search when their perceived internal employability was

low, compared to their younger counterparts. However, age did neither moderate the associations between perceived external employability and job search nor the associations between occupational expertise and perceived internal or external employability.

Based upon these findings, we posit that it is important for organizations to understand that occupational expertise is a critical antecedent of perceived employability. However, referring back to the distinction between self and other appraisals earlier in this entry, these self-perceptions of employability will not necessarily be consistent with how others might perceive the employability of older workers – while it will still be these others who might affect older workers' actual opportunities in the internal labor market. As a result, organizations might risk to decrease the motivation and engagement of older employees who, despite their occupational expertise, do no longer perceive internal opportunities for further growth or development but yet stay in their current organization. This might have negative consequences for the sustainability of careers of the employees involved, for the dynamics and motivations in teams of colleagues, and for organizational performance in the long run.

### **Toward Sustainability Across the Life Span**

Based upon this entry, we may conclude that there is indeed a broadly held and persistent view that older workers are less able to cope with the demands of the modern, complex, and competitive organization than younger employees and that older workers' ability or motivation to change jobs or to learn new skills and expertise has deteriorated. Moreover, the possible danger of a self-fulfilling prophecy even worsens the situation, referring to the emotional, attitudinal, and behavioral reactions of the older worker to the instrumental leadership style that is only focusing upon the here and now functioning and wherein supervisors ignore the strength and capacities of their senior staff members. These reactions might, for example, consist of a decrease in motivation and

engagement, a decrease in efforts from the employee's side to actively engage in their future employability enhancement, and increased immobility which is translated in "getting stuck" in their current organization wherein no further opportunities for growth and development are perceived, to mention but a few.

Enhancing workers' competences throughout their life span and adjusting their workplaces and tasks will offer these workers significant future career potential within the labor market. HRM policies should be rooted into a so-called "conservation" model, wherein employees, regardless of their age, are seen as long-lasting valuable organizational assets, instead of the long-adhered "depreciation" model. As older employees are not less motivated to acquire new knowledge and skills, compared with their younger colleagues, management, in particular one's immediate supervisor, should focus upon facilitating employability and career success across working life. With an age-conscious HRM policy, aging of the working population does not need to pose a threat.

Moreover, individual development plans are needed that are based upon valid and reliable multisource instruments and sufficient guidance and training for the raters, not in the least place aimed at detection rating biases. To our opinion, the employability measurement instrument that has been described earlier has high practical value and might be used for comparing current competences and future career potential of employees working in different organizational units or departments. The latter might produce an improvement in recruitment, staffing, and career mobility practices. Moreover, the instrument enables us to further investigate the relationship between individual, job-related, and organizational career activities, on the one hand, and employability, on the other. This might eventually lead to useful recommendations for enhancing lifelong career success, as age-related changes may be carefully detected as well.

However, in order to really help organizations with suggestions on how to protect workers' employability across the life span, we need a sound conceptualization of the concept of

sustainable careers. “Sustainable careers” is defined as the sequence of an individual’s different career experiences, reflected through a variety of patterns of continuity over time, crossing several social spaces, and characterized by individual agency, herewith providing meaning to the individual (De Vos and Van der Heijden 2015).

Different patterns of *continuity over time* (De Vos and Van der Heijden 2015; Van der Heijden and De Vos 2015) mean that in the sequence of different kinds of career experiences, periods of employment can be interchanged by periods of part-time work, volunteering, unemployment, sabbatical leave, care-giving, and so on. A career is, in essence, dynamic. It is a cycle of events and decisions that determine the work people are doing, the changes they make from one job to another (within or across organizations), or transitions between paid work and other statuses (e.g., nonpaid work, unemployment, temporary leave, and retirement). These events, decisions, and their outcomes (i.e., subjective and objective career success) are intertwined.

Also, the *social context* (De Vos and Van der Heijden 2015; Van der Heijden and De Vos 2015) wherein careers unfold has undergone significant changes. Careers are enacted within and across different types of social contexts (work, home, friends, leisure), and they increasingly take place across several different employers. Continuity here implies that influences of actors and factors in the social space, as well as the choices individuals make regarding (the combination of) the different social spaces they live in, may impact the sustainability of their careers.

By *agency* (De Vos and Van der Heijden 2015; Van der Heijden and De Vos 2015), we mean that how the career develops over time is the result of many choices made by the individual owner of the career, not the mere consequence of external influences and constraints stemming from this social space. Choices are made in line with the individual’s career and private needs and aspirations, yet, obviously, these have to be aligned with organizational (employer) objectives and cannot be separated from the individual’s broader life context in order to balance or compromise between (opposing) the individual’s work, career, and

private interests, on the one hand, and (opposing) the employer’s interests, on the other hand (Van der Heijde and Van der Heijden 2006; Van der Heijden et al. 2009).

Finally, careers entail a continuous need to produce new expertise, while, at the same time, they create new opportunities for development. The qualifications that are required for a job are becoming increasingly complex while, simultaneously, the “half life” of these qualifications is becoming increasingly shorter. Employees who are able to make their careers sustainable and who are able to survive the current needs are the ones with not only the most up-to-date knowledge and skills but also the capability to continuously build up the new expertise requirements while deriving *meaning* (De Vos and Van der Heijden 2015; Van der Heijden and De Vos 2015) from their professional activities.

This line of reasoning on the notion of sustainable careers brings age and employability at the core of careers. As careers have changed, the challenges for realizing sustainability throughout one’s career are particularly prevalent when one considers the demographics, that is, the aging workforce, yet in contradiction, the highly prevalent focus on employability and career success of employees in their early career stages. We need new empirical models and HRM policies and practices to safeguard employability throughout the life span, thereby considering that careers have a longer life span than what is often assumed in organizational career management approaches and individual career choices. In other words, employability is a critical criterion for ensuring that employees remain motivated and able to fulfill work-related roles at all ages.

## Cross-References

- ▶ [Age Stereotypes in the Workplace](#)
- ▶ [Age-Related Changes in Abilities](#)
- ▶ [Human Resource Management and Aging](#)
- ▶ [Motivational Theory of Lifespan Development](#)
- ▶ [Retirement and Continuity Theory](#)
- ▶ [Selection, Optimization, and Compensation at Work in Relation to Age](#)

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## Swiss Interdisciplinary Longitudinal Study on the Oldest Old (SWILSOO)

Dario Spini<sup>1</sup> and Christian J. Lalive d'Épinay<sup>2</sup>

<sup>1</sup>Faculty of Social and Political Sciences and Swiss National Centre of Competence in Research LIVES, University of Lausanne, Lausanne, Switzerland

<sup>2</sup>Faculty of Sciences of the Society, CIGEV, University of Geneva, Geneva, Switzerland

## Synonyms

Longitudinal studies

## Definition

SWILSOO is a Swiss longitudinal study with a follow-up of 10 years (nine waves; 1994–2004) of 340 participants and 5 years (five waves; 1999–2004) of 376 respondents, all aged 80–84 years at baseline.

## Description of the Study

### Procedure and Sample

SWILSOO is a two-cohort longitudinal research study of octogenarians conducted by an interdisciplinary team directed by C. J. Lalive d'Épinay (principal investigator) and Dario Spini (assistant director) (Lalive d'Épinay et al. 2008), at the Center for Interdisciplinary Gerontology, University of Geneva. The research program started in 1992 and ended in 2008; the fieldwork took place from 1994 to 2004. The study was funded by several grants from Divisions I and IV of the Swiss National Science Foundation (No 5004-58534/58536, 1253-8261). A set of new analyses based on data from SWILSOO are currently developed in the framework of the Swiss National Centre of Competence in Research LIVES – Overcoming Vulnerability: Life Course Perspectives ([www.lives-nccr.ch](http://www.lives-nccr.ch)).

The first cohort (born in 1910–1914) was drawn from a cross-sectional study on the aging population (65+ years) conducted in 1994 (Lalive d'Épinay et al. 2000) and was followed for 10 years (1994–2004); the second cohort (born in 1915–1919) was followed for 5 years (1999–2004). The periodicity of the interview waves varied from 12 to 18 months, resulting in a total of nine waves for the first cohort and five waves for the second. The main objective of the study is to describe the heterogeneity of the elders' life trajectories and situations at a very advanced age. The first sample consisted of 340 respondents, the second of 377; all of the participants were aged 80–84 years and living at home at baseline. In total, 2890 interviews were completed. The SWILSOO data are archived and available at the Data and Research Information Services:<http://forscenter.ch/en/data-and-research-information-services/>.

The sample of the two cohorts was stratified by region (Canton of Geneva and Canton of Valais) and by gender. The two cantons were chosen to increase the heterogeneity of situations; Geneva is primarily urban, and Valais, located in the Alps, is semirural. The Canton of Geneva forms part of one of the main metropolitan regions in Switzerland; it has a high population density (1590 inhabitants/km<sup>2</sup> in 1990), a large proportion of foreign residents (notably because of the presence of international organizations), an essentially tertiary economy, and a sizeable public sector. In contrast, the Canton of Valais has a lower population density (84 inhabitants/km<sup>2</sup> in 1990). Its heritage is one of farming, mountain life, and Catholicism, and it currently has a rapidly expanding tertiary sector, notably in the tourist sector.

A major strength of SWILSOO is the random selection of respondents based on the cantonal register for Geneva and the municipalities' registers in Valais, which enabled the follow-up of a sample that was also heterogeneous in terms of socioeconomic background. Among the cohorts, in Valais, slightly less than half of the men (47%) and three-quarters of the women (77%) completed only compulsory school; in Geneva, these proportions were 21% and 43%, respectively. The elders from Valais were mostly manual workers: farmers, workers, and tradesmen; only 37% were white-collar employees, in comparison with 62% in Geneva.

At the end of the fieldwork in 2004, there were 59 respondents left of the first cohort (which started in 1994) and 173 from the second (which started in 1999). To monitor attrition, the civil registries of both cantons were periodically checked to control deaths, removals, and dropouts among the participants. This process allowed analyses of mortality predictors (Guilley et al. 2005; Spini et al. 2001). Analyses of attrition in terms of different variables (gender, geographical area, social status, income, education, and religion) showed that only the geographical area was significantly related to the risk of dropout; there were twice as many dropouts in Geneva as in Valais. Health did not impact dropouts. This result may be explained by the proxy procedure implemented since the start of SWILSOO, which resulted in

394 interviews (14%) conducted by proxy (mainly spouses, offspring or other family members, and eventually professionals in nursing homes) for 194 respondents who could have been lost otherwise (Lalivé d'Épinay et al. 2008; see also Ghisletta and Spini 2004).

### Questionnaire

The questionnaires used in wave 1 were longer than those used in the following waves, notably because they included biographical questions and questions about socioeconomic background. Since the second wave, four forms of standardized questionnaires have been used, depending on the respondent's type of residence (private home vs. institution, mainly nursing homes) and the reporting person (self vs. proxy). The questionnaires used with proxies were shorter and logically did not include self-reported measures.

Trained interviewers administered the questionnaires during face-to-face interviews held in a place chosen by the respondent (in most cases, the respondents' homes). The basic structure of the questionnaire included questions about living circumstances (e.g., nature of domicile: private vs. institution, apartment/house, number of rooms, means of transportation), financial situation (e.g., assets, income, nonmonetary resources, insurance coverage and social benefits), health (e.g., illnesses, physical pain, functional health, sensory capacities, depressive symptoms, illnesses and accidents since the last interview; periods of confinement to bed; falls; hospitalizations; consumption of care; medical checkups; dental care; medication; alcohol and tobacco consumption; physical activities and exercise; functional status of cohabitants), institutional network (e.g., the nature and frequency of care received), family and friendship network (e.g., the family size and composition, proximity of offspring and siblings, existence of a close friend, frequency of exchanges, the nature and frequency of the support provided and received, neighborhood relationships), activities, social and cultural life (e.g., the nature and frequency of activities, media use, participation in associations, religious activity), and psychosocial dimensions (e.g., self-rated health, life satisfaction, social and temporal health

comparisons, beliefs and values, perception of important changes since the last interview, cognitive functioning). In addition to the wave-after-wave interviews using a close-ended questionnaire, 74 in-depth interviews were conducted to collect narratives of the lives of the very old.

### Research Highlights

#### Fragilization and Frailty

The aim of SWILSOO was to describe and compare life trajectories in very old age. The research focused on the trajectories of fragilization and on frailty (Lalivé d'Épinay and Spini 2008; Spini et al. 2007a). Fragilization was defined as a universal process of losses in various functions and systems as a result of senescence, while frailty was defined as a state of vulnerability to various stressors that limits the capacity to recover previous levels of functionality and adaptability after exposure to a stressor.

Three health statuses were also operationalized: (1) ADL-dependent: a person unable to perform at least one of five activities of daily living (washing, dressing/undressing, eating, rising from/going to bed, moving inside home) without assistance; (2) ADL-independent but frail: with frailty defined as suffering from deficiencies in at least two of the following five domains: sensory capacities, mobility, memory, energy, and physical ailments; (3) Robust: no ADL incapacities and deficiency in no more than one of the five domains mentioned above. The results for the dynamics of health states showed that frailty is the health status that affects the majority of very old people (80–94 years old); for most of them, frailty was a long-lasting stage of their last years. The results also showed that progression from frailty to independence may occur (in approximately one case out of five), but is quite short-lived, and that most individuals who became dependent had gone through a period of frailty. Moreover, long-term ADL-dependence is not a normative conclusive stage of long lives. Women and people in lower social categories – notably manual workers – are at a higher risk of ADL dependency; however, it was not the primary health status, even

at the end of the longitudinal follow-up period. Finally, the analysis of health trajectories also showed that continuity in the status of robustness or frailty is the most frequently observed trajectory (Guilley and Lalive d'Épinay 2008, pp. 29–36; Guilley et al. 2008).

### Family and Social Relationships

The research mainly focuses on the support elders receive from their networks. However, preserving the ability to give (or to exchange) is a crucial developmental resource across the life course, including old age (Antonucci and Jackson 1990). Studying the evolving structure of services that the elders provide and receive from their family revealed that, not surprisingly, ADL dependency drastically altered the capacity to provide services. At the same time, frail elders continued to provide support to their family members at the same level that robust elders did (with some adaptations in the nature of the services provided). This result highlights the subjective importance in very old age of preserving a positive, exchange-oriented status within the family for as long as possible (Guilley and Lalive d'Épinay 2008, pp. 85–92). The reverse longitudinal association between social relationships and health has also been investigated. The results showed that having at least one surviving sibling and paying regular visits to family members and friends has a positive impact on remaining independent (Guilley and Lalive d'Épinay 2008, pp. 93–102). Finally, the study by Ghisletta, Bickel, and Lövdén (2006) showed that increased media and leisure activity engagement slowed the decline in perceptual speed, but not in verbal fluency or performance, whereas cognitive performance was not associated with changes in activity engagement.

### The Interface Between Formal and Informal Support

How does the interface between formal and informal support work and evolve in very old age, a context associated with an increased need for help and a declining number of potential caregivers (because of the decrease in contemporaneous family members and close friends)? Various theoretical models have been devised. Three were tested

in relation to instrumental help. The increase in formal support is associated with: (1a) an increase in or (1b) the stability of informal support (complementarity); (2) a relative decline in informal aid (adjustment of the informal network); and (3) the disappearance of informal help (radical substitution). The analyses were based on the changes reported during the nine waves of interviews with the community dwellers from the first cohort. Complementary support was observed in 72% of the interviews (1a: 47%; 1b: 24%), the adjustment of informal support in 21%, and radical substitution in only 7%. The concern that welfare state support through formal services may crowd out support from relatives and friends in the context of a post-industrialized country such as Switzerland is thus unfounded (Guilley and Lalive d'Épinay 2008, pp. 103–112). The results from SWILSOO are in line with the crowding in process described by Künemund and Rein (1999), that is, the generous welfare systems that provide resources for elderly people increase rather undermine solidarity.

### Disruptive Events and Their Impact

From the second wave on, the interviews with the respondents were introduced in the following way: *Since our last meeting* (recording the date, if necessary), *have there been any major changes in your life?* This strategy had the practical goal of establishing the connection between the last and current interviews, but it also had the scientific goal of scrutinizing the individual's awareness of changes in the course of his/her life and the relationship between subjectively perceived changes and the range of objective changes that occurred between successive waves.

At the end of the 5-year follow-up, 80% of the survivors mentioned changes, with a mean of three changes; after 10 years, 88% mentioned changes, with a mean of six changes. The main domains of change were health and family, which accounted for over 80% of the mentions. When another person was involved in the change, he/she was almost always a close relative and, in one out of every two cases, the event was bereavement (Guilley and Lalive d'Épinay 2008, pp. 47–64).

In very old age, bereavement for a beloved one refers mainly to siblings (40%) and close friends (50%). A precondition for measuring the specific impact of a death on the survivor is to ensure that the bereavement is not the product of any other type of change, particularly health problems, that could have occurred during the same time span. Here, three categories of sequences were compared: the bereavement sequences with no mention of any other important changes, the health trouble changes sequences (with no bereavement), and the no-change sequences. Two temporal spans were considered: short term, when the event occurred between two waves of interviews, in which case the impact was measured at the second wave, and middle term, when the impact was measured at the third wave. Comparing the bereavement sequences to the no-change sequences revealed a slight and short-term impact on functional impairments and a very significant and long-lasting increase in depressive symptoms. Depending on the status of the person who died (e.g., a family member or a close friend), the adverse impact of the loss on the psychological health of the bereaved displays a distinctive process. The death of a family member stimulates a tightening of ties within the family that seems to buffer the negative impact on well-being. No such regulation comes into play with the loss of a friend. As a result, the bereaved suffers from a greater increase in depressive symptoms, with also a delayed disruptive effect on his/her sense of closeness (Lalivé d'Épinay et al. 2003; Cavalli et al. 2009).

### **Community Dweller Elders and Nursing Home Residents**

In Switzerland in the year 2000, only 19% of elders aged 80+ were living in a nursing home (22% among women, 12% among men; statistics from the Swiss Federal Statistical Office), as a result of a “remaining at home” social policy. SWILSOO's longitudinal design allows comparisons of the trajectories of the elders who moved into a nursing home with those of the elders who remained in their private home.

The interaction of two sets of factors led individuals to move into a nursing home. On one

hand, accelerated fragilization resulting in severe frailty, often with ADL dependency, was a crucial factor associated with relocation. On the other hand, an increasing feeling of loneliness also favored a move to a nursing home. Such feelings were not necessarily related to social and family isolation but more to the awareness of a rapidly increasing imbalance between the care (medical, instrumental) the elder requires, the growing risks encountered in everyday life at home, and the insufficiency of the care that both informal and formal networks are able to provide.

Comparing the evolution of indicators between the wave before and the one after the move (the time span between the two waves was 12–18 months) into a nursing home shows that this period is very critical in terms of health and well-being and is marked with losses and risks in various domains. After the transition, a stabilization is observed, with a lower risk of accidents than during the last years at home, for example.

Two widespread preconceptions are (1) that nursing home residents have a low level of exchanges (visits, phone calls, etc.) with their family and (2) that living in a nursing home affects morale and well-being. Neither the first nor the second was observed in this study. During the transition and the first period in the nursing home, the residents benefitted from a higher level of interactions with family members than they had at home; after the first year in a residence, there was no significant difference in the level of interaction or in well-being between residents and community dwellers (Cavalli et al. 2007; Cavalli 2012; Lalivé d'Épinay and Cavalli 2013).

### **The Paradox of Well-Being in Later Life**

Older individuals have many strategies for maintaining their well-being at a relatively high level despite objective health losses (Spini et al. 2007b). This phenomenon, usually described as the well-being paradox (Kunzmann et al. 2000), shows that despite an accumulation of losses during older age, individuals maintain a relatively stable and positive level of well-being. This paradox has been observed in numerous studies and is typically considered a robust finding.

Research from Girardin Keciour and Spini (2006) considered the specific health transitions that individuals experience and how these transitions were related to well-being. At the mean level, the paradox of well-being again emerged; while the number of incapacities increased across waves and with advancing age, the level of well-being was relatively stable and did not vary with age or time at the intraindividual level. However, when individual transitions from different states of health (independent, frail, and dependent) were considered, a different result was observed. Those who experienced a trajectory that included independence (stable independence, independence to frailty, or frailty to independence, 54% of trajectories) showed relatively high levels of well-being. Those who were frail at two successive waves (33% of trajectories) showed moderate levels of well-being. Interestingly, those who experienced a period of dependence (stable dependence or frailty to dependence, 13% of trajectories) showed low levels of well-being. Notably, 72% of the observed health trajectories remained in the same state (stable independence, frailty, or dependence) across two waves. Thus, stability and high levels of well-being occur because a majority of aging individuals experience a relatively stable and positive health trajectory, even in old-old age (Guilley and Lalive d'Épinay 2008). Moreover, when health has deteriorated, the levels of well-being are relatively lower. Thus, the paradox of well-being may not be as paradoxical as previously suggested.

### Cross-References

- ▶ [Australian Longitudinal Study of aging \(ALSA\)](#)
- ▶ [Berlin Aging Studies \(BASE and BASE-II\)](#)
- ▶ [China Health and Retirement Longitudinal Study \(CHARLS\)](#)
- ▶ [Interdisciplinary Longitudinal Study on Adult Development and Aging \(ILSE\)](#)
- ▶ [Irish Longitudinal Study on Ageing \(TILDA\)](#)

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elderly participants are discussed as well as future directions for the project.

## Introduction

The global centenarian population is rapidly increasing (Richmond 2008), which has raised concerns about the burden this demographic change might have on health-care systems. At the same time, there is growing enthusiasm about the attainability of exceptional old age as well as longer productivity in the workforce and a focus on the role of modifiable, environmental factors in aging. As part of a growing wave of research into the very old, the *Sydney Centenarian Study* (SCS) was launched in 2007 at The University of New South Wales (UNSW), Australia. The SCS was developed to explore the genetic and environmental factors that contribute to successful aging among the very old with a particular focus on brain health. It included both centenarians (i.e., those 100 years of age or more) and “near-centenarians” (i.e., those 95–99 years old), henceforth referred to collectively as “centenarians.”

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## Sydney Centenarian Study

Adam Theobald, Catriona Daly, Zixuan Yang,  
Karen A. Mather, Julia Muenchhoff,  
John Crawford and Perminder Sachdev  
Centre for Healthy Brain Ageing, University of  
New South Wales, Sydney, NSW, Australia

### Definition

This entry discusses the history, protocol, methodology, and initial outcomes of the Sydney Centenarian Study, a longitudinal study of cognitive and physical function of people aged 95 years or more. Difficulties of research involving very

## Theoretical Orientations

### Successful Aging

Individuals who have survived to extreme ages, particularly those who have not developed dementia and who remain functionally independent, provide an excellent model of successful brain aging. This unique population may potentially yield insights into protective factors for brain health which are applicable for younger individuals.

### Differential Aging

The “oldest old” could be expected to exhibit different characteristics to the “younger old.” Further, differences have been demonstrated between male and female centenarians (Hazra et al. 2015)

as well as significant cohort effects (Cho et al. 2012). The SCS allowed for the examination of differences between centenarians and the comparison of centenarians to younger populations.

### **Cognitive Aging**

There is poor understanding about what represents “normal” cognition among the very old. It is known that dementia is not inevitable for centenarians (Perls 2004); however, impairments are common, and assessment is often hindered by sensory impairments and general frailty. Defining a “cognitive phenotype” and developing normative data for this age group will assist future researchers to disentangle pathology from natural aging processes.

### **Study Objectives**

The SCS was launched in 2007 with the following stated aims: (i) to determine the cognitive profile of exceptionally old individuals; (ii) to relate cognition in this age group to brain imaging parameters; (iii) to examine centenarians from neuropsychiatric, medical, nutritional, and lifestyle perspectives; (iv) to determine the incidence of dementia in centenarians; and (v) to examine health-care needs and level of functional autonomy among centenarians.

### **Study Overview**

A cohort of men and women aged 95 years and above were recruited from seven local government areas in the East and Inner West regions of Sydney. Participants underwent an initial cognitive, medical, and psychiatric assessment in their own homes and were invited to undergo an MRI scan and provide a blood sample. They were also asked to provide a detailed medical and nutritional history and an overview of their current and past levels of physical, mental, and social activities. Participants completed a brief follow-up assessment 6 months, 12 months, and 18 months after baseline to assess rates of incident dementia and monitor changes in cognition, physical health, and functional independence.

### **Recruitment and Study Timeline**

The SCS was conceived in 2006 by Professor Perminder Sachdev (neuropsychiatrist). It was initially led by Dr. Charlene Levitan (psychologist) and funded by a research grant from the National Health and Medical Research Council (NHMRC). Recruitment began in 2007, predominantly via a targeted mail out to Sydney residents aged 95 years or above living in the targeted geographical regions. Addresses were obtained from both the Australian Electoral Commission (AEC) and Medicare Australia (all Australian citizens are registered with the AEC and Medicare, and noncitizen permanent residents are registered with the universal Medicare). A second mail out was conducted in 2010. This recruitment method was supplemented by other strategies to make the sample as complete as possible: local media campaigns, approaching directors of aged care facilities, attending community senior citizen groups, advertising through local surgeries, and approaching participants from another longitudinal study, the Sydney Memory and Ageing Study (Sachdev et al. 2010). Between 2007 and 2013, 345 participants completed a baseline assessment (Wave 1). Two hundred and thirty-two participants completed a 6-month follow-up assessment (Wave 2), 174 completed a 12-month follow-up assessment (Wave 3), and 124 of the cohort went on to complete a fourth assessment (Wave 4) 18 months after their baseline assessment. Blood samples were taken from ~70% of the cohort, while 8% underwent an MRI scan. A further 54 individuals aged 95 or more who lived outside the immediate catchment area were recruited to give blood samples. Twenty eight of these additional participants had MRI scans bringing the number of participants with brain scans to 57. A new wave of recruitment is planned for 2016 with the aim of increasing the sample to 600 participants. However, since the second wave of recruitment is 9 years after the first, there may be cohort effects which will be taken into consideration in the analysis. Lifestyle and neuropsychological data for the existing sample is undergoing review and is expected to be released in 2016.

## Sample

The SCS sample included 345 individuals (247 females, 98 males) aged between 95 and 106 years with a mean age of 97.4 at baseline. Inclusion of “near-centenarians” (i.e., those aged 95–99) allowed for a much larger sample to be developed; at baseline, 88% of the sample was near-centenarians, while 12% were aged 100 years or more. Approximately one quarter (27%) of the sample was from a non-English-speaking background. Half of the sample was recruited via the targeted mail out, with other strategies contributing the remaining 50% (Sachdev et al. 2013). Participants were not screened for cognitive, physical, or sensory impairment; all individuals who met the age requirement and agreed to participate were included. When an individual was unable to provide consent, their next of kin were approached. Each participant was asked to give details of a family member or friend to act as their “Informant,” i.e., someone with whom they had regular contact and could answer questions about their cognitive and physical function.

## Assessment Protocol

Baseline assessment comprised three separate home visits, typically spaced 1–2 weeks apart (Sachdev et al. 2013). The initial visit captured demographics, medical history, family medical history, current medications, fall history, subjective cognitive complaints, a brief cognitive screen – the Addenbrooke Cognitive Examination Revised (ACE-R), which includes the Mini-Mental State Examination (Mathuranath et al. 2000) – and a dietary questionnaire. A brief medical exam was also conducted which included height and weight measurements, blood pressure, lateral stability, visual acuity, grip strength, and lung function. The second visit comprised a comprehensive neuropsychological battery including tests of memory, processing speed, visuospatial functioning, language, executive function, and premorbid function. The final visit included measures of autobiographical memory, mood and

anxiety, satisfaction with life, social integration, and physical and mental activity. Diet, physical activity, and mental activity questionnaires captured both current lifestyle as well as lifestyle behaviors at various stages in their lives (e.g., between the ages of 40 and 50).

Biannual follow-up assessments (6, 12, 18 months) were brief and confined to one session. They included the same cognitive screen (ACE-R), interval medical history, interval fall history, and an abbreviated medical exam. Questionnaires about diet, social activity, physical activity, and mental activity were repeated across all four assessments.

Informants were approached at each wave to gather information about participants. They were asked to confirm the participants’ demographic details and medical history, as well as complete questionnaires about functional impairment, cognitive decline, and level of independence.

## Diagnosing Dementia in Centenarians

The prevalence of dementia increases exponentially with age, with the oldest old population at the highest risk of developing dementia. The approaches for diagnosing dementia in centenarians vary widely as do the subsequent prevalence estimates (Gondo and Poon 2008). The challenges for diagnosing dementia in centenarians have been described elsewhere (Slavin et al. 2013) and include a lack of normative data, sensory and physical impairments affecting cognitive performance, as well as contentious definitions of “normal” in this population. This makes it difficult to define notions of “impairment” and “pathological decline” within this age group.

The essential elements of a dementia diagnosis (or major neurocognitive disorder), according to the DSM-5, include a decline from previous levels of cognitive performance to a level at which functional independence is compromised (American Psychiatric Association 2013). In the SCS, a diagnosis of dementia was given to those with both impaired cognition and function. Impaired cognition was defined as having a score less than or equal to 23 on the Mini-Mental State Examination

(MMSE). Impaired function was defined as having a score of greater than or equal to 3 on the Bayer Activities of Daily Living Scale (Hindmarch et al. 1998) that was adjusted so as to represent problems judged by informants as being due to cognitive rather than physical causes (Anderson et al. 2007). Cases in which there was concern about performance, discrepancy in results, or limited information were presented to a consensus panel for assessment. This panel consisted of a neuropsychiatrist, a psychogeriatrician, a neuropsychologist, and other research staff. An additional subgroup of participants was brought to the consensus panel to ensure the reliability of this approach.

At baseline, 120 (35%) participants were classified as having dementia, 208 (60%) were considered to not have dementia, and in 17 cases, there was not enough information to make a diagnosis.

## Neuroimaging in the Sydney Centenarian Study

Neuroimaging studies involving exceptionally long-lived individuals are scarce but important for understanding the neuroanatomical basis of successful brain aging. Past studies of normal aging in “young” elderly have revealed that brain aging is heterogeneous and follows a “frontotemporal” pattern, i.e., brain loss with aging is greatest in the frontal and medial temporal lobes (Fjell et al. 2014). It is not known if this pattern of brain loss remains consistent as individuals approach 100 years of age.

A cross-sectional, non-demented cohort was drawn from the SCS and the Sydney Memory and Ageing Study (MAS) (Sachdev et al. 2010), and the profiles on structural magnetic resonance imaging (MRI) of the oldest old were compared with the younger old, by repeated measure analysis of covariance (ANCOVA) (Yang et al. 2016). The greatest loss of brain volume at advanced age was found in the medial temporal lobe (including the hippocampus) and parietal and occipital cortices, indicating that the “temporo-posterior” regions of the brain are particularly

vulnerable in exceptional longevity, even in those who aged successfully. This topographic distribution is distinct from the “frontotemporal” pattern in the younger elderly or the “temporoparietal” pattern typical of Alzheimer’s disease (Fjell et al. 2014).

White matter hyperintensities (WMHs), considered as surrogates of small vessel disease of the brain, were found in almost all of the SCS participants. Relationship of age with WMHs was examined using the general linear model and was found to be stronger at older age, suggesting that the accumulation of WMHs accelerates with advancing age. Despite the high prevalence and the extensive accumulation of the WMHs, their pathogenesis, progression, and impact on cognitive and motor function in exceptional longevity remains poorly understood. The clinical implications, including issues of prevention and treatment, warrant further investigations.

## MRI Markers of Dementia

Examining the markers of pathological brain aging in the oldest old was another important aspect of neuroimaging in the SCS. Neuropathology is common in non-demented individuals at advanced age, and the conventional neuropathological markers are found to be weaker predictors of dementia in the oldest old than in the young (Savva et al. 2009). Data from SCS provided a unique opportunity to examine the association between structural MRI and clinical dementia. A wide range of MRI markers of neurodegeneration and vascular pathology were examined in the oldest old using logistic regression, with dementia being the outcome variable. Similar to neuropathology studies, our data showed that the association between MRI markers and clinical expression of dementia is not as well demonstrable in the oldest old as in younger old, in particular for vascular lesions. This suggests that while very old individuals do demonstrate considerable brain pathology, its presence is consistent with normal cognitive functioning. Factors underlying the brain reserve in this population need to be better understood to inform strategies for dementia prevention.

## Blood Collection and Biochemistry

Peripheral blood samples were collected for biochemical analysis and DNA extraction for genetic analyses. Routine blood analyses performed include assessment of levels of lipids (total cholesterol, HDL- and LDL-cholesterol, and triglycerides), sodium, potassium, chloride, bicarbonate, homocysteine, urea, creatinine, estimated glomerular filtration rate, urate, glucose, C-reactive protein (CRP), and a full blood count. Blood samples (EDTA plasma, serum, buffy coat) have also been stored at  $-80^{\circ}\text{C}$  for future work. For a small subset, a blood sample in a PAXgene tube (PreAnalytiX GmbH, Switzerland) was also collected for RNA extraction.

A particular group of plasma proteins, the family of apolipoproteins, play a crucial role in lipid metabolism and are implicated in age-related cognitive decline, Alzheimer's disease and longevity (Song et al. 2012; Yu and Tan 2012; Shadyab and LaCroix 2015; Atzmon et al. 2006). Hence, it was of interest to determine levels of these plasma proteins in the very old to establish any potential links of these proteins to physical and cognitive health in this age group. Levels of seven apolipoproteins (A-I, A-II, B, C-III, E, H, and J) were measured in a subset of EDTA plasma samples ( $N = 147$ ) using a multiplex immunoassay (WideScreen™ Human CVD Panel 1; Novagen, EMD Chemicals Inc, WI). The data indicated that plasma apolipoprotein levels, in particular apolipoprotein E, differed in the very old compared to “younger” old age groups (<95 years) and were associated with cognitive performance.

## Genetics

Prior studies have demonstrated that longevity is influenced by genetic factors and its influence appears to strengthen at the upper limits of the lifespan (Newman and Murabito 2013; Sebastiani and Perls 2012). Therefore, studying the genetics of exceptional longevity may shed light on the genetic and biological factors that lead to successful aging.

DNA from SCS participants was extracted from donated blood samples using conventional methods by Genetics Repositories Australia. One of the genes most consistently associated with longevity across different studies is the apolipoprotein E (*APOE*) gene (Shadyab and LaCroix 2015), which is also linked to late-onset Alzheimer's disease. Genotyping of the *APOE*  $\epsilon 2/3/4$  polymorphism was undertaken using TaqMan assays (Applied Biosystems Inc, Foster City, USA) for the two *APOE* SNPs rs7412 and rs429358. In the SCS subsample with *APOE* genotyping data available ( $N = 280$ ), only 13.5% of participants carry at least one copy of the  $\epsilon 4$  allele, which is the major risk factor for late-onset Alzheimer's disease. In addition, genome-wide genotyping has been performed using the Illumina Omni Express array (California, USA) at the University of Queensland Diamantina Institute, Brisbane, Australia. Currently, after quality control procedures, we have genome-wide genotyping data for 256 participants. This data has also been imputed to the 1 K genome panel. For a subsample of participants, genome-wide DNA methylation has been assessed using the Illumina 450 K array (California, USA). In the near future, whole genome sequencing is planned for a subsample of participants aged 100 years and over.

Gene expression changes have been reported across the lifespan; however, few studies have examined the transcriptome comprehensively in long-lived individuals. In the SCS, RNA has been extracted using the Qiagen PAXgene blood miRNA kit (PreAnalytiX GmbH, Switzerland), and the transcriptome has been assessed using RNA sequencing for 24 participants.

## Inherent Difficulties of Centenarian Research

Research involving the very elderly poses significant methodological challenges.

### Proof of Age

Determining the age of participants in centenarian research is critical. Self-reported date of birth is

not necessarily reliable, especially for participants with cognitive impairment. Birth certificates were sought for each participant, but given that year of birth for the cohort ranged from 1902 to 1918, before many countries maintained accurate records, convergent sources of information were also requested. These included marriage certificates, passports, driver's licenses, military certificates, baptismal certificates, birth certificates of children and siblings (if any), and other corroborating documents.

### **Establishing a Representative Sample**

Recruitment for the SCS was restricted to areas of Sydney proximate to the research center for reasons of convenience, and attempts were made to recruit as comprehensively as possible within this geographical area. Centenarians living independently were contacted by mail, centenarians in aged care were often approached through staff, and media advertising was also employed. Despite these efforts, many centenarians in the area declined to participate or were too impaired to give consent, and their families were unwilling. Those who volunteered to participate and were able and willing to complete all assessment tasks, particularly the comprehensive neuropsychological battery, represent the higher functioning centenarians, representing a healthy volunteer bias. This makes the establishment of normative data difficult.

### **Assessing Cognition**

Assessment of cognition in SCS participants was plagued by a number of difficulties. Sensory impairments were common. Some participants had limited or no vision, and the majority of participants had at least mild hearing difficulties. Test materials were adapted where possible (e.g., using large print, assisting participants to complete self-report questionnaires); however, many participants still had difficulties seeing or hearing the material, and thus valid data could not always be gathered. Interpretation of performance was made more difficult by the lack of normative data as the majority of tests have been developed for a younger demographic.

### **Managing Fatigue**

Fatigue was commonly noted during assessments, even among those who appeared to be higher functioning and in relatively good health. Baseline assessment was split across three home visits so as not to overburden participants, although each session was still at least 1 h in length. Breaking sessions into smaller periods, providing regular breaks, and prioritizing the more crucial elements of the assessment were all important in obtaining maximum valid data.

### **Reliance on Informants**

Given that a large proportion of the SCS sample exhibited cognitive impairment, data collected from informants (family members or close associates) was critical to obtaining an accurate profile of a participant's physical, cognitive, and functional abilities. However, informants were not always willing to answer questions or may have exhibited cognitive difficulties themselves, particularly when the spouse of a participant was the nominated informant. The objectiveness of friends and family members is also variable. For example a family member may be concerned that their relative will be placed in aged care if they are assessed as being impaired and thus overrate their functional capacity. Finding reliable informants who have regular contact with participants and then keeping them engaged throughout the study is a crucial aspect of centenarian research.

### **Future Directions**

The SCS provides an exciting and unique opportunity to explore the oldest old population. As well as providing normative cognitive, functional, psychological, and physiological data for this group, the SCS endeavors to identify risk and protective factors for dementia and successful brain aging. It is hoped that the output of this project will inform models of aging, consequently informing service planning, health burden estimates, and care delivery strategies.

The longitudinal design of the study affords researchers the opportunity to track the emergence and progression of pathology and successful

aging across a number of measures. This enables various relationships to be explored and tested over time and at specific time points. Among other topics, the psychological landscape of centenarians, the inevitability of dementia, and the association between cognitive and physical frailty are of particular interest to the research group.

The inclusion of biomedical data enables the biomarkers of dementia to be examined and collated with clinical diagnostic data, providing greater accuracy while normative data is lacking. Similarly, genetic data have been collected for the majority of participants and are in the process of being analyzed in attempts to assess the genetic contributions to successful aging and dementia in the oldest old. Finally, brain imaging for a subset of participants, combined with the brain donor program, provides information on the gross and microscopic structure of the brain at the extreme end of the lifespan. Continued research will focus on these measures.

The SCS is a member of the International Consortium of Centenarian studies on Dementia (ICC-Dementia <https://cheba.unsw.edu.au/group/icc-dementia>), a collaboration which seeks to harmonize centenarian and near-centenarian studies across diverse ethno-racial and sociocultural groups, to describe the cognitive, functional, and psychological profiles of the oldest old. In addition, it is hoped that the SCS's involvement in this consortium will aid efforts to ascertain the age-standardized prevalence and incidence of dementia, internationally.

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## Technology and Older Workers

Neil Charness<sup>1</sup>, Walter R. Boot<sup>1</sup> and Sara J. Czaja<sup>2</sup>

<sup>1</sup>Institute for Successful Longevity, Department of Psychology, Florida State University, Tallahassee, FL, USA

<sup>2</sup>University of Miami Miller School of Medicine, Miami, FL, USA

### Definition

#### Technology

Technology definitions cluster around the concept of the application of knowledge to solve practical problems, with many definitions including words such as technical knowledge, product, equipment, engineering, applied science, and tools. Here we will restrict consideration of technology to information and communications technology (ICT), technology aimed at facilitating communication of information, usually between distant sources. Typically, ICT devices contain microprocessor chips that support programmable behavior. The archetypal example is a digital computer system linked to a communication network, with that system having surface forms such as desktop, laptop, tablet, and smartphone.

#### Older Worker

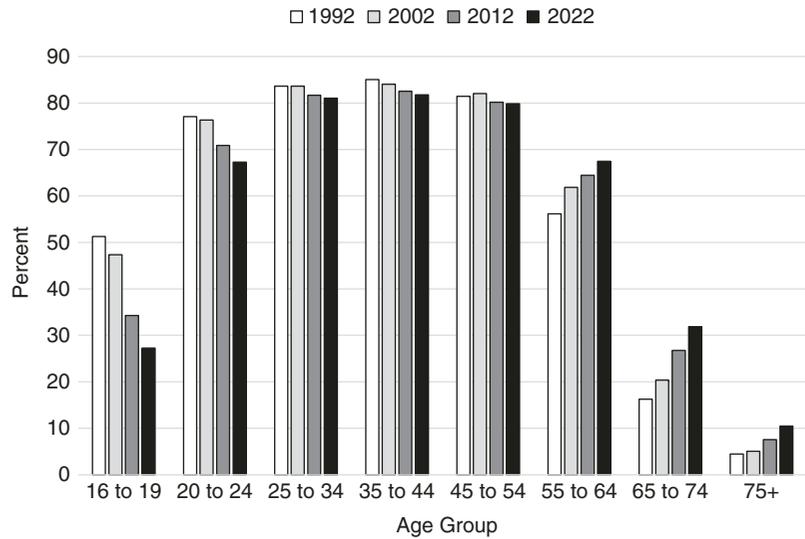
It is always difficult to define or provide an age cutoff for an “older worker” as there is no

consensus about the term. It varies according to occupation and context. For example, a report by the National Research Council focusing on the health and safety of older workers (Wegman and McGee 2004) adopted the age of 45 as the arbitrary cutoff, whereas currently maximum US Social Security benefits begin at age 67 for those born after 1960. Also in the general literature, someone aged 65+ is generally referred to as older. Further, perceptions of aging are changing with the aging of the baby boomers, so the meaning of the term “older worker” is likely to change in the near future. Generally, we feel that although chronological age is important and has meaning with respect to functional abilities, what is most important is the health of the individual, their attitudes and preferences about remaining employed in their older years, and their abilities relative to the demands of the job in question.

### The Role of Technology in Older Worker Participation in the Labor Force

How does the widespread diffusion of technology into the workplace impact the older worker’s participation, productivity, and well-being? Sub-questions include whether older workers are more reluctant to engage with technology (see entry on “► [Work Motivation and Aging](#)”), how both self and manager perceptions may affect older worker training opportunities (see entries on

**Technology and Older Workers, Fig. 1** US labor force participation rates and projections by age group (Data from Toossi 2013)



“► [Job Attitudes and Age](#),” “► [Age Discrimination](#),” and “► [Recruitment and Selection of Older Workers](#)”), and what role technology plays in older worker productivity, in training older workers (see entry on “► [Training at Work and Aging](#)”), and in older worker withdrawal from the labor force (see entry on “► [Timing of Retirement](#)”). We begin with the latter.

### Demographics of Older Workers and Trends for Work and Retirement

As the general population ages, so too does the labor force, depending on participation rates and number of workers in the various age categories. One demographic feature common to many industrialized nations is the presence of the baby boom cohort, the large group of children born in the two decades following the end of the Second World War. That large birth cohort continues to affect long-term projections for labor force participation of older adults, as depicted in Fig. 1.

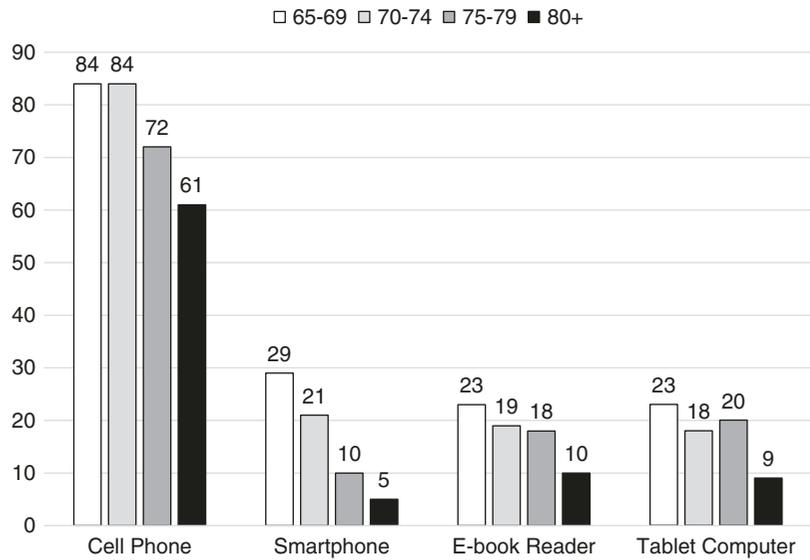
As shown, younger workers are expected to continue their trend of declining labor force participation rates over time. By contrast, those in age groups of 55+ years are expected to show increasing participation rates over time. That is, over the next decade, a much higher percentage of such older workers can be expected to remain in the

labor force, suggesting that current trends of increasing technology deployment may not be a significant psychological barrier to participation. The median age of the labor force is expected to continue its increase from age 37.1 years in 1992 to 42.6 years in 2022, with workers aged 55+ years representing nearly 26% of the labor force by 2022 (Toossi 2013).

There is a similar trend in other developed nations of increased labor force participation of older workers. Many European countries have recently implemented policies aimed at promoting later retirement by increasing the age of entitlement to full pensions, in part to cope with current and projected growing government expenditures for pensions (OECD 2011) and the need for skilled workers in many occupations.

A second historically recent trend in developed countries is the growing labor force participation rates of women as compared to men (see entry on “► [Women and Retirement](#)”). Prior to late in the twentieth century, and even today in many less-developed nations, women would not typically engage in paid work outside the home, or if they did when young, they usually left the labor force permanently when they had children. Thus, the aging workforce is also going to be an increasingly female one, with US men aged 55 years and older expected to decline slightly in participation rates from 46.8% to 46.2% from 2012 to 2022, but

**Technology and Older Workers, Fig. 2** Percent ownership of portable computing devices by age group (65–69 years, 70–74 years, 75–79 years, 80+ years) in the United States in 2013 (Data from Smith 2014)



women expected to show an increase from 35.1% to 37.5% in that same time interval (Toossi 2013). In terms of levels, men aged 55+ are expected to increase from 17.2 million in 2012 to 21.6 million in 2022 compared to same age women increasing from 15.2 million to 20.2 million. Given differences in anthropometric characteristics such as strength and body size for women compared to men, there is much to be done in the area of workplace design to ensure that it safely accommodates both sexes. Finally, given the growth in minority populations in the United States and in the older population, we can expect that the labor force will be more ethnically/culturally diverse.

How best to ensure productivity, safety, and comfort for an aging workforce will be a significant challenge to many nations. Technological innovations are seen as one way to address productivity and safety challenges. For example, technology-based jobs are generally less physically demanding which is beneficial for older workers. Technology and telework applications also allow those with mobility problems to work from home. Assistive technologies may also allow workers who have some type of functional disability to remain productively employed. However, for these promises to be realized, the technology will need to be designed properly to ensure effective use by older workers whose perceptual, cognitive, and psychomotor capabilities are likely to be undergoing

normative age-related decline (Fisk et al. 2009; Salthouse 2010) though they may be advantaged in general knowledge (see entry on “► [Expertise and Ageing](#)”). Furthermore, designing effective training strategies will be crucial to addressing comfort with and adoption of new technology.

### General Population Technology Use by Age/Cohort and Implications for Older Workers

Older adult cohorts, aged 65+ years, generally lag younger ones in terms of ITC technology adoption (Charness and Boot 2015). The lag is particularly noticeable for older cohorts aged 75+ years, as seen in Fig. 2.

Although even those 80+ years were likely to own cell phones (61%), very few of those devices were smartphones (5%). In the general US population, cell phone ownership was 91% and smartphone ownership was 55% in 2013. The bring-your-own phone device to work trend is accelerating and smartphones are increasingly likely to be considered necessary items for work settings. Although it is difficult to generalize from the older population’s general technology use, considering that few of them are still working, it seems reasonable to conclude that reluctance to adopt technology might be a barrier to later life

work participation, despite a desire to remain in the work force, perhaps in part-time work, past the normal retirement age.

## Theories of Technology Adoption and Use in the Workplace

Several theories and models of technology adoption and use have focused on uncovering and specifying the factors that predict technology use in a variety of contexts, including the workplace. These models can help identify and reduce barriers to technology adoption that might interfere with participation in the workforce later in life, by enumerating the costs and benefits of adoption. Two of the more popular models are the *Technology Acceptance Model* (TAM) (Davis 1989) and, the more complex extension of TAM, the *Unified Theory of Acceptance and Use of Technology* (UTAUT) (Venkatesh et al. 2012). At the core of both models and their variants is the idea that a new piece of technology will be adopted to the extent that a potential user believes it is easy to use (low cost) and useful (high benefit).

Within the TAM model, perceived ease of use and perceived usefulness have a significant impact on decisions regarding technology use in the workplace. A worker who believes a software package will allow him or her to perform their job better is more likely to choose to use it compared to a worker who perceives that the software is difficult to learn and use. Within this model, these factors influence attitudes toward use and use intention, ultimately determining actual use behavior. Updates to TAM (TAM2 and TAM3) highlight important attitudinal and contextual factors that influence perceived ease of use and usefulness. Of particular relevance to predicting acceptance in older workers are the factors of computer anxiety and computer self-efficacy, which tend to be related to age. An older worker with high computer anxiety and low computer self-efficacy will be unlikely to perceive a new piece of technology as easy to use, discouraging acceptance. Empirically, personality characteristics, attitudes, and technology

experience have been found to predict perceived ease of use and usefulness within an older adult sample, suggesting that interventions focused on changing attitudes and increasing technology experience (e.g., training) may increase technology use and acceptance by older adults in the workplace (Mitzner et al. 2014).

Similar to TAM, the *Unified Theory of Acceptance and Use of Technology* (UTAUT) highlights performance expectancy (degree of belief that the technology will improve job performance) and effort expectancy (degree of belief that the technology will be easy or difficult to use) as major factors influencing the intention to use technology. However, actual use is also influenced by the perception of facilitating conditions or the belief that the workplace has systems and procedures in place to support use (e.g., training, technical support). Social influences also play a role in shaping the intention to use technology, with individuals more likely to use technology when they believe other important people (e.g., supervisor) expect them to use technology. Importantly, age (and also gender) is theorized to moderate the relationship between predictor variables and intention to use/actual use, with these factors generally being more important for older workers compared to younger workers. For example, the effect of effort expectancy, social influence, and facilitating conditions tends to be larger for older workers compared to younger workers in their model, and these moderating effects have been confirmed empirically (Venkatesh et al. 2012). UTAUT and the results that support it suggest additional steps that might be taken to ensure that older adults benefit from available workplace technology (e.g., ensuring that older workers feel well supported in their technology use). However, ultimately it is critical that the technology is designed so that it is easy to use and useful to diverse user groups.

## Issues in Designing Technology for Older Workers

To ensure meaningful engagement with technology by older adults in the workplace, technology needs

to be designed well, taking into account the needs, abilities, and preferences of older workers. Normative age-related changes in vision (acuity, contrast sensitivity), hearing, attention, memory, fluid ability (reasoning), movement control, and cognition can make using technology, and learning to use technology, more challenging for older workers compared to younger workers (Fisk et al. 2009). For example, cognitive abilities are an important predictor of both technology use and breadth of technology use. When designing technology for older workers, normative age-related perceptual and cognitive declines need to be considered, or else technology that has the potential to improve efficiency and productivity may not be adopted by older workers, or if it is adopted, it may not be used to the fullest extent and have the desired benefit due to usability issues (see entry on “► [Work Design and Aging](#)”).

There are a number of strategies that can be taken to design technology for older workers (Boot et al. 2012). For example, improving the physical stimulus that the worker has to respond to can help offset age-related perceptual declines. A technology display that uses black text on a white background is much more suitable compared to black text on a gray background due to age-related changes in contrast sensitivity. Large or adjustable fonts can also help to compensate for declines in acuity. To decrease cognitive load and reliance on memory, important information should be placed in the task environment and should be easily accessible. Rather than expect an older worker to remember a complex sequence of actions to complete a goal within a piece of software, the software might be designed to automatically highlight the next field to be entered or the next menu item that requires selection. Crystallized knowledge, or knowledge of facts, is often found to be age invariant until old age. This can be taken advantage of by designing technology to be consistent with what an older worker already knows. Consistency across different technologies can also benefit the process of learning a new technology (e.g., always having the same icon in the same location to access the “help” function). Interoperability across systems can also reduce the challenges associated with using technology. Consistency across versions of applications, such as

software updates, is also important. These human factors principles are discussed here in the context of benefiting the older worker, but following these design principles should also make technology easier to use for younger workers as well.

In addition to normative age-related declines in perception, cognition, and motor control, increasing age is also associated with a variety of disease processes that could make technology use in the workplace more challenging. For example, arthritis may make the interaction with small technology and handheld technology a challenge. Cataracts, glaucoma, and macular degeneration can have a much more profound impact on vision compared to typical changes in acuity (Owsley 2011). When designing for older workers, design should anticipate the needs of a broad range of older workers with different abilities to reduce barriers to adoption and to ensure that technology has its intended effect on efficiency and productivity.

### **Issues in Training Older Workers for Technology Use**

Clearly another critical factor with respect to the uptake of workplace technology among older workers is the availability of training and technical support. In today’s work environment with the continual diffusion of new technologies, training and retraining of older workers is critical to organizational effectiveness. The literature on aging and skill acquisition generally indicates (Charness 2009) that older adults are able to learn new skills though it usually takes them longer than younger adults and they typically require more practice and more instructional support. The job training literature that focuses on older workers though somewhat scarce generally supports these findings. The structure of the training program also impacts on training success. It is also important to note that older adults are not technophobic and are interested in learning new technologies.

There are guidelines regarding design of training programs for older adults (Czaja and Sharit 2013). These general guidelines take into account the characteristics of adult learners. However, it is important to note that few interactions between

age and training technique have been found such that a particular technique works better for older as compared to younger workers. There does not seem to be one training technique that is best for older adults as in any training situation it depends on the characteristics of the trainee population (e.g., amount of prior experience, skill level), the task or the skill to be trained, the setting, and the available resources.

In general, the pacing requirements of a training program are critical for older people to accommodate age-related changes in information processing speed; sufficient time must be allowed for older adults to process the training material and to complete any associated practice tasks or evaluation activities. In addition, it is generally advisable for the learner to be actively involved in the learning process and be exposed to and provided with practice on a wide variety of examples. Feedback should be provided in a timely manner so errors do not become engrained and as far as possible linkages between new material and material that is familiar should be made. In addition, instructional support should be readily available, and training support materials should be easily accessible, well designed, and easy to use. Finally, the learning environment should be as distraction free as possible and where possible trainees in a group training situation should have similar skill levels. Of course, training opportunities must be available for older workers. There are some data to suggest that employers invest less in training older workers because of stereotypes that older people can't learn (Pitt-Catsouphes et al. 2007). Similar to findings regarding adoption of new technology, older workers are more likely to participate in training programs if they believe they are capable of learning new skills and they perceive training participation as beneficial.

The emergence of new technologies is not only creating a continual need for worker training and retraining but also influencing how training is being conducted. Technology-mediated training or "e-learning" is rapidly being adopted by many organizations as it provides opportunities for training to occur any time and any place and presents a viable option for distance learning. However, a

potential disadvantage is the lack of face-to-face interactions with an instructor. This emphasis on "e-learning" is coupled with an increased emphasis on workers assuming responsibility for continuous learning. In other words opportunities for formal job training in classrooms with an instructor may become less available, and there will be an increased emphasis on "online learning or training" arrangements. The implications of this for older workers are not yet understood.

### **Prospects for Prolonging Work Life with Technology**

There is considerable pressure to have older workers delay retirement in order to support the social welfare obligations for health care and pensions in most developed countries. Many older adults are also choosing to remain in the workforce longer as they are healthy and have a desire or economic need to remain productive. There are some industries where heavy physical demands and high-risk work environments could make this goal of a prolonged work life an unreasonable one for some older workers (Wegman and McGee 2004). The general economy has diversified in the past century beyond agriculture and manufacturing to sectors involving clerical work, such as office work, that are generally less physically demanding. However, these jobs often incur greater mental demand, particularly for using and learning to use new technology. So, why work at an older age?

Surveys have indicated a positive association between age and job satisfaction (Glenn et al. 1977). Those who remain in the labor force at older than normal retirement ages seem to do so in part because they "really enjoy going to work" with affirmation for that item rising from 88% at age 55–59 to over 95% for those age 65+ (National Institute on Aging 2007); other factors for remaining in the labor force are opportunities for financial gain and for socializing benefits. Also, some forms of work may be protective for maintaining cognition. Complex work is associated with beneficial effects for older worker

cognition (Schooler et al. 1999), so continued participation in technologically advanced work environments may provide benefits for both the financial and cognitive health of an aging workforce. Further, technology use can potentially compensate for normative age-related changes in functional capacity and provide direct support for impairments that occur more frequently as people age thereby accommodating older workers with disabilities. Further, to the extent that older, experienced workers in aggregate receive appropriately designed technology products and training for their use, they are likely to be productive contributors (Allen 2001). Generally, meta-analyses have shown that age and productivity show little relationship at the level of the individual (Ng and Feldman 2008).

Greater longevity in the workplace past age 55 is linked to higher education levels, higher wages, working in smaller firms, working in industries that do not have high physical demands (not working in manufacturing and construction), and having younger coworkers (Juhn and McCue 2012). Well-implemented technology addressing ergonomic concerns can help reduce physical demands (lifting devices), but a concern is that some technology products may increase mental demands particularly for inexperienced users, leading to slower adoption, as seen in population-level age lags in technology adoption particularly at older ages (Smith 2014). Aside from lack of relevance (34% of reasons), usability concerns (32% of reasons) were cited by non-Internet users in the United States (15% of the population) for not adopting the Internet, including the attitude “too old to learn” (Zickuhr 2013). Addressing usability barriers for technology adoption, including attitudinal, social/institutional, and physical ones, will be central to encouraging and enabling older workers to prolong labor force participation. In addition, training support must be available and designed to accommodate older adults. If technology is designed properly and accompanied by appropriate training, it can improve the health, safety, productivity, and longevity of an aging workforce.

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## Telemental Health

Zvi D. Gellis

School of Social Policy and Practice, Center for Mental Health and Aging, University of Pennsylvania, Philadelphia, PA, USA

### Synonyms

Gerontechnology; Telecare; Telehealth; Telemedicine

### Definition

In gerontechnology, the term *telemental health* is considered a subcategory of commonly

interchangeable terms such as *telecare*, *telehealth*, or *telemedicine*. These terms are three examples of information and communication technology for health and mental health service delivery. The field is reemerging in health care with a wide array of telehealth terms; thus, there is a lack of consensus in terminology.

## Telehealth and Older Adults

The global population is aging rapidly. In the U.S. A., over 20% of adults will be 65 years or older by 2030 with the greatest expansion in the “oldest old” (85 years+) age-group. These demographic trends will have significant impacts on an aging population in terms of health and mental health care. The use of telehealth technology services designed to meet the physical and mental health needs of older people at home has attracted increased attention. Telehealth can monitor the patient remotely to detect changes in health status thus enabling service providers to intervene “just in time” to improve quality of care. It provides instant health/mental health status feedback to patients offering them the opportunity to develop self-management or remedial behaviors and can increase knowledge about diseases and medication.

The significant rise in older adults will result in a substantial increase in chronic medical conditions (congestive heart failure, chronic obstructive pulmonary disease, hypertension, diabetes) and prevalent mental health comorbidities such as depression. Untreated depression increases the risk of further disability, limits mobility, increases suicidality, and deters recovery. Cognitive impairment can also increase the risk of depression.

Due to financial constraints, health care industry will likely shift health policy priorities from acute to management strategies that may include preservation of independence, health and mental health symptom control, and improved quality of life. Psychological interventions and symptom monitoring will become a key focus of treatment plans for many older adults suffering from health and mental health problems. Currently, numerous technological solutions are being developed or

implemented to meet these physical and mental health needs. Delivering telemental health services to at-risk older adults may provide a cost-effective method to assess and monitor symptoms, improve communication with treatment providers, and offer evidence-based mental health treatments in order to reduce unnecessary hospital readmissions.

Telehealth and telemental health have been around for over five decades but have reemerged as a viable health service due to communication technology advances. *Telehealth* is a broad term described by the Health Resources and Services Administration as the use of electronic information and telecommunication technologies to support long-distance clinical care, patient and professional health-related education, public health, and health administration (Health Services Resources Administration: Telehealth. U.S. Department of Health and Human Services 2013). The American Telemedicine Association describes *telemedicine* as the use of medical information exchanged from one site to another via electronic communications to improve a patient's clinical health status (American Telemedicine Association: What is telemedicine? 2013), limiting its core function to providing medical services, that is, use of electronic communication and information technologies to provide or support primary care, medical specialties, intensive care services, emergency departments, and medical education programs. Telehealth is beneficial for older adults who cannot access specialists in their community, who prefer to receive care at home, are from differing ethnic, cultural, and linguistic backgrounds, and are institutionalized.

## Telemental Health

Telemental health is a subset of telehealth using communication technology to provide behavioral health services from a distance (Myers and Turvey 2013). Telemental health services have frequently used the modality of real-time videoconferencing since it is most similar to traditional face-to-face mental health practice. Telemental health also uses other technology modalities such as mobile

technologies (e.g., mHealth), online therapy, and electronic communication and health information technology (e.g., eHealth). Telemental health can overcome distances and alleviate imminent gaps in the availability and accessibility of mental health services. Telemental health has the potential to support health care systems serving older patients with chronic diseases and co-occurring mental health disorders. Telemental health requires only audio or visual modalities. It provides greater accessibility to mental health services to isolated older adults, those receiving home health services, and rural and remote communities that frequently have few services or specialty care. Telemental health services may be cost effective due to reduced need for professionals to travel to these areas. With improved communication technologies such as telephone, Internet, tablet, smartphone, and videoconferencing, the practitioner can use nontraditional methods for mental health assessment and treatment. Currently, Internet Protocol network technology with reliable security and service quality may offer further cost reductions in service delivery. Telemental health services can be delivered in two ways. Synchronous mode encompasses live real-time interactive two-way communication. Asynchronous mode is the transmission of health information that is not in real time (e.g., email, psychological reports) to review at a later time.

The American Telemedicine Association has developed practice guidelines for video-based online mental health services (Turvey et al. 2013). It includes clinical, technological, and administrative considerations of professional and patient identity verification, patient appropriateness for telemental health, informed consent, physical environment, communication and collaboration with the patient's treatment team, emergency mental health management, and medical, referral, and cultural competency.

## Telemental Health Practice Settings

Telemental health services are offered to older adults in various settings: community-based home health care, primary care, long-term care,

Veterans Health Administration, and rural or remote communities. Much of what is known in the community-based telehealth field is based on descriptive data with few definitive trials demonstrating effectiveness for telemental health interventions. In the United States, the National Association of Homecare and Hospice estimates that 21% of Medicare-certified home health agencies offer telehealth services for homebound older patients diagnosed with cardiovascular disease, pulmonary disease, hypertension, and diabetes with the mission to independently “age in place” and reduce health costs (National Association of Homecare and Hospice 2010). Preliminary evidence has been reported for patients with various medical conditions. Integrated telehealth and telemental health services targeting chronic disease (heart failure, pulmonary disease) and comorbid depression have been demonstrated to be feasible, acceptable, and effective for geriatric homebound medically ill patients (Gellis et al. 2014; Sheeran et al. 2011). Web-based telemental health has been shown to improve depression and psychosocial well-being of older diabetes patients. Telephone-delivered depression interventions show promise in improving depression symptoms and quality of life in older prostate cancer survivors, in older Latinos with heart failure, and in primary care patients. Telephone-based interactive voice recording home monitoring has been successfully used to include regular depression screening in a heart failure program (Turvey et al. 2007). However, in a large British trial study, home-based telehealth provided through primary care and hospital clinics was not found effective in improving quality of life, depression, or anxiety in older adults with heart failure, diabetes, or pulmonary disease (Cartwright et al. 2013). A variety of telehealth technology strategies are used for chronic disease management protocols, symptom monitoring, guideline-based assessments, and evidence-based interventions for depression care. Frequently, they include telephone, computer videoconferencing, and Internet-based applications with wireless capability.

In long-term care settings, models of telepsychogeriatric care have taken the form of telemental health consultation services via

videoconferencing for affective disorders, cognitive impairment, and dementia. Telemental health clinical components include diagnostic assessments, dementia screening and psychiatric consultations, depression screening, psychoeducation, and family support. Culturally appropriate telemental health services have also been reported with encouraging outcomes (Poon et al. 2005; Yeung et al. 2011). Preliminary reports of these services suggest that they are acceptable to staff and nursing home patients and are potentially time and cost efficient. Some of the challenges for telemental health in the long-term care setting include patient visual or hearing impairment, somatic complaints, instability of consciousness, and medication side effects. Overall, telepsychogeriatric care is an emerging field, though with mixed results and unknown effectiveness.

In the United States, the Veterans Health Administration provides free health and mental health services to all individuals who have served in the military. The Veterans Health Administration has a large and robust telebehavioral health rural service program using computerized videoconferencing technology and continues to develop new hybrid models of telemental health services. Mental health care for older veterans has received attention due to high prevalence rates for depression, suicidality, anxiety, and PTSD disorders. Older veterans make up nearly 45% of those enrolled in the Veterans Health Administration. It is the largest telehealth provider in the U.S.A. and has offered telemental health services over the past decade to aging veterans with multiple chronic and mental health conditions who are living in rural areas where transportation and services are scarce.

In the Veterans Health Administration, telehealth was found to be an efficient strategy for delivering health and mental health services and enhanced collaborative care within an integrated service delivery system. Telemental health provides preliminary support in the use of computerized videoconferencing for individual and group therapy with high levels of patient and clinician satisfaction (Morland and Kloezeman 2013). Evidence on psychological outcomes is moderately strong for Internet and telephone

applications in the Veterans Health Administration health system. Telemental health has been found to be generally as effective as face-to-face care for treatment-seeking veterans (Ruskin et al. 2004). In addition, the Veterans Health Administration has found significant reductions in hospital admissions (Jia et al. 2009), urgent-care or emergency room visits (Chumbler et al. 2005), and primary care visits while using telehealth services (Barnett et al. 2006).

## Tablet and Mobile Phone Technology

Tablet computer and mobile smartphone technologies are well positioned for health and mental health information dissemination and psychotherapy and are now being used in health service delivery. Users of tablet devices and smartphones are prevalent, and these devices are comprised of Android or iOS platforms. Tablets and smartphones can also be used to extend the reach of mental health practice from the office to home. These devices offer numerous applications including direct patient services via audio or video applications, health information, self-monitoring activities of mood and symptoms, relapse prevention notes, patient journaling, behavioral activation record keeping, homework completion reminders, adherence to medication and treatment regimens, appointment reminders, and psychoeducation. Mobile phone, tablet devices, and software applications are ubiquitous in monitoring mental health care. These devices have many advantages including accessibility, low cost, portability, low power requirements, immediate and important “push” notifications, and search capability. They can offer access to low-income populations, individuals with mental health diagnoses, ethnic minorities, developmentally challenged, and older adults. These devices can build skills in improving mental health to foster self-determination and healthy independence. Barriers to using these devices in mental health care are similar to telemental health videoconferencing and include issues of security, privacy, service availability, reliability, adherence, and efficacy of assessment and interventions.

The Veterans Health Administration is a leader in the mobile technology field and is currently using videoconferencing smartphones to provide psychotherapy in live video sessions with veterans diagnosed with depression, anxiety, and post-traumatic stress disorders. The advantages of these devices include bringing mental health care to the veteran, reduction in stigma, reductions in delays in care, and increased continuity in care. Currently, little is known about how these devices are used with older adults. Further, there is a paucity of scientific evidence on the efficacy of mobile and tablet devices for mental health applications.

## Future

Telemental health services for older adults are diverse ranging from home health care to chronic disease management, psychogeriatric consultation, dementia diagnostic assessment, remote primary and specialty care, and psychotherapy. Telehealth technology has revolutionized the mental health sector in an attempt to improve or maintain the quality of care while curtailing costs. The use of telehealth and telemental health technology, such as two-way audio-video biometric monitoring, interactive televideoconference counseling, electronic disease management devices, email and text, smartphone, tablet, and the Internet, has been instrumental in conducting patient assessment, depression interventions, psychoeducation, psychotherapy, and providing remote patient monitoring on a real-time basis.

The advantages of telehealth and telemental health technology may include reductions in barriers to services access, an increase in efficiency for providers, reductions in overall health care costs, reductions in delays in care, preservation of resources locally, reductions in mental health symptoms, and increase in patient satisfaction in health care delivery. With a telemental health approach, there are service implementation barriers including patient adherence to the technology and training of professionals in the use the devices for integrated chronic care and mental health management. Training of patients in the

use of telemental health applications and telehealth remote monitoring devices is of importance in assuring robust data, increasing self-efficacy, and treatment adherence. Further, there is always a need to maintain ongoing resources and personnel who possess the skills to provide care while managing electronic medical records, providing technology support to the patient, and transmitting data to other health and mental health team members to facilitate just-in-time communication.

Overall, empirical evidence to support telehealth and telemental health interventions for cardiac disease, COPD, diabetes, and mental health conditions is increasing. These interventions have become accepted forms of health services. However, there is only preliminary scientific evidence for its effectiveness and cost. (Chaudry et al. 2010) However, the few telehealth controlled trial studies generally demonstrate primarily positive outcomes independent of diagnostic category. Studies predominantly use personal contact (either by telephone or videoconferencing) as a main component of telehealth intervention. Personal interactive contact between service provider and patient offer better outcomes compared to studies without personal contact. Nurses generally play a key role in telehealth patient monitoring, though social workers, psychologists, mental health therapists, and physicians are also telemental health providers. These professionals provide some combination of psychoeducation, psychotherapy, chronic illness care, depression care, and/or medication support. With regard to behavioral outcomes, telehealth studies provide moderate evidence toward positive outcomes of medication or diet adherence, depression improvement, physical activity, quality of life, and disease self-management (Kang-Yi and Gellis 2012). The future will witness further mobile and tablet applications for psychotherapy with broad acceptance of these modalities.

## Cross-References

- ▶ [Gerontechnology](#)
- ▶ [Mental Health and Aging](#)

- ▶ [Problem-Solving Therapy](#)
- ▶ [Psychological Theories on Health and Aging](#)

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## Time Perception and Aging

Patrizia S. Bisiacchi<sup>1</sup> and Giorgia Cona<sup>2</sup>

<sup>1</sup>Department of General Psychology, University of Padova, Padova, Italy

<sup>2</sup>Department of Neuroscience, University of Padova, Padova, Italy

Time perception, or more extensively time processing (i.e., time perception, estimation, reproduction and monitoring), refers to the ‘subjective’ experience of time.

Time processing is one of the most pervasive and essential aspects of our mental functioning since it is involved in all motor, perceptual, and cognitive activities. Timing of intervals ranging from seconds to minutes is crucial for representing the external environment (Buhusi and Meck, 2005, Grondin, 2010). Many everyday circumstances indeed involve short duration estimation. For example, while driving a car or crossing a street, time and speed estimates provide vital information.

It is worthwhile to notice that, despite there are no dedicated sensory receptors for perceiving time and although there is often no awareness of it, this ability is extremely precise. It is recruited in a widespread number of activities, for example,

synchronizing movements, predicting and anticipating events (or estimating durations).

In fact, it has been stated that the ability to monitor time and to be prepared for future events are part of the peculiarities of human beings. Nevertheless, there are persons, in particular aged persons, who show systematic biases in time perceptions that may put them at risk for independent daily living.

It is well known indeed that older individuals show changes in a multitude of cognitive and sensory domains and particularly in functions that rely upon those neural structures which show a decline with age, namely, prefrontal systems and hippocampus.

Recently, there has been growing interest in understanding cognitive mechanisms and neural bases of our sense of time (Gibbon et al. 1984), and this may shed some light on time perception in the life span.

In order to understand age changes in time processing in the present paper, it will be described the most influential model of time processing and the evidence on the neural basis of this human ability.

## Mechanisms of Time Processing

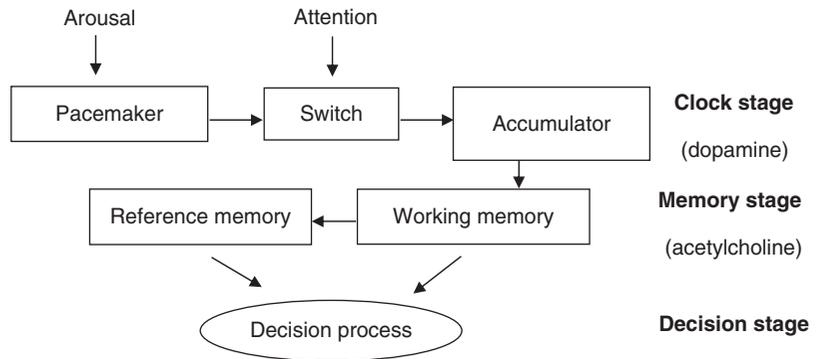
From a cognitive point of view, one of the most influential models of time processing, the scalar expectancy theory (SET), assumes that individuals encode durations by means of a specialized mechanism, the so-called internal clock, which is involved in all timing operations and for various timescales (Rubia and Smith 2004). Such mechanism is multicomponential and acts by means of a three-stage process: a clock stage, a memory stage, and a decision stage (Fig. 1).

According to the SET, durations are judged by a modular information processing system composed of clock, memory, and decision processes. The clock consists of one pacemaker, a switch, and an accumulator.

The pacemaker emits pulses that pass through an attention-controlled switch into an accumulator, which counts the pulses (clock stage) and stores the result in a “current time” working

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**Fig. 1** Schematic representation of the scalar expectation theory model for time processing (Adapted from Gibbon et al. (1984))



memory (WM) (memory stage). The current stored pulses are then compared with those in the reference memory system, which contains a long-term memory representation of pulses accumulated on past trials (decision stage). The rate of the pacemaker is influenced by arousal level, as increasing arousal led to a faster internal tempo and to longer duration judgments.

The most recent theories proposed that attention processes affect the latency and the “wideness” of the switch mechanism. Attentional factors may influence these features and thus the number of pulses entering into the accumulator. When attention is directed away from time, the switch remains less open and some pulses are lost, leading to an underestimation.

Although the internal clock model can explain most of the behavioral data, it is still difficult to exactly define the function of each stage as well as to identify the relative neural correlates. Moreover, each stage of time processing requires the intervention of specific cognitive functions. Encoding an interval, attending to time, keeping the representation of a duration in working memory, and deciding differentially involve subcortical and cortical areas (Coull et al. 2004). Therefore, the range of intervals’ length or/and the nature of the timing task are critical to any statements about which brain areas are recruited.

One way to bypass such a limitation is to study the neural basis of such model by neuroimaging techniques, neurological patients, and healthy aged persons.

### Neural Basis of Time Processing

Some of the first clearest evidence of a specialized brain network for interval timing comes from a functional magnetic resonance imaging (fMRI) study (Stevens et al. 2007). In this study, authors obtained the selective activation of brain areas by varying the attention toward temporal and nontemporal features of visual stimuli. Namely, participants were asked to direct their attention to the duration or to the color of the circle presented in a screen, which was parametrically modulated. Areas in the visual cortex (V4) showed a linear increase in activation when participants paid more attention to the color of the stimuli. In turn, the pre-supplementary motor area (pre-SMA) showed a linear activation when participants paid more attention to time, thereby identifying this area as part of the timing circuit.

Recently, Coull and Nobre (1998), using an independent component analysis (ICA) approach on fMRI data, identified four main brain circuits that are active during the performance of timing tasks – the frontoparietal, the frontostriatal, the cerebellum, and the motor one – that are highly probable to be implicated in different aspects of temporal information processing. Within these, the frontoparietal network has been consistently found to be involved in the discrimination of temporal durations.

Neuroimaging studies have found multiple brain structures to be involved in time processing, including the cerebellum, the basal ganglia, the insula, the dorsolateral prefrontal cortex

(DLPFC), the supplementary motor area (SMA), the inferior parietal cortices (IPC), and the ventral premotor cortex. Specifically, a frontoparietal cortical network has been consistently reported to intervene in a large number of tasks, including the right DLPFC, the SMA, the IPC, and the premotor cortices. Importantly, a distinction has been made between neural circuits dedicated to the processing of sub-second durations and circuits dedicated to the processing of supra-second durations and between explicit and implicit timing (Macar and Vidal 2004). Explicit timing is engaged whenever subjects make a deliberate estimate of discrete duration in order to compare it with a previously memorized standard. Conversely, implicit timing is engaged, even without a specific instruction to time, whenever sensorimotor information is temporally structured and can be used to predict the duration of future events.

Besides the neuroanatomical bases of interval timing, event-related potential (ERP) studies have tried to shed light on the functional correlates of time processing.

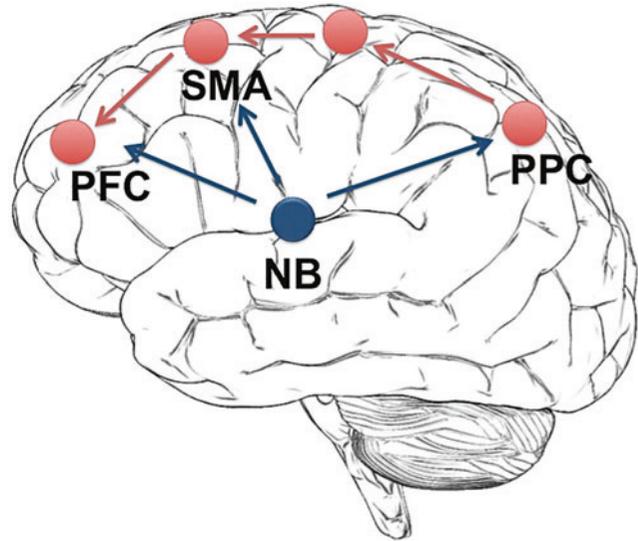
Given their resolution in the milliseconds range, electrophysiological methods represent the elective method in studying how brain processes time. Specific ERP components were shown to index processing of short interval durations. There is increasing evidence that a negative slow wave, the contingent negative variation (CNV), observed in frontal regions, is significantly modulated by interval length (Tarantino et al. 2010). More specifically, this wave, classically considered an expectancy wave, marks time on the basis of previous memorized durations. More recently, indeed, CNV morphological features, including peak and slope inversion latency, have been shown to mirror the duration of a previously encoded target interval when it has to be reproduced or discriminated (Mento et al. 2015; Battelli et al. 2007). Remarkably, the neural generators of the temporal CNV have been located in the SMA, confirming the crucial role of this area for timing. Researchers suggest that the CNV may be considered an index of the clock as well as of memory and decision.

Several fMRI, ERP, and neuropsychological studies emphasize the involvement of the right inferior parietal cortex (IPC) in the perception of current time durations that last from milliseconds to seconds. This associative area, by means of its integrative properties, subserves the timing of events in both visual and auditory modality. Patients with neglect tested on tasks requiring the estimation of short durations have shown to consistently overestimate stimuli presented in the neglected space and underestimate stimuli presented in the good field. Patients with lesions in the right IPC have shown deficits in perceptual abilities that require the analysis of time. The contribution of the inferior parietal cortex is very interesting when considered in the light of recent theories which postulate time perception to be strongly linked to the perception of space. Some authors (Belin et al. 2002) have recently proposed that the right parietal lobe, other than subserving spatial functions, has a dominant role in controlling attention over temporal information of events. This area has been considered as the key structure of a “when pathway.” Differently from the contralateral control on spatial information, the parietal control over temporal information is bilateral.

An earlier PET study (Malapani et al. 1998) has highlighted the contribution of a common neural network, including the right frontoparietal/left cerebellum areas, in tasks requiring the discrimination of duration and intensity of sounds. In this work, the authors have suggested that duration discrimination tasks are performed in the human brain by the combination of two cortical networks or groups of areas working in concert: (i) a “sensory attentional network,” which is active in discriminating quantity, such as duration and intensity, probably highly specific and supramodal since its activation is often reported irrespective of the sensory modality and sensory feature being attended to, with components in the right frontal and parietal lobes and (ii) a “temporal processing network,” more specifically involved in the temporal aspects of the discrimination task, involving the activation to varying degrees of the basal ganglia, cerebellar hemispheres, and right lateral prefrontal cortex.

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**Fig. 2** Frontoparietal (*red*) and frontostriatal (*blue*) brain areas functionally connected during the performance of timing tasks. *PFC* prefrontal cortex, *SMA* supplementary motor area, *PPC* parietal posterior cortex, *NB* basal nuclei



Data also support the role of frontostriatal circuits in interval timing. Patients with Parkinson's disease who suffer from a degeneration of nigrostriatal dopaminergic projections have been found to be impaired in perception and production of time intervals. Off-therapy patients tend to overestimate the shorter intervals and to underestimate the longer ones. This "migration effect" has been interpreted as a dysfunctional representation of memory for time, which intervenes in comparing the current elapsing time with an earlier learned interval, and could be eliminated by administering L-DOPA (Salthouse 1996).

Figure 2 illustrates the main circuits involved in time processing in order to summarize the principle findings on neural basis of time processing

### Aging and Time Processing

As described previously, time processing involves multiple different cognitive functions and, particularly, attention and working memory (WM). Since both attention and WM abilities are known to decrease with increasing age, it might be hypothesized that time processing may also decrease with increasing age. Moreover, time processing, attention, and WM share the same brain structures and neurotransmitter systems, which are the most sensitive to aging. Hence the

study of time processing may provide very sensitive measurements of age-related differences in cognitive functioning.

According to SET, an internal pacemaker generates pulses at a regular rate, which are then recorded by an accumulator. To estimate time, information from the accumulator is processed by the working memory and compared to reference values stored in long-term memory.

Several researches suggested that the setting of people's internal clocks is affected by age. This might be explained by the speed of processing hypothesis (Baudouin et al. 2006). According to this explanation, aged individuals have a general slowdown in information processing; thus they would have a slowdown at the clock stage. Some studies tried to estimate the speed of the internal pacemaker as a function of age. Participants were asked to produce regular finger tapings at the fastest possible rate or at a paced rate. It was found that increasing age was associated with slower tapping for both fastest and spontaneous rates.

Based on these results, it might be concluded that people's internal clocks run more slowly with advancing age and become less accurate.

Other studies reported differences in time estimation and in time reproduction. It was found that older adults performed longer verbal estimates and shorter productions than younger participants.

In a time reproduction task consisting in the presentation of an increasing number of durations requiring the reproduction of only one of them, older participants showed more errors with increasing task complexity than younger participants.

This pattern of results changed when attention and WM load were manipulated.

When divided attention was required for successful performance, larger effects in the older than the younger participants were observed. This may be explained by an attentionally modulated accumulator that links attention and clock-speed accounts of timing results. This pattern of results is not explained by a clock-speed model, since such a model would propose an accelerated clock in aged participants, which is contrary to slowness of physiological and cognitive processing speed with age.

Baudouin et al. (2006) argued that different mechanisms were involved in duration production and duration reproduction. They found a double dissociation: production was correlated with spontaneous motor timing and reproduction with working memory measures. These findings support a role of WM in the modulation of the internal clock rate.

Perbal et al. (2002) used temporal production and reproduction tasks in young and older participants with either a concurrent counting or reading task. These dual-task conditions resulted in shorter reproduction and longer production durations in both age groups. The elderly showed a higher coefficient of variations in the reproduction task in the concurrent reading condition, and this led to lower temporal precision compared to younger participants due to dual-task requirements in terms of attention and working memory load.

In the previous paragraphs, we described time-related processes that reside almost always under our awareness and intentional control. In most situations, indeed, although we perceive time, we do not think about it. Nevertheless, a situation in which the matter of time becomes critically evident and salient in our mind is when we are late, for example, for an appointment or a deadline. This represents a failure of a cognitive

ability typically called time-based prospective memory (PM). PM refers to people's ability to perform an intended action at the appropriate time in the future. The time-based PM activities include, for example, remembering to take medication at noon, or to take cupcakes out of oven after 30 min.

In time-based laboratory paradigms, participants are engaged in an ongoing task (e.g., lexical decision task), and they are required to remember to complete intentions (e.g., pressing a key) at a particular moment or after some duration has elapsed, such as remembering to perform an action every 5 min or after 8 min (Einstein et al. 1995; Henry et al. 2004). Their watches are removed, and they can monitor time by pressing a particular key or by looking at a clock that is outside the field of view. Since ongoing activity is not related to the PM task, there are no external reminders or cues embedded in the ongoing activity that trigger PM intention. Given this, time-based PM tasks are thought to be heavily dependent on self-initiated retrieval and monitoring processes (Henry et al. 2004).

In old age, an efficient PM was found to be the major prerequisite for independent living. Nevertheless, the picture arisen from the studies on aging is mixed with some studies showing age decline in PM performance and others revealing no age differences or even a better performance in older adults (Einstein et al. 1995; Cona et al. 2012b).

PM seems to be particularly sensitive to aging because it is characterized by less environmental support (e.g., explicit aids or reminders), and it depends more on self-initiated retrieval processes. As older adults exhibit a reduction in the availability of such attentional and self-initiated resources, they would have insufficient resources to accomplish PM tasks successfully.

Notably, older adults tend to perform worse in time-based PM tasks compared to younger adults, when they are tested in laboratory settings (Cona et al. 2012b). On the other hand, it is quite surprising that older adults perform as well, or even better, than their younger counterparts in PM tasks when these are carried out in naturalistic and

realistic settings. These experiments usually include, for example, remembering to telephone the experimenter at a specific time over 5 days or 2 weeks, following medication schemes, or attending appointments. The higher performance of older adults in naturalistic tasks, called age-PM paradox, has been attributable to several distinct factors such as more experience of older individuals with time management, generational differences in attitudes to politeness and punctuality, fewer distractions, greater awareness of memory failures, or better utilization of reminder aids. However, current understanding of the role of motivation, memory reminders and aids, and lifestyle busyness in PM tasks is still poor and requires to be further addressed.

Remembering to accomplish time-based intentions relies upon multiple processes. Among these, time estimation and monitoring seem to play a crucial role. According to the test-wait-test-exit (TWTE) model (Mäntylä et al. 2009), in time-based PM tasks, individuals intermittently test time (by checking the clock) to see whether the target time has come for executing the intended PM action. If the correct time is still not reached, individuals wait for a period of time until another test seems appropriate. The exit of this loop happens when the target time occurs and the intended action is executed. In line with the TWTE model, most of the studies showed that the overall pattern of clock-checking frequency can be represented by a J-shaped function (Henry et al. 2004; Maylor et al. 2002). Such studies indeed revealed that the number of clock checks is not constant during the task but increases as target time is approaching. Furthermore, for both younger and older adults, a relationship between time-based performance and number of clock checks has been consistently found (Henry et al. 2004; Maylor et al. 2002). Interestingly, an increase in the number of clock checks in the time interval just preceding the target time has been shown to predict an improvement in the PM performance.

Several studies showed that the frequency of clock checking was lower for older adults compared to younger adults and highlighted that such effect was accentuated during the time interval

just preceding a PM action (Henry et al. 2004). The reduced number of clock checks in older adults seems to reflect impairment in time monitoring, which might be considered one of the factors responsible for the poorer PM performance evidenced in older adults (Einstein et al. 1995).

Some studies analyzed the frequency of clock checks occurring before a failure and before a success in PM response (Mioni and Stablum 2014). Specifically, in the study by Maylor and collaborators (2002; Experiment 1), participants were engaged in watching a movie (i.e., ongoing task) for a successive recognition memory task, and, simultaneously, they were required to stop a clock every 3 min (time-based PM task). In general, young participants showed a better time-based PM performance compared to older participants. The PM accuracy was found to be associated with the frequency of clock checking. In particular, before a successful PM action, older participants checked the clock more often as compared to young participants; on the other hand, before unsuccessful PM actions, older adults showed a flat monitoring function even in the last 3-min interval. According to the authors, this pattern of results would suggest that time-based PM deficits in aging are mainly due to momentary lapses of attention.

Mäntylä and collaborators (2009) showed that the frequency of clock checking varied as a function of the cognitive resources required for the ongoing task in older adults. Specifically, the frequency increased across age in the low-demanding condition (i.e., listening to a brief story), with older adults checking the clock more frequently than their younger counterparts. Such monitoring strategy allowed older participants to obtain the same accuracy in PM performance shown by younger participants but led to an additional cost in ongoing performance. Conversely, when the ongoing task demands were higher (i.e., a series of cognitive tests), older participants checked the clock less frequently and, consequently, had an impairment in PM performance. In this condition, older adults would not have sufficient attentional resources to adopt the same compensatory strategy used under the

low-demanding ongoing task condition, and this determined a decline in PM accuracy.

Another study drew similar conclusions (Cona et al. 2012b) using event-related potentials (ERPs). So far, this is the only study that explored age-related neural changes underlying time-based PM processes. The authors found age-related alterations in a sustained ERP activity over prefrontal regions, which seem to suggest a decline in maintaining of intention. Notably, they found a higher frontal P3 in older adults, reflecting the allocation of additional resources to the ongoing task. This, however, led to a cost on PM performance, given that fewer resources were available to keep the intention in mind. Indeed, older participants who exhibited a higher frontal P3 were those who had poorer PM performance and lower number of clock checks. In line with Mäntylä and collaborators' (2009) idea, this study suggested that age-related decline in PM is the result of the reduced amount of resources available for the PM processes – as clock checking – given that older adults tend to allocate many resources for the ongoing task.

A further study highlighted that, when participants were allowed to execute a limited and fixed number of clock checks, a different pattern of clock checking was evidenced between younger and older participants (Mioni and Stablum 2014). Indeed, younger adults checked the clock less frequently in the time intervals far from the target time and started to monitor more frequently as approaching the target time. This pattern reflects the recruitment of a time monitoring strategy. By contrast, older participants did not exhibit such strategic pattern of clock checking and did not use all the clock checks available.

Taken together, these studies showed that an inefficient use of clock-checking strategy contributes to failures in time-based PM performance in advancing age.

In conclusion, we tried to outline the major findings on age differences in interval timing, in time-based prospective memory, and on the neural basis of such processes.

To summarize, great interest in the literature has been directed toward cognitive processes

involved in time processing, in both young and older persons. However, the literature is misleading about the contribution of different cognitive processes to time processing and their relation with aging. Specifically, one matter of debate concerns the role of attention and clock speed in accounting for the changes in temporally controlled responses. Indeed, based on the findings from different age groups and in conditions with different levels of cognitive resources requirements, it appears clear that attention and working memory play an important role in time processing in the elderly. Nevertheless, such relation is still unclear and needs further investigation. Also, the age-related changes on the neural bases underlying those processes that strictly require time processing and monitoring, such as the time-based PM, deserve a deeper exploration.

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## Timing of Retirement

Trude Furunes

Norwegian School of Hotel Management,  
University of Stavanger, Stavanger, Norway

## Synonyms

Decision to retire; Labor market exit; Labor market pathways; Older workers; Pension reforms; Retirement decision processes; Retirement pathways

## Definition

This contribution focuses on the act of retirement, that is, exiting the labor market, and the potential processes involved prior to an older worker's retirement decision. Employee and employer perspectives are discussed.

## Introduction

To minimize the growing economic burden caused by population aging, there has been an increasing focus on prolonging older workers' careers. Internationally, recent pension reforms and initiatives to prolong working life have led to multiple retirement options and possible pathways among which older workers can choose (Furunes et al. in process).

In spite of pension reforms and initiatives to prolong working life, obstacles to prolong working life exist at the individual level (e.g., motivation to continue or bridge careers; Feldman 2007), at the organizational level (e.g., manager attitudes; Furunes and Mykletun 2010), and at the labor market level (e.g., finding appropriate alternative

jobs; Alcover et al. 2014). In this entry, research related to understanding the timing of retirement is differentiated according to whether it refers to timing of retirement as seen from the employee perspective or timing of retirement as seen from the employer perspective. It is important to include both perspectives, as timing of retirement may not always be a matter of individual choice or preferences, but instead may result from a negotiation (or conflict) between the employee and the employer.

### Retirement Is Contextual

Retirement may be defined as exiting the labor market permanently. Here, timing of retirement is understood as the transition to retirement originating in paid work, either full time or part time. If the transition to retirement originates in long-term disability or extended unemployment, the situation will be very different and falls outside the scope of this entry.

It is important to stress the probable influence of retirement systems on employee behavior and employer practices. This implies that retirement and the timing of retirement should be interpreted in a context (e.g., national retirement system, labor market situation). Nevertheless, there are commonalities across retirement systems and countries.

### Retirement Systems

Until European countries started to reform their pension systems, the main pathways to retirement were disability pension, old age retirement, or contractual early retirement as negotiated in some countries. Pension systems differ in terms of what levels of wage replacements are offered through public pensions. High levels of wage replacement and attractive early retirement schemes tend to encourage early retirement, whereas lower levels of pension benefits and moderate early retirement schemes do not (see, e.g., Blöndal and Scarpetta 1998; Engelhardt 2012). Pension reforms were mainly introduced to

reduce incentives to retire early in order to prolong older workers' careers.

In some countries in continental Europe, initiatives to prolong working life have been mainly focused on bridge employment through motivating older workers to take alternative jobs to prolong their working lives (see Alcover et al. 2014), whereas other countries in northern Europe (e.g., Denmark, Norway, Sweden, Finland) have chosen to involve the social partners in working life through campaigns and/or tripartite agreements. Some countries have reformed their pension systems by eliminating the mandatory retirement age (see, e.g., Manfredi 2011), whereas other countries have kept the mandatory retirement age but changed the incentive structure to allow withdrawal of pensions while still at work. These retirement reforms have expanded the opportunities for individual choice and increased the number of trajectories retirement can take.

Because retirement can follow different trajectories, the timing of retirement may be a matter not only of when but also of how. In countries with mandatory retirement, the main exit routes prior to reaching the mandatory retirement age are disability pension or early retirement. For employees who are still working when they reach the mandatory retirement age, several trajectories are available: (1) retiring completely, (2) retiring partially while continuing to work in the same job, (3) retiring partially while working in a different job with the same employer, (4) retiring partially and working with a new employer, (5) retiring partially from the current employer and becoming self-employed, and (6) retiring completely and getting an unpaid/volunteer job.

Any paid work after an individual retires or starts receiving a pension, either with another employer or as self-employed, falls in the category bridge employment (Ruhm 1990).

As retirement ages and patterns vary across countries and industries, it is unlikely for the timing of retirement to be the same for all workers. According to Ekerdt (2010, p. 69), "every cohort retires in the context of its times." Studies of the transition to, event of, and timing for withdrawal from work are the most extensive genre of retirement research; however, as retirement is an

ever-evolving institution, matters are never settled and there is always something new to say. Moreover, there is considerable variability in how people age (Hansson et al. 1997), which is also likely to be reflected in how individuals approach and time their retirement.

### Theories on Timing of Retirement

Different theoretical frameworks have been applied to study the timing of retirement. One of the most influential theoretical approaches in scientific debates about early retirement is the *Economic Theory of Retirement*, which assumes that older workers are rational, utility-maximizing individuals who time their retirement by considering their maximal financial opportunities and constraints so that lifetime income is optimized (Engelhardt 2012). According to this theory, individuals value leisure over work and will leave the labor market at the earliest time possible – that is, when pension payments compensate sufficiently for potential labor income.

Another construct that has received attention in relation to retirement timing is *future time perspective*. Future time perspective has at least two connotations that are relevant to the timing of retirement. The first is whether individuals focus on the future or the past (i.e., whether they have a short or long planning horizon). Future time perspective is found to be positively associated with preparedness for retirement (e.g., Hershey and Mowen 2000). This implies that individuals who are oriented toward the future are better prepared financially than those who have a short planning horizon. A second connotation of future time perspective is the “individual’s perception of his or her remaining time to live” (Kooij et al. 2013, p. 88). Kooij et al. (2013) distinguished between open-ended and limited future time perspective and found that limited future time perspective was positively related to age, implying that older workers see their future as less open.

Considering retirement as an individual behavior may be a limitation, as most older workers live

in households with other persons who may influence their retirement decisions and the timing of their retirement. There are two main competing hypotheses on how a husband or wife’s retirement behavior affects the spouse’s labor market participation. On one hand, it has been hypothesized that couples will choose to coordinate their retirement in order to get “complementary leisure” (see, e.g., D. M. Blau 1998). This hypothesis assumes that older retirees will enjoy their leisure time more when their spouses are with them and thus will attempt to exit working life jointly. On the other hand, the “added worker effect” mechanism (Lundberg 1985) suggests that one partner will increase his or her labor efforts when the other partner disengages, in order to compensate for the household’s income loss.

Both hypotheses have received empirical support. For instance, early studies by Hurd (1990) and Gustman and Steinmeier (1994) found that complementarity of leisure is a key factor in explaining why husbands and wives often retire simultaneously. Conversely, studies by Cullen and Gruber (2000) and Maloney (1987) support the hypothesized added worker effect. One possible reason why both these hypotheses have received support is that retirement is contextual. Different retirement and social security systems have different incentives. Further, the spouse and household income are only two among many possible factors influencing the timing of retirement.

In a more recent contribution, Ekerdt (2010) proposes a more complex model, including four social structural contexts that should be taken into account when analyzing retirement behavior: the welfare state, the family, the labor market, and cultural norms and values about age, work, and leisure (i.e., the normative age of retirement, later-life entitlement to leisure, moral assumptions, and solidarity between generations). All four of these contexts are likely to play a role in an individual’s retirement timing. It is thus important to remember that the timing of retirement is rarely a result of experiences proximate to retirement but rather is related to individual experiences throughout the course of the worker’s life.

## A Process Perspective on Retirement Timing

Scholars have started to acknowledge that retirement planning is a complex phenomenon or process (Topa et al. 2009) that occurs over a span of time and involves a series of reflections and decisions concerning the timing and form of retirement (Moen 2012). One process approach to understanding how older workers gradually approach retirement is the retirement process model (Beehr 1986; Feldman and Beehr 2011). Feldman and Beehr's (2011) three-step model of retirement describes how workers progressively disengage from work by (a) imagining the possibility of retirement, (b) assessing when it is time to let go of long-held jobs, and (c) putting concrete plans for retirement into action. This model distinguishes between preferences, intentions, and the act of retiring, and it describes a process of increasing decisiveness toward the timing of retirement. These three steps are so broad that most employees approaching retirement will likely fit into at least one of them at some point. As such, Feldman and Beehr's three-phase model may be useful in understanding "how far from retirement" a worker perceives himself or herself to be. However, this model seems to assume that all workers at a certain age or stage in life have started to make retirement decisions. In contrast to this assumption, recent studies have provided more detailed information on the retirement decision-making process, suggesting that not all individuals disengage in the way proposed by Feldman and Beehr. For instance, a study of academics suggests five different ways of orienting oneself toward retirement: "reflections, explorations, assessments, discussions, and planning regarding retirement-related choices and alternatives" (Furunes et al. 2011b, n.p.). Individual variations in retirement orientations were found to covary with competencies, work enjoyment, and work identification, thus creating variations in how workers relate to retirement (e.g., their retirement intentions). A seemingly homogenous group of white-collar workers were classified into five

groups: (1) those *in love with the job*, who had very high competence, had very high work engagement, were job engaged, and planned to continue; (2) those *in the middle of a work project*, who had high competence, had high work enjoyment, were engaged in their project, and had considered but not yet planned for retirement; (3) those who retired to do new work tasks with their *pension as a stipend*, had high competence, and were so engaged in their topic that they sought alternative careers; (4) those whose competence was obsolete, whose work enjoyment was declining, and whose engagement was lost, who were barely *hanging in there* and planned to retire soon; and (5) those who lacked updated knowledge, had lost enjoyment, were disengaged, and were ready to retire or had already done so, because they were *done with the job*. Groups 3, 4, and 5 seemed to have determined that their options were better outside their current employment relationship, and the timing of their retirement seemed related to both their work and life experiences. Although this study adds details and new pathways to retirement, it says little about when timing or retirement starts, as the lowest age of interviewees was 58, an age at which it was assumed that they had started timing their retirement.

## At What Age Does Timing of Retirement Start?

Calculating average retirement ages is easy, as most nations have accessible public data. Assessing the starting point for retirement timing, however, is considerably more difficult. As stated above, research increasingly acknowledges that retirement is not a discrete event but rather a messy and often disrupted process (Loretto and Vickerstaff 2012) involving hesitation and doubt (Ekerdt et al. 2001). Research has also established that retirement pathways are initiated long before retirement (see, e.g., Kloep and Hendry 2006) and acknowledged that the timing of retirement is a long process, with older workers developing expectations, intentions, and plans for retirement

long before the actual labor market exit (Zaniboni et al. 2010). Thus, there has been little focus on when timing of retirement starts.

On the one hand, it is well documented that a number of factors are associated with retirement timing. Survey data show that health, finance, marital status, caring commitments, job satisfaction, employer policy, and benefit status influence the timing of retirement (see, e.g., Phillipson and Smith 2005). On the other hand, practice shows that individuals with equal health and financial status may time their retirements differently (Loretto and Vickerstaff 2012). To explore retirement timing more closely, interactions between health, partners, and gender have received attention.

Wang et al. (2011) suggested applying a resource-based dynamic perspective to improve our understanding about the form and nature of the retirement process and adjustment to retirement. Furunes et al. (2015) argue that individual resources influence older workers' late career decision-making and retirement timing in the same way that they influence retirement adjustment.

Solem et al. (2014) found that labor market resources (i.e., health, education) influenced not only the timing of retirement but also the connection between intention to retire and retirement behaviors. Workers with low education and those with poor health tend to have fewer opportunities to remain in the workforce as long as they prefer. Additionally, blue-collar workers retire earlier than planned more often than white-collar workers; thus, the former have fewer opportunities to implement their decisions when they decide to retire late.

Nilsson (2012) found a distinction between those who left working life early and those who extended their working careers; specifically, "stayers" felt important to others and socially included at work and had meaningful tasks and a functional state of health, whereas those who left working life before 65 years of age considered their possibilities to be better outside working life and thus left as soon as they had a sufficient pension.

Ekerdt et al. (2001) found that retirement decisions among older workers in the United States involved a process of hesitation and doubt. Similar findings from Norway found that retirement

decisions frequently changed and were postponed close to the time of actual retirement among persons with ambivalent feelings toward retirement (Solem 1989).

In a meta-analysis, Topa et al. (2009) showed that poor health, negative working conditions, and positive attitudes toward retirement were positively related to both retirement planning and retirement decisions, whereas job involvement and job satisfaction were negatively related to retirement planning and retirement decision-making. Additionally, retirement planning was positively related to bridge employment, life satisfaction, and retirement satisfaction. An explanation for this finding may be that individuals who feel that they are in control of their retirement process are more satisfied compared to those who feel that retirement is forced upon them and thus have not planned for it. Likewise, those who have made plans have been found to adjust better to retirement (see, e.g., Anderson and Weber 1993; Wöhrmann et al. 2014). Below, some studies on the influence of family and health on retirement timing are presented.

### **The Influence of Partners and Families**

Acknowledging that the timing of retirement is not only an individual decision, some research has taken partners and families into account as likely to influence the retirement decision. One of the reasons for this may be that for individuals linked to the retiree, the change in status may have counterpart effects (Ekerdt 2010).

American research has produced empirical evidence for joint retirement (i.e., couples choosing to retire at the same time). The desire for complementary leisure, as mentioned earlier, is often argued to be the reason for this phenomenon. Similar findings also resulted from a recent longitudinal study in Norway (Syse et al. 2014), where a spouse's work exit was found to be a strong predictor of a respondent's work exit, suggesting that spouses tend to coordinate their retirement. These findings differ from those of a study in the UK that found joint retirement to be less common than expected (Loretto and Vickerstaff 2012). In the UK study, joint retirement was found in cases of the sudden ill-health of one of the partners

(which made them recognize their own and others' vulnerability and mortality and thus led them to choose to retire together) and among couples who approached retirement in a more passive way (e.g., after long-term unemployment).

These studies call for the importance of studying retirement as household behavior. Also, they illustrate why it is important to study the timing of retirement in its complex context, which points not only to the retirement system but also to differences in characteristics such as social class, marriage, ethnicity, and race. For instance, in Norway, educational homogamy among married couples is highly prevalent (Birkelund and Heldal 2003) and thus likely to make it possible for couples to retire jointly. Conversely, in countries with low female labor market participation at higher ages, it is more likely for husbands to continue working to reduce the loss of income of the non-active wives.

### **The Relationship Between Health and Timing of Retirement**

The relationship between health and retirement is bidirectional; health is central to the timing of retirement, and retirement may have varying effects on health (Oksanen and Virtanen 2012). Healthier workers remain at work longer than those with reduced health or working capacity (see, e.g., Harkonmäki et al. 2006). Finnish longitudinal studies show that improving health and work ability within the work context is possible (see, e.g., Tuomi et al. 2001) and may thus prevent early retirement.

When discussing whether it is ethical to prolong older workers' careers, it is often stressed that the work should not hamper the health of the worker; hence, it is important to know both the costs and the benefits of such efforts for the individual worker (Coe and Zamarro 2011). A large European study found a significant positive effect of retirement on general health. Another recent study of workers' health prior to and after retirement (Syse et al. [in peer review](#)) suggests that retirement may provide substantial health benefits. Those retiring were more likely to experience health improvements and less likely to

experience health deteriorations compared to those at the same age who continued working. Retirees were also more likely to increase their levels of physical activity and experience weight loss; thus, the study suggests that exiting working life may be beneficial for some. However, there is reason to believe that different kinds of retirement will have different health outcomes. For instance, a study comparing individuals retiring on disability pension to those retiring on early retirement or old age pension and those still working (Furunes et al. 2012) found that those retiring on disability pension experience a decrease in self-esteem that were not found in the other groups.

### **Effect of Gender on Timing of Retirement**

Loretto and Vickerstaff (2012) stress that, for the generation that is now retiring, the retirement process may be very different for women versus for men. Women's entry into the labor market in the 1970s, especially in northern Europe and the UK, makes the now-retiring baby boomers the first generation to have high participation rates for both genders. However, it is common for women to have different work and life experiences than males (Sargent et al. 2013), as more women than men have experienced the "double burden" (Bratberg et al. 2002) of housework and paid work, as well as interrupted careers and part-time work due to caring for children and/or older family members. Discontinuous work histories or late labor market entries influence their pension earnings (Price and Nesteruk 2010) and thus may influence the timing of their retirement.

### **Timing of Retirement and the Role of Leadership and HRM Policies**

While family and health certainly play a role in the timing of retirement, the retirement decision is also related to the work environment and workplace management. Recent pension reforms and initiatives to prolong older workers' careers have created new conditions for managing an

aging workforce. Leadership can take many forms and involve a series of processes related to employees' timing of retirement. Leadership strategies, for example, are likely to be different in countries that have a mandatory retirement age compared to those countries that have abolished the mandatory retirement age. Even in countries that have had strong national initiatives and tripartite agreements, such as Norway, the degree to which organizations have implemented strategies and actions to prolong the careers of their employees varies across organizations and leaders. Manager attitudes toward older workers are found to play a role in how eager they are to implement age-friendly HR practices and whether they think it is possible to postpone retirement (Furunes et al. 2011).

In order to influence employees' timing of retirement and manage older workers successfully, employers and managers may need to consider work ability and timing of retirement for each individual worker. This does not always seem to be the case in practice, however, as a study from the UK found that some line managers would turn a blind eye to poor staff performance among seniors approaching retirement to avoid conflicts, hoping that the older underperforming worker would retire soon anyway (Manfredi 2011). In countries in which the mandatory retirement age has been removed, Manfredi suggests that employers will need to focus more on performance management so as to avoid age biases and claims of age discrimination (Manfredi 2011).

Is it possible for employers to influence employees' timing of retirement? The answer to this question is yes – not for all employees, but for many – by understanding the multifaceted process and the role of the organization and the closest leader(s) in the timing of retirement. As employee motives and abilities change with age (e.g., Kanfer and Ackerman 2004), it is also likely that the utility and effects of human resource (HR) practices will change with age (Kooij et al. 2010).

Research shows that older and younger workers differ in terms of what motivates them to do a good job. For older workers, having an interesting job, being able to use their skills and

abilities, and feeling that they contribute, have autonomy, help others, and have a secure job are important (i.e., internal motivation). Younger workers, on the other hand, are motivated by challenging work tasks, career development, teamwork, and being recognized and rewarded (i.e., external motivation). On average, research suggests that the importance of internal motivation increases with age, while the importance of external motivation decreases with age.

According to the social exchange theory (Blau 1964), the degree to which employees return positive attitudes and behavior to the organization will be dependent on the perceived value of the offered HR activities. Kooij and van de Voorde (2015) suggest that organizations tailor their HR practices to the needs of older workers. In a study of HR practices, Kooij et al. (2010) identified four different HRM bundles of HR practices: (1) development, (2) maintenance, (3) utilization, and (4) accommodation.

Bundle 1, development, includes HR practices such as training to enable the employee to increase his or her level of functioning. Bundle 2, maintenance, includes HR practices aiming at maintaining the employees' level of functioning to enable him or her to meet new job tasks and challenges. Bundle 3, utilization, includes HR activities such as horizontal job change, job redesign, and mentoring that can help the employees to develop other relevant job resources. Finally, bundle 4, accommodation, includes HR practices such as reduced workload and part-time work that can help employees with reduced work ability when maintenance or utilization is not possible.

So far there has been little research conducted in this area. Initial research has found that Dutch and British organizations primarily used accommodative HR practices (e.g., additional leave, exemption from shifts, reduced workload) to retain older workers, suggesting that these organizations' managers may have a tendency to promote HR practices that release the pressure to older workers, whereas younger workers are offered developmental HR activities. One of the main roles of a leader is to make the person-environment fit as good as possible, so that the employee can continue to work as long as he or

she desires; hence, HR bundles should be selected according to their function.

Although to date relatively few empirical studies have actually demonstrated the importance of retention measures for the timing of retirement, there has been some initial investigation. In Norway, for instance, the most common entitlement age for retention measures is 62 (Hermansen 2014). Additional leave seems to be a widespread retention measure among European employers (see, e.g., van Dalen et al. 2009), for instance, it is by far the most commonly used retention measure by Dutch employers. One limitation is that there are few studies of whether these measures have the intended effect (i.e., influencing individuals' timing of retirement). A study by Hermansen (2014) shows that there has been an increase in the overall relative risk for 61- and 62-year-old workers to retire on contractual early retirement (AFP) in Norway in the period between 2001 and 2010. However, for older workers employed in companies offering additional leave, there has been a decrease in the relative risk of retiring early. In the analysis so far, it is difficult to know whether the small effects found it to be due to the HR practices per se or due to the organizations' general increase in attention toward older workers (i.e., a symbolic effect).

Although some initial work has been done on the role of leadership on the timing of retirement, there is a need for further studies. There is enough evidence for large individual differences in aging to claim that HR practices should be based on individual needs rather than collective goods that need to be negotiated by labor unions (see, e.g., Midtsundstad and Bogen 2014). There are also sufficient indications to suggest that organizations and managers can influence the timing of retirement (see, e.g., Furunes et al. 2015).

## Cross-References

- ▶ [Age Discrimination](#)
- ▶ [Age Diversity at Work](#)
- ▶ [Age Stereotypes in the Workplace](#)
- ▶ [Age-Related Changes in Abilities](#)
- ▶ [Early and Unplanned Retirement](#)

- ▶ [Human Resource Management and Aging](#)
- ▶ [Job Attitudes and Age](#)
- ▶ [Leadership and Aging](#)
- ▶ [Motivation to Continue Work After Retirement](#)
- ▶ [Organizational Strategies for Attracting, Utilizing, and Retaining Older Workers](#)
- ▶ [Retirement and Continuity Theory](#)
- ▶ [Stress and Well-being: Its Relationship to Work and Retirement for Older Workers](#)
- ▶ [Women and Retirement](#)
- ▶ [Work Design and Aging](#)
- ▶ [Work Motivation and Aging](#)

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## Tokyo Centenarian Study and Japan Semisupercentenarian Study

Hiroki Inagaki<sup>1</sup>, Yasumichi Arai<sup>2</sup>,  
Yasuyuki Gondo<sup>3</sup> and Nobuyoshi Hirose<sup>2</sup>

<sup>1</sup>Research Team for Promoting Independence of the Elderly, Tokyo Metropolitan Institute of Gerontology, Tokyo, Japan

<sup>2</sup>Center for Supercentenarian Research, Keio University School of Medicine, Tokyo, Japan

<sup>3</sup>Department of Clinical Thanatology and Geriatric Behavioral Science, Osaka University Graduate School of Human Sciences, Suita, Japan

### Synonyms

Cognitive function; Japan Semi-supercentenarian Study; Personality; Psychological well-being; Tokyo Centenarian Study

### Definition

In this entry, we report the aims, methods, and findings of the Tokyo Centenarian Study (TCS) that was completed in the urban area of Tokyo in 2000–2002 and the Japan Semi-supercentenarian Study (JSS) that is being carried out for centenarians aged 105 and over in the whole area of Japan since 2003.

### Aim and Recruitment

#### Tokyo Centenarian Study

In Japan, against a background of a rapidly aging population, the number of centenarians has increased notably. According to the Japanese Ministry of Health, Labor and Welfare, this population has continued to increase by 10% in recent years. When the Tokyo Centenarian Study (TCS) was initiated in 2000, there were 13,036 Japanese centenarians, 83.4% of whom were women. In 2014, the Japanese centenarian population increased to 58,820, with the female proportion increasing to 87.1%. The proportion of centenarians in total

Japanese population is about 0.05%, and about 7.6% is elderly people aged 80 and over. In the future, Japan will unavoidably become a “super-aged” society. There is a high probability the extreme elderly can have multiple disabilities and risk losing their ability to live independently.

Accurate descriptions of what happens to individuals’ health and independence at the tail end of the human survival curve have assumed an important role in accurately estimating future disability trends and health-care demands, which has enormous social, economic, and medical implications in an aging society. Research focusing on very aged people and centenarians helps inform how to extend a healthy life expectancy and how to adapt to functional decline. In addition, the achievements from research can contribute to the reconstruction of the social system in relation to coping with a “super-aged” society and to offer possibilities for a way of living an extended life. It is thought that studying the population of centenarians may inform best about how to achieve these aims.

The aims of the TCS were to (1) describe the status of centenarians and characterize ultimate aging in humans (i.e., When we live until the limit of the human life span, what do we become?), (2) identify the factors associated with longevity and healthy aging, and (3) examine the mechanism of adaptation to functional decline, based on the assumption that centenarians are a model of healthy longevity. Psychological factors, including personality, cognitive function, and subjective well-being, were also evaluated.

For sampling, we used an annual list of centenarians in Japan published by the Japanese Ministry of Health, Welfare, and Labor until 2003. (Unfortunately, it was stopped to be published since 2004.) According to this list, 1,785 centenarians lived in 23 wards of metropolitan Tokyo between 2000 and 2002. Addresses of 1,194 centenarians were identified from the basic registry of residence, and individuals were sent a letter inviting them to participate in the study. A total of 513 centenarians agreed to participate in the study, of which 304 (21.7% male and 78.3% female) participated in both the visits and mailed survey. The remaining 209 centenarians participated in mailed survey only

(Hirose et al. 2004; Gondo et al. 2006; Takayama et al. 2007; Inagaki et al. 2009).

### Japan Semi-supercentenarian Study

While conducting the TCS, the researchers came to the conclusion that centenarians are no longer an ideal model for investigating human longevity. One of the reasons for this was the rapid increase in the number of centenarians. In Japan, the number of centenarians in 2014 was approximately 58,820, ten times higher than in 1994, and this number is expected to increase in the future. Additionally, centenarians are a heterogeneous group, from bed-ridden individuals to those having complete autonomy. Most centenarians are not in good health, experiencing declines in cognitive function, as well as being physically frail. Therefore, the study focused on individuals aged 110 years and over, known as supercentenarians (SCs). However, SCs are extremely rare, despite the overall increase in centenarians. National census results in 2010 indicated that 1 in 2,500 people were centenarians; however, semi-supercentenarians (SSCs), defined as people over 105 years of age, accounted for 1 in 45,000 people and supercentenarians (SCs) just 1 in 1,500,000 people. In addition, mortality rate for those aged 100 years and over was calculated and the rate did not rise after 105 years of age. Therefore, it was decided that SSCs and SCs were a more realistic model of healthy longevity than centenarians. Previously SCs had been considered as the best model for health and longevity, but it was difficult to collect data from sufficient numbers for adequate statistical analysis. The number of SSCs and SCs has been increasing recently. In 1991, there were 133 SSCs and five SCs; however, by 2010, the numbers increased to 2564 and 78, respectively. The larger SSC and SC population has made it possible to collect enough samples for more reliable statistical analysis. Therefore, the Japanese Semi-supercentenarian Study (JSS) was launched, in which a nationwide survey of SSCs was conducted, involving examinations using a standardized procedure (Arai et al. 2014).

JSS is a nationwide longitudinal survey, mainly consisting of individuals aged 105 years of age or older. Since 1963, a list of centenarians had been

compiled annually by the Ministry of Health, Welfare, and Labor, associated with the resident registration system and periodic census. According to the list, 849 SSCs were living in Japan in 2002 including 23 SCs. Names and addresses of 543 individuals (82 men and 461 women) among the 849 SSCs listed were identified, and individuals were sent a letter inviting them to participate in a home visit examination. 135 SSCs (20 men and 115 women) consented to participate in the visit. The list was discontinued in 2002; therefore, the recruitment strategy changed and SSCs were identified using one of the following methods: (a) subjects that had participated in the TCS in 2001–2002 and had reached 105 years of age by March 31, 2003, (b) individuals on the Basic Resident Register on the 23 Tokyo wards, and (c) individuals with their name and a part of an address published in a newspaper or other media. Of those identified and contacted, 161 replied, 17 declined to participate, and 51 were deceased. Of the 93 who agreed to participate, 20 (2 men and 18 women) participated in the mailed survey and 73 (14 men and 59 women) participated in the visit. Additionally, local government and the nursing homes, covering the whole country except Okinawa, were requested to introduce SSCs by mail (Arai et al. 2014). This is the current recruitment strategy for the study. A total of 591 SSCs, including 33 SCs, were enrolled in the JSS by the end of March 2015.

## Data Collection

The mailed survey collected sociodemographic data, medical history, family history, subjective visual and auditory dysfunction, and basic and instrumental activities of daily living (B-ADL and I-ADL). After the mailed survey, a geriatrician, a psychologist, and a nurse visited a subset of centenarians in their current residence, such as their home, nursing home, or hospital. The geriatrician completed a medical examination, which included blood pressure measurement, an electrocardiogram (ECG), and a blood sample. Circumstance of care was reported to a nurse, from a centenarian's family member or care staff.

A psychologist rated several psychological variables including cognitive function using the Mini-Mental State Examination (MMSE) (Folstein et al. 1975), personality using the NEO Five-Factor Inventory (NEO-FFI) (Costa and McCrea 1985), subjective well-being using the Philadelphia Geriatric Center (PGC) Morale Scale (Lawton 1975), and depression using the Geriatric Depression Scale (GDS) (Sheikh and Yesavage 1986). Additionally, researchers asked about the centenarian's most important life events. After the visit, a psychologist and other expert gerontologists assessed the degree of cognitive impairment using a Clinical Dementia Rating (CDR) (Morris 1993) based on videotaped interviews of the centenarians and activities and state of daily living provided by the participant's family or caregiver.

## Results

This section reports the psychological findings from the TCS and JSS.

### Comprehensive Functional Status

In the TCS, 304 centenarians were classified using four phenotypes based on three functional dimensions: visual and auditory function, physical function, and cognitive function (Gondo et al. 2006). Only five centenarians (2%) were classified as "exceptional," meaning all functional dimensions were assessed as excellent. 56 centenarians (18%) were classified as "normal," meaning they had good physical and cognitive function and were maintaining an independent life. 167 centenarians (55%) had a problem with either physical or cognitive function; therefore, they were classified as "frail." The remaining 76 centenarians (25%) had a dysfunction with both physical and cognitive aspects and were consequently classified as "fragile." Therefore, based on biomedical or functional aspects, only 20% of centenarians in the study achieved successful aging.

### Cognitive Function

The prevalence of dementia in centenarians varies, with reported prevalence ranging from 50% to 70% (Inagaki et al. 2009;

Gondo et al. 2014a). Using the Clinical Dementia Rating (CDR) (Morris 1993), dementia was defined as CDR1 and over; CDR1 is defined as cognitive function with mild impairment, and CDR2 and CDR3 are defined as moderate and severe impairment, respectively. Consequently, the prevalence of dementia in Japanese centenarians was estimated as 61.9%. This prevalence is similar to previous studies. In some of previous studies, MMSE has been applied to estimate prevalence of dementia in centenarians. However, by using the cutoff point applied for younger elderly, we may underestimate centenarians' cognitive function. Consequently, we assessed CDR (dementia or not) as external criterion and then used receiver operating characteristic (ROC) analysis to estimate appropriate dementia cutoff points of MMSE for centenarians. Applying this method, we found a MMSE cutoff of 17/18 points for the centenarians, compared with 23/24 points in the younger elderly (Gondo and Poon 2007). In addition, to determine which cognitive functions decline with aging or are maintained regardless of aging, we used the MMSE to evaluate the performance regarding specific cognitive domains in cognitively intact centenarians. Specifically, centenarians with CDR 0 (no impairment) were selected. Compared with young-old and old-old, the total MMSE score for centenarians was lower, indicating that general cognitive functioning declined in centenarians. Cognitive orientation and memory declined; however, language and praxis, as well as concentration, did not significantly differ from the younger elderly (Inagaki et al. 2009). Compared to the elderly with mild cognitive disability (CDR 0.5–1), decline was mostly dominated by deterioration of primary memory in centenarians. Long-term memory and orientation also were reduced; however, their functioning was maintained at a normal level. Working memory is likely to deteriorate more easily compare to other cognitive domains. Language and praxis also declined, but this decline was only small.

### Personality

To identify personality characteristics specific to centenarians, a new method was used that

compares actual personality test scores of centenarians with a predicted test score for a 100-year-old, which was calculated based on younger controls (Masui et al. 2006). We conducted regression analyses for each personality score with age as an independent variable using scores of younger individuals. As a result, we adopted either a linear or a quadratic regression model that best fitted the data for each personality trait. Then, we calculated the predicted value for each personality trait for a 100-year-old based on the selected model and the actual mean scores and compared each score. The subjects of this analysis were 70 cognitively intact centenarians aged 100–106 years old and 1812 elderly persons aged 60–84 years old. Five personality traits (neuroticism, extraversion, openness, agreeableness, and conscientiousness) were assessed by NEO-FFI (Costa and McCrea 1985). Openness scores were higher in both male and female centenarians, and conscientiousness and extraversion were higher in female centenarians, compared with the predicted centenarian's scores. Thus, centenarians seem to have specific personality traits, and the traits of openness, conscientiousness, and extraversion are potentially associated with longevity through health-related behavior, stress reduction, and adaptation to the challenging problems of the extreme elderly (Masui et al. 2006).

### Psychological Well-Being

As described above, our study documented deterioration of comprehensive functional status among most of centenarians. However, a disparity was found between functional status and psychological well-being in centenarians. In the TCS, psychological well-being among different functional subgroups was evaluated and compared using the Japanese version of the PGC Morale Scale (Lawton 1975). Centenarians who were physically frail but cognitively intact (i.e., a "frail" subgroup) demonstrated the same levels of psychological well-being as the "normal" (i.e., not frail) subgroup in centenarians. In addition, psychological well-being in centenarians was higher than in the young-old and old-old subgroups with physiological deterioration (Gondo 2002; Gondo et al. 2013). As a theory to explain these positive levels of psychological well-being

in the extreme elderly, further studies are focusing on gerotranscendence, which is defined as “a shift in meta-perspective, from a materialistic and rational vision to a more cosmic and transcendent one” (Tornstam 1989). The Japanese version of the scale was developed to measure gerotranscendence and data collected from the elderly, including centenarians (Masui et al. 2010).

### Additional Contributions of the TCS: CAQ Questionnaire Development

In some situations, it is difficult to assess a centenarian’s cognitive function using performance tests, because most centenarians may have visual and hearing impairment, physical disability, or low levels of arousal. Estimation of the cognitive function by others who know the centenarian well may therefore be an effective method of assessing this competence. Based on this concept, a cognitive assessment questionnaire was developed (Masui et al. 2005; Gondo et al. 2014b). The CAQ aims at assessing the cognitive functions indirectly, by measuring the cognition-related daily activities. Although it is not possible to completely disentangle cognitive and physical capacity using this approach, the CAQ includes selected activities of daily living which can be considered to relate more strongly to cognition rather than physical functions. The item selection process was based on discussions of three psychologists who compared different existing scale for ADLs/IADLs. The final questionnaire consisted of 19 items which are shown in Table 1. For its validation, the CAQ was distributed to the family members of 233 centenarians or their care staff. Findings indicate that the CAQ had a high internal consistency (Cronbach alpha was 0.94) and great concurrent validity based on high correlations with the MMSE ( $r = 0.85, p < 0.01$ ). In addition, this questionnaire was able to evaluate the functional level of participants below the lower limit assessable by the MMSE and was not affected by vision or hearing impairment. Because CAQ does not assess cognitive functions as directly as performance tests, such as MMSE, HDS-R, etc., it has some limitation regarding the

**Tokyo Centenarian Study and Japan Semisupercentenarian Study, Table 1** Table items of CAQ

1	When someone greets him/her, he/she can greet them
2	He/She can express feelings, for example, delight, anger, sorrow, and pleasure
3	He/She can say thanks to someone's services to him/her
4	He/She can understand his/her age roughly correctly
5	He/She can reminisce his/her happy past story
6	He/She can correctly say his/her date of birth
7	He/She can reminisce his/her sad past story
8	He/She can behave in mind of others' evaluation
9	He/She can correctly understand what season it is now
10	He/She can understand his/her relatives' recent history and dwelling place roughly correctly
11	He/She can understand the program roughly correctly when he/she is watching TV or listening to a radio
12	He/She can turn on the TV or the radio and change the channels on his/her own
13	He/She can listen to someone's problem and give advice to them
14	He/She can smarten up his/her belongings in his/her own way
15	He/She can absorb ideas of book or magazine when he/she is reading them
16	He/She can remember about episodes which appeared a few days ago
17	He/She can calculate easy hanging money
18	He/She can stay home alone without any worry
19	He/She is working or doing the housework daily

degree of exactness with which the CAQ can assess cognitive functioning. However, we still consider that the CAQ is a very useful measure, because it does not require much expertise to apply this test compared to the previous observation methods such as CDR and it can apply to subjects who can no longer respond to the performance tests.

### Summary

The TCS started in 2000, followed by the JSS in 2002. Data collection in the JSS is ongoing. In order to describe the status of centenarians, characterize ultimate aging in humans, and identify the

factors associated with longevity and healthy aging, some psychological factors including personality, cognitive function, and subjective well-being were assessed and evaluated, under the assumption that centenarians and supercentenarians are models of healthy longevity. Cognitive function showed an overall decrease; however, some cognitive functions maintained the same level, while others hardly decreased. Centenarians have specific personality characteristics. We speculate that this specific personality of centenarians contributes to longevity through health-related behavior and effective stress management. Despite centenarians' decline in physical and cognitive function, their subjective well-being is higher than expected from younger elderly. A psychological adaptation model for the extreme elderly, such as gerotranscendence, could be used as a mechanism to describe this phenomenon.

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## Training at Work and Aging

Carmen K. Young and Margaret E. Beier  
Department of Psychology, Rice University,  
Houston, TX, USA

### Synonyms

Employee development; Learning; Skill acquisition; Worker education

### Definition

Training is defined as a collection of organizational activities that presents employees with job-relevant information with the intent of yielding permanent changes in job-related knowledge, skills, and attitudes. The objective of work-related training is to increase job performance and ultimately work toward organizational goals. Aging employees in the workplace experience developmental changes in cognitive ability and motivation that can affect their performance during training programs. Below, considerations for age-related training are discussed.

### Training Older Workers

In 2013, adults aged 55 years or older comprised about 61% of the U.S. workforce (Bureau of Labor Statistics, 2014). Other countries across the world are also experiencing upward shifts in the median age of their workforce population, with some countries (e.g., Japan) projected to have over 40% of their workforce older than 50 years of age by the year 2020 (Skirbekk

et al., 2012; Van Katwyk, 2012). As older adults continue to comprise an increasingly large portion of the workforce, they will require training for new jobs and continuous updating of their current skills in existing jobs. Understanding how to best design training for older workers necessitates a focus on understanding age-related changes in abilities and goals that impact performance in, and motivation for, training.

Training is defined as activities planned by an organization that lead to a permanent change in employees' job-related behaviors (Wexley & Latham, 2002). The primary purpose of work-related training is for employees to acquire new skills that they can use to positively impact job performance. Organizations recognize the value of good training as evidenced by the significant annual investment of resources toward training. In 2012, the average direct learning expenditure per employee for Fortune Global 500 organizations in the U.S.A. was \$802, with an average of 31.5 learning hours spent per employee annually (American Society for Training and Development, 2013). The demand for training is expected to continue into the foreseeable future, with technological advances and an increasingly global workforce placing higher premiums on keeping skills up-to-date and expansive enough to work successfully around the globe (Burke & Ng 2006). Though this may prompt various organizations to focus on rapidly changing market demands in their respective fields, there should also be a focus on the characteristics trainees bring to training situations that may dictate their success in training (e.g., motives, goals, and abilities).

Factors related to trainee characteristics have been shown to be influential before, during, and after training programs. Research suggests that two of the best predictors of training performance are cognitive ability and motivation (Colquitt et al., 2000). Both of these variables change as adults age in ways that can affect work-related issues (i.e., engagement in training programs and performance during training). Age has been shown to be negatively related to training performance and positively related to training time, meaning that as people age, they tend to take longer in training and do not perform as well

(Kubeck et al., 1996). Nonetheless, training programs can be designed to account for age-related changes in abilities and motivation, which create environments where older adults can perform well (Callahan et al., 2003).

Here, the current research on age- and work-related training is reviewed. Person-related attributes in relation to aging (i.e., cognitive ability and motivation) will be described and discussed within the context of the situational demands for trainees that arise from training environments. Future directions of aging and training research will also be discussed.

## Person-Related Attributes

### Cognitive Ability

Cognitive ability is one of the strongest predictors of training performance, accounting for approximately one-third of the variance in training performance (Beier, 2008); people who are generally higher in cognitive ability tend to do better in training relative to those who are lower. Research has commonly delineated components of cognitive ability into two types: fluid ability and crystallized ability (Horn & Cattell, 1967). Each type of cognitive ability is related to different, specific mental functions and each develops differently over time. As such, they have different age-related trajectories that provide implications for designing training given to older workers.

Fluid ability is associated with generating, transforming, and manipulating information. It is highly related to working memory capacity and is generally considered the raw reasoning ability that people possess. In training situations, fluid ability is important for learning novel tasks, processing information, and retaining newly learned material (Carroll, 1993). Some scholars posit that the amount of fluid ability a person has limits the amount of cognitive resources and attention a person has available to dedicate toward learning new tasks, such as those presented in training environments (Kanfer & Ackerman, 1989). As such, fluid ability is considered an essential determinant of learning in training.

Crystallized ability is associated with domain-specific knowledge obtained through life experiences and education. It is generally measured using verbal comprehension, vocabulary, and general knowledge tests (e.g., assessing information that is available to a general population). Fluid and crystallized ability are positively correlated (i.e., people who have higher levels of fluid ability are also likely to have higher levels of crystallized ability), which is reflective of the idea that crystallized ability develops as a function of the investment of fluid ability in learning (Horn & Cattell, 1967). However, these two abilities have different trajectories that develop with age.

Fluid ability increases from birth and peaks in early adulthood (around age 20 or so). Once a person ages beyond young adulthood, fluid ability steadily declines throughout the remainder of a person's life. This leaves older adults with fewer cognitive resources available for allocation toward learning novel tasks, as would be necessary in many training environments. Indeed, research has found that age-related differences in training performance follow expected trends for fluid ability. In particular, older adults have more difficulty learning new things compared to younger adults (Kubeck et al., 1996).

Similar to fluid ability, crystallized ability increases during the early portions of a person's life span, specifically from birth to young adulthood. But instead of declining after young adulthood like fluid ability, crystallized ability remains stable or even increases until approximately age 70. Consequently, crystallized ability is likely to remain stable throughout a person's working years. Research also suggests that crystallized ability in the form of domain knowledge is positively related to new learning in that particular domain (e.g., prior knowledge about investment products was positively correlated with new learning about retirement accounts for an age-diverse sample; Ackerman & Beier, 2006). This implies that learning is facilitated – even in the face of declining fluid ability with age – in training environments that build upon pre-existing knowledge. That is, in these types of situations, crystallized ability can compensate for some losses in fluid ability.

Cognitive ability is an important determinant of success in training. Although older adults are likely to have more difficulty reasoning through novel problems compared to younger adults, they are likely to benefit from the vast array of knowledge they bring to bear on the training situation. For example, in a training program on a new software program for architects, a less experienced and younger architect might rely more on her attentional and memory capacity to encode and remember the information presented in training. Conversely, a more experienced and older architect might rely more on his knowledge of the current tools used in his job to integrate and remember the trained material. Though cognitive ability is a strong predictor of performance, age-related differences in motivation can also speak to an employee's success in a training program.

### Motivation

As adults age, their motivation for performing certain tasks or behaviors changes. One of the most common theoretical frameworks for examining motivation in work contexts is expectancy theory. Under expectancy theory, a person's level of motivation for a given task is determined by a combination of (a) the *valence* or value a person places on outcomes resulting from engaging in the task, (b) the *instrumentality* of a task to yield desired outcomes, and (c) the *expectations* that the effort dedicated toward the task will produce desired results. When applied to the context of training, this means that older adults will decide to engage in training opportunities if they value the outcomes associated with the training (e.g., outcomes such as a promotion or a more efficient way of doing an old task), believe that the training is useful to achieve the outcomes they value (e.g., skill enrichment), and believe that effort will lead to successful performance in training (Beier & Kanfer, 2010).

Because goals and values influence motivation for engaging in training, it is important to understand how they shift with age. In particular, shifts in goals are thought to be related to perceptions of time left (i.e., at work or in life); older people are thought to perceive that they have relatively

limited future time compared to younger people (Kanfer & Ackerman, 2004). This perspective that time is limited will lead people to choose goals that satisfy social or emotional needs over those that emphasize professional development (e.g., people with this perspective are more likely to be focused on building meaningful relationships than achieving a promotion). Conversely, when time is perceived as unlimited, professional development goals are favored as the person strives to advance at work. These changes imply that older adults will be less motivated relative to younger adults to engage in training opportunities that further professional goals, but would continue to be interested in training opportunities aligned with social or emotional goals. For instance, older workers may not be as motivated as younger workers to participate in training that would teach them computer programming so they could earn a promotion, but older workers may be just as motivated – or even more motivated – than younger workers to participate in training related to managing and coaching subordinate employees. Perhaps because much of the training research has focused on technical tasks, there is evidence that older workers are less willing to take part in training activities relative to younger workers (Beier, 2008).

In addition, because learning completely novel information (i.e., information that cannot be easily integrated into existing knowledge) becomes increasingly difficult with age, older workers may choose to operate in the environments that are most aligned with their existing skills and focus on developing those talents they already have. When necessary, older workers would also be expected to use strategies to compensate for skill deficiencies when they encounter difficulties in the training environment (Kanfer & Ackerman, 2004). These choices have implications for training because they determine whether older adults will engage in training opportunities and how they will behave during training. For example, as older adults realize that their cognitive resources associated with memory and learning are becoming limited, they will choose to focus their attention on learning in domains with which they are already familiar, rather than to explore new

pursuits in a broad range of domains. During training sessions, older adults would also be expected to engage in strategies to counteract losses in fluid ability such as mnemonic devices, note-taking, and moving at a slower pace. If these strategies are successful, age-related differences in performance may not be evident. That is, compensatory strategies – if effective – can serve to reduce age differences in training performance.

In summary, both cognitive abilities and motivation change as people age, such that older adults have fewer cognitive resources available for allocation toward novel tasks and begin to value social and emotional needs over professional development needs. These age-related changes in cognitive ability and motivation affect older adults' willingness to engage in training and their training performance. Nonetheless, the way training is designed can also affect performance. The following section will examine a variety of situation-based training demands that can yield differences in performance for older workers compared to younger workers.

## **Training Intervention Demands**

### **Cognitive Demands**

The basic purpose of training is to learn new skills. Theory and research suggest that learning a new task is effortful at first and will place demands on fluid ability (i.e., fluid ability being implicated in learning novel information). After a skill has been practiced over time, using the skill becomes less effortful and less reliant on fluid ability (e.g., riding a bike or driving a car, Kanfer & Ackerman, 1989). As the skill is learned, performance increasingly becomes a function of crystallized ability (i.e., task-related knowledge). Because fluid ability is somewhat limited for older adults, it is likely that the initial stages of effortful learning will be especially taxing, which would lead to poor performance and decreased motivation for training.

For instance, learning how to parallel park would be incredibly cognitively demanding for a person who has never driven before. That is, the task would require focused attention such that the

driver would not have any extra cognitive capacity to process extraneous information (e.g., they would likely turn off the radio or not participate in a conversation). Conversely, the same parking task should be significantly less demanding for a person who has practiced driving for 6 months because the task of parallel parking builds upon the experienced driver's pre-existing knowledge. As such, training can be designed to scaffold knowledge, building upon existing experience and knowledge. Training that builds upon existing knowledge should benefit older learners given the vast amount of knowledge they possess.

As described above, a trainee's expertise in an area can influence how cognitively taxing training is, but features of training design can also affect the cognitive demands associated with it. For example, the pace of training, the mode of delivery (e.g., lecture, electronic), the trainee's ability to control how quickly he or she moves through the training (i.e., learner control), the training materials, and the amount of instruction provided during training can all affect the cognitive demands associated with the training. Specifically, training environments that provide trainees minimal instruction and the opportunity to explore (e.g., discovery learning) can be more cognitively demanding than training environments that provide a more guided approach to the training content. An example of a training environment with minimal instruction is building a puzzle with only the image of the final product as a guide, whereas a guided approach would provide the image of the final product, but also instructions for the placement of each piece. Although discovery-learning environments have been shown to be effective for training – particularly for retention of trained material over time – these approaches can be cognitively taxing and difficult for people with limited fluid abilities. As such, people higher in cognitive ability, particularly fluid abilities, should be relatively more successful in these training environments than people lower in fluid abilities. Thus, it would seem to be particularly important to design training interventions for older workers that scaffold on existing knowledge and that provide extensive instruction,

particularly at the beginning of training when a task is new. There is some evidence that training that is relatively higher in structure is more effective for older learners than training that is relatively lower in structure (Carter & Beier, 2010). Nonetheless, the results of this literature remain equivocal and very few research studies have been published on the topic to date.

Another important consideration for designing training for older workers is its pacing. A meta-analysis of the training features affecting success in training for older adults found that older people learned more when training was self-paced versus instructor-paced (Callahan, Kiker, & Cross, 2003). Moreover, this study found that pacing of training was more important for success than the mode of delivery (lecture versus online, etc.). This is likely because older learners take longer than younger learners to process new information. Thus, self-paced training permits learners to take the time they need to encode training content into memory. Furthermore, self-paced training is higher in learner control – that is, the learner is responsible for determining when they have learned the content in one training module enough to progress to the next training topic. Consequently, self-paced training can be more meta-cognitively engaging than instructor-paced training as it forces learners to think about what they are learning during the training intervention. This thinking about one's own thinking also leads to increased performance in training.

In summary, success in training is a function of cognitive abilities, motivation, and the design of the training intervention. Because abilities and motivation are likely to change with age, the relationship between training design and performance in training is also likely to be moderated by age (i.e., the effectiveness of training interventions will differ depending on a trainee's age). Interactions between individual attributes and training treatments are called aptitude by treatment interactions (Campbell & Kuncel, 2001). Aptitudes are defined as any stable person-related trait, including cognitive ability, that is correlated with training outcomes and that interact with the training environment (which is the treatment). As described above in the context of training

structure and pacing, aptitude by treatment interactions is an important consideration when designing training for older workers.

### **Future Directions for Research on Training and Age**

Due to the aging of the global workforce and worker needs for continuous skill development, research on the training interventions that are most effective for older people is imperative. But unfortunately, this research is also sparse, most likely due to the cost and availability of samples of workers between the ages of 20 and 70 who are willing to participate. Thus, one of the first things researchers can do is to move beyond undergraduate samples in training research and to examine the effectiveness of work-related training with working-aged people (including younger, middle-aged, and older workers). This will provide insight into those elements of training design that are most effective for working adults. Moreover, training conducted in the context of normal organizational training can also provide insight into the factors affecting motivation for training. Examining motivation for a training program is difficult in laboratory environments when the training content is not especially relevant to work-related concerns.

An additional research need is related to the study of motivational and self-regulatory processes implicated in training success. Relative to what is known about changes in abilities throughout the life span, little is known about changes in motivation, goals, and self-regulatory processes relevant to training. Theory suggests that people shift from achievement to emotionally fulfilling goals later in life and that older people will value generative versus achievement outcomes associated with training (Kanfer & Ackerman, 2004). It would be beneficial to confirm these ideas with additional empirical evidence. Specific topics ripe for research include the predictors of interest in training and development activity (e.g., Maurer et al., 2003) and understanding how framing training and development activities may influence interest (e.g., Cox & Beier, 2009). Future research

would also benefit from examining whether training interventions could be designed to boost self-regulation for older adults during training (e.g., Carter & Beier, 2010).

## Conclusion

The aging of the global workforce will require that some people work past those years normally slated for retirement, either in their same jobs or in new roles. Moreover, the fast pace of business development will require workers of all ages to constantly update their work-related skills. As described above, research suggests that age-related changes in abilities and motivation can affect performance in training. But research also shows that training can be designed to facilitate learning for older workers. In particular, structured training that scaffolds onto existing knowledge and training that is self-paced can benefit older learners. In the coming years, it will be increasingly important for researchers to understand more about the training designs that affect learning in, and motivation for, training. It will also be increasingly important for training designers in organizations to consider the developmental changes in cognitive ability and motivation that influence training success. Designing training with the unique needs of older learners in mind will benefit not only the trainees, but the organizations who will increasingly rely on older workers in the coming years.

## Cross-References

- ▶ [Age-Related Changes in Abilities](#)
- ▶ [Selection, Optimization, and Compensation at Work in Relation to Age](#)
- ▶ [Work Motivation and Aging](#)

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## Training Psychologists in Aging

J. Kaci Fairchild<sup>1</sup> and Brian Yochim<sup>2</sup>

<sup>1</sup>Sierra Pacific Mental Illness Research Education and Clinical Center, VA Palo Alto Health Care System, Stanford University School of Medicine, Palo Alto, CA, USA

<sup>2</sup>Department of Medicine, National Jewish Health, University of Colorado School of Medicine, Denver, CO, USA

### Synonyms

Education; Instruction; Teaching

### Definition

The process of developing the attitudes, knowledge, and skills to become a proficient professional geropsychologist. Training occurs at the undergraduate, graduate, internship, postdoctoral, and post-licensure level.

## Background

As the number of older adults has grown, the field of geropsychology is advancing to meet their evolving needs. For example, as of 2011, over 100 clinicians in Europe have studied in the European Master's Program in Gerontology (EuMaG), which involves studying in various cities in Europe (Aartsen 2011; Heijke 2004). Yet, there remains a worldwide shortage of mental health professionals with specialized training in working with older adults. For example, there is a shortage of psychologists and psychiatrists with expertise in aging in Europe (Fernandez-Ballesteros et al. 2007; Ribeiro et al. 2010) and Australia (Snowdon et al. 1995) and a shortage of clinicians with expertise in dementia in Asia (Chiu and Chiu 2005). As of 2010, there were two graduate programs with specialty tracks in clinical geropsychology and five institutions with a gerontology department in Australia; Canada had no graduate programs with specialty geropsychology tracks, but had at least 12 institutions that had gerontology programs (Pachana et al. 2010). In Portugal, the awareness of the need for knowledge and experience with older adults is still emerging within clinical psychology, although the importance of a life course perspective in psychology courses and programs is starting to be recognized (Ribeiro et al. 2010).

Most information regarding geropsychology training focuses on American training, and that will be the focus of this chapter. The American Psychological Association (APA) adopted an official policy on psychological practice with older adults in 2003, and this was followed in 2010 by the establishment of geropsychology as a specialty of professional psychology (American Psychological Association 2004; Molinari 2010). Yet despite these advancements of the field, there is a well-documented shortage of qualified mental health practitioners to provide treatment to our aging society (Qualls 2010). At the start of the new millennium, a survey of over 1000 members of APA revealed that while only a small percentage identified older adults as their primary clientele, two out of three reported regularly providing care to older adults (Qualls et al. 2002). Of those

providing care to older adults, few had received formal training in geropsychology, with the most frequently cited training opportunity being informal clinical experience or on-the-job training. Furthermore, approximately half of those sampled identified a need for additional training in order to achieve competence in working with older adults. There has since been a steady growth of geropsychology training programs as well as the development of a formal, cohesive model of geropsychology training, the Pikes Peak Model for training in professional geropsychology (Knight et al. 2009).

### **Pikes Peak Model of Training in Professional Geropsychology**

The Pikes Peak model of training in professional geropsychology serves as a framework in which all aspects of training can be organized. Several national (EUA) geropsychology conferences led up to their creation. In 1981, the “Training Psychologists for Work in Aging” conference was held in Boulder, Colorado. This conference (now known as “Older Boulder”) worked to define the state of geropsychology knowledge and also produced specific training recommendations for geropsychologists (Knight et al. 1995). “Older Boulder” was followed up in 1992, with a second national conference held in Washington, DC. The focus of “Clinical Training in Psychology: Improving Services for Older Adults” (now known as “Older Boulder II”) was on further refinement of geropsychology training themes and discussion of certification of competence (Molinari 2010; Knight et al. 1995). This produced the “Three E’s” model of training: Exposure, Experience, and Expertise. In this model, the level of training recommended is matched to the goals of the trainee, i.e., the degree to which the trainee will work with older adults in a professional capacity. All psychologists should have some *exposure* to working with older adults. For those psychologists who wish to have some older clients in their clinical practice, *experience* working with older adults across different settings is necessary. Finally, to gain *expertise* in clinical

geropsychology or become an advanced practitioner of geropsychology, a psychologist should have the requisite knowledge and skills within many aging-related areas (Molinari 2010; Devries 2005; Hinrichsen et al. 2010).

In 2006 a third conference, the “National Conference on Training in Professional Geropsychology,” was held in Colorado Springs, Colorado, near Pikes Peak. This conference, known as the Pikes Peak, sought to develop a comprehensive training model and articulate competencies for the practice of professional geropsychology. The primary product of this conference is the listing of the Pikes Peak Competencies in Professional Geropsychology, which are a collection of competencies organized around attitudes, knowledge, and skills essential to work with older adults as well as training recommendations for those seeking to meet these competencies (Knight et al. 2009). While aspirational in nature, these competencies provide a comprehensive model to assess the training needs of those who work with older adults. It is noteworthy that the model recognizes that specialized training in geropsychology is not essential for all psychologists who work with older adults; however, as the patient issues become more complex, the need for specific training increases. As such the competencies are most applicable for those who wish to primarily work with older adults.

In their seminal paper, Knight et al. (2009) define the attitudes, knowledge, and skill competencies for geropsychology practice. The competencies list is meant to be an aspirational list to be used for programs and clinicians seeking training in geropsychology to create and evaluate a plan of training at different levels, including graduate, internship, postdoctoral, and post-licensure levels. Core attitudes include (1) the goal of practicing within one’s competence, (2) recognizing how one’s attitudes and beliefs about aging will affect her or his work with older adults, (3) being aware of individual diversity in all its forms, and (4) continually increasing one’s knowledge, understanding, and skills related to working with older adults. Four domains of knowledge in the Pikes Peak Model include normal adult development and aging; the interaction of life span

development with increased neurological and health problems in later life; assessment methods and tools suitable for assessing older adults; and using knowledge of developmental, cohort, contextual, and systemic issues to inform interventions with older adults. There are six aspects of training that are considered critical parts of a training program for a geropsychologist: (1) understanding of normal aging; (2) supervision by professional geropsychologists; (3) gaining of self-awareness about one's responses to aging that vary by health status, cultural and individual identities, and diverse historical cohort experiences; (4) training in a variety of settings; (5) interprofessional team training; and (6) ethical and legal issues and practice standards that are involved in work with older adults.

Readers are encouraged to review Knight and colleagues' (2009) article in *American Psychologist* for a complete overview of the Pikes Peak competencies in geropsychology.

### Council of Professional Geropsychology Training Programs (CoPGTP)

In addition to these comprehensive competencies, the Pikes Peak conference also produced the Council of Professional Geropsychology Training Programs (CoPGTP), which includes universities, internship training sites, and postdoctoral training sites. The purpose of CoPGTP (often pronounced "COG-TIP") is to further the advancement of geropsychology through promotion of geropsychology-focused education and training that is consistent with the Pikes Peak model of geropsychology. CoPGTP also provides a forum for training programs to share resources among themselves and with those interested in pursuing specialized geropsychology training.

In 2009, CoPGTP formed the Task Force on the Assessment of Geropsychology Competencies to develop an assessment tool for training programs and supervisors to evaluate trainees' development in the Pikes Peak competencies as well as for those psychologists that wish to engage in a self-assessment of their own training needs. As such, professionals who use the tool are able to

address the needs of many at different points in their training and careers (i.e., graduate school practicum, internship, postdoctoral fellowship, and post-licensure) (Karel et al. 2010a). The Pikes Peak Geropsychology Knowledge and Skill Assessment Tool includes detailed behavioral descriptors of the Pikes Peak competencies, which are then rated along a continuum that spans from novice to expert (Karel et al. 2010a). It is currently freely available through CoPGTP.

CoPGTP also provides extensive resources for those who wish to pursue training in geropsychology. Through its website ([www.copgtp.org](http://www.copgtp.org)), CoPGTP provides a directory of undergraduate, graduate, internship, and postdoctoral training programs with a geropsychology emphasis. Resources for post-licensure psychologists include listings of aging-focused APA videos and web-based trainings as well as recommended readings, websites, and related training opportunities for the Pikes Peak competencies.

### Levels of Training in Geropsychology

Given the growing number of older adults, the number of future geropsychologists in the "pipeline" will likely continue to be insufficient. The field thus relies on established providers to seek out specialized training in geropsychology so as to best meet the needs of their diverse older clients. Formal training is one of the best predictors of practice patterns, as those who received formal training in geropsychology are most likely to practice with older adults (Qualls et al. 2002; Hyer et al. 2005). To provide the greatest exposure to geropsychology and increase the likelihood a trainee will specialize in geropsychology, training should occur across the educational continuum beginning in undergraduate coursework, then to graduate studies, predoctoral internships, and postdoctoral fellowships. Training should not end after licensure, as there are numerous continuing education opportunities designed to meet the needs of practitioners who desire additional training in geropsychology (Hyer et al. 2005).

**Undergraduate Coursework.** Geropsychology is firmly rooted in a lifespan development theory

and as such has much overlap with developmental perspectives (Qualls 2010). In addition to the traditional coursework in human development, colleges and universities now offer certificates or degrees in adult development and aging. Universities often offer courses in adult development and aging or lifespan development. In addition to specific courses in aging, it is recommended that aging topics be interwoven into a variety of psychology courses, such as Introductory Psychology, Sensation/Perception, Human Sexuality, and Cognitive Neuroscience (Vacha-Haase 2010). Readers are encouraged to review Whitbourne and Cavanaugh (2003) for detailed instructions as to how to incorporate aging throughout undergraduate psychology coursework.

For those students who wish to seek out graduate training in psychology, their undergraduate coursework should be augmented with opportunities for clinical practice and/or research. Clinical experiences are of great benefit as they can help trainees decide if they would like to seek careers in mental health and also provide an opportunity to select a population of interest. Many graduate programs require the trainee to apply to certain tracks (e.g., health psychology, geropsychology, adult clinical). Thus, by gaining some clinical experience prior to applying to graduate school, the trainee is best able to make an informed decision regarding her or his choice of graduate training programs. In addition to gaining clinical experiences prior to graduate school, a competitive trainee will also obtain research experience. As many if not most graduate programs are based in a scientist-practitioner or scholar-practitioner model, research training makes an applicant more competitive. Opportunities for participation in research can typically be found through faculty in psychology departments, and some universities offer class credit for research experience. Trainees are encouraged to consult with faculty in Psychology, Gerontology, and Social Work departments for research training experiences. Ideally these experiences would lead to peer-reviewed posters and presentations at local, regional, or national conferences or peer-reviewed journal publications.

**Graduate Studies.** Psychologists that receive specialized training in aging are more likely to provide services to older adults (Qualls et al. 2002); thus, graduate training in professional geropsychology is an important piece of the field's efforts to meet the needs of the aging society. The APA's Division 20, Adult Development and Aging, maintains a current listing of doctoral training programs that offer training in geropsychology (<http://www.apadivisions.org/division-20/publications/graduate-studies/index.aspx>). As of 2015, there were 115 doctoral training programs listed in the United States and 15 international programs.

Currently, there are two primary models for graduate training in geropsychology. The first of these is training in a generalist psychology program with extra coursework available in aging, which is by far the most common model of training. More recently, doctoral programs focused on professional geropsychology have been developed. Both types of programs provide opportunities for trainees to obtain training and experience in working with older adults, but the programs differ in the types of training experiences offered as well as the opportunities to work with faculty who have a shared interest in working with older adults (Qualls et al. 2010).

**Generalist Programs.** Traditionally, options for training in professional geropsychology were limited to those provided within a generalist-training program. These training programs may have a few geropsychologists on faculty, or adjunct faculty, who provide mentorship to students with an expressed interest in geropsychology. These generalist-training programs may be driven by a mentorship model of admission in which trainees are recruited to work with a specific faculty member; thus, having an expressed interest in geropsychology at the time of program entry is beneficial. Alternatively, a generalist-training program may recruit strong applicants without an expressed interest in geropsychology and then incorporate work with older adults into the curriculum to promote the study of geropsychology. Generalist

programs may offer aging-focused coursework, such as Adult Development and Aging or Psychology and Aging. Other courses, such as Neuropsychology, Lifespan Development, and Cognitive Psychology, will include aging-relevant topics, though that is not the focus of those courses. Generalist programs may offer practicum experiences that specialize almost exclusively in older adults, such as a long-term care setting or a geriatric memory disorders clinic. If specialized practicum experiences such as these are not available, trainees are encouraged to tailor their practicum experiences to the older adult population whenever possible. For example, a trainee in a community-based mental health clinic may choose to focus on treating clients aged 65 or older or younger adults experiencing caregiver stress. Opportunities for research with older adults are also a possibility in generalist program, and trainees may be encouraged to choose an aging-related dissertation topic.

*Specialist Geropsychology Programs.* These programs offer formal training in geropsychology that is guided by the Pikes Peak competencies. While a generalist-training program may have one or two geropsychologists on faculty, programs with a formal geropsychology track have numerous faculty with expertise in aging that form a core of mentors for trainees in the track. Trainees are recruited specifically to the geropsychology track and matched to one of the core faculty mentors. Matching several students to geropsychology faculty at a given time provides the opportunity for a cohort of trainees that share similar professional interests (Qualls et al. 2010). As these programs follow the Pikes Peak model, courses are designed to provide trainees with the foundational knowledge, skills, and attitudes for the practice of professional geropsychology. Similarly, practicum experiences are selected to further develop competencies defined by the Pikes Peak model and provide opportunities for advanced training with older adults. Research in this track is aging specific, and trainees often conduct research with their faculty mentors, in

addition to their aging-focused dissertations. Whether a trainee chooses a generalist program or one with a specialty track in geropsychology, they should actively participate in clinical, research, and professional development activities throughout their graduate career so as to be most competitive for doctoral internships. In 2014, 20.2% of applicants did not match to an internship (Association of Psychology Postdoctoral and Internship Centers 2015). Successful applicants have broad clinical training experiences in treatment *and* assessment, a strong track record of publications and presentations at professional conferences, and participation in professional societies as student members or even student representatives. To achieve these benchmarks, trainees are encouraged to consult with their faculty mentors and seek out training opportunities early and often.

*Doctoral Internships.* Doctoral programs in clinical and counseling psychology require the completion of a yearlong internship prior to the awarding of the graduate degree. Doctoral internships represent an opportunity for advanced clinical training across a variety of settings including community-based clinics, university settings, private hospitals, academic medical centers, forensic facilities, and Veterans Affairs Medical Centers. Each of these settings has options for trainees to work with older adults as part of structured clinical rotations; thus, most trainees will complete internship having gained some experience working with older adults (American Psychological Association 2004). This infusion of older adults throughout clinical rotations reflects the growing number of older adults in healthcare systems that are receptive to mental health services (Karel et al. 2010b).

If training is viewed sequentially, geropsychology training at the internship level should build upon the competencies (i.e., attitudes, knowledge, and skills) that began in undergraduate training and were further developed in graduate school (Hinrichsen et al. 2010), a view that is consistent with the Pikes Peak model. Internship represents a unique opportunity for trainees to

work with older adults in new settings with greater independence, though while still under supervision of experienced providers. There is variability among internship training programs in terms of training model (e.g., scientist-practitioner, scholar-practitioner, clinical scholar) and structure of the training year. Trainees may work half time or full time on rotations that are 3, 6, or 12 months long. These advanced clinical experiences are augmented with regular didactics and the promotion of trainees' professional development through faculty mentorship.

While most internships offer options for work with older adults within clinical rotations, some internships have a specific geropsychology track within the larger training program. These track-specific programs offer clinical rotations that focus on older adults, such as community living centers or nursing homes, home-based primary care, and geriatric neuropsychology clinics, as well as possibilities for trainees to work in settings that are complementary to their geropsychology training, such as behavioral medicine or palliative care. Programs such as these may also have clinical-research rotations focused on aging-related issues, which may suit those interested in an academic or research career. Internships with a geropsychology track often have regular aging-focused didactics and case conferences with the geropsychology faculty.

Several factors may influence a geropsychology trainee's decision to apply to an internship program including number and type of clinical rotations, number of geropsychology faculty, availability of aging-related research, didactics offered, desire to pursue future board certification, location of internship and cost of living in the area, and a number of other personal factors. No matter which type of internship program is selected (i.e., generalist vs. track-based), trainees with an interest in aging can use the Pikes Peak competencies assessment tool to inform their selection of clinical rotations as well as provide a metric to evaluate their development in the competencies throughout their internship year.

As trainees begin their internships in the summer and fall, their thoughts invariably turn to the next step in their professional career, which for

many is a postdoctoral fellowship. Trainees who have completed geropsychology training at the internship level will be competitive for a geropsychology postdoctoral fellowship (Hinrichsen et al. 2010).

**Postdoctoral Fellowships.** The goal of postdoctoral fellowships is to prepare trainees for independent practice and provide the supervised experience necessary for licensure in most states. Over the past two decades, numerous geropsychology fellowships have been developed for those who desire clinical and research training in geropsychology at the fellowship level. Most APA-accredited geropsychology postdoctoral fellowships are based in VA hospitals that also have APA-approved internship programs. Thus, there is often a sharing of resources, similar clinical experiences, and the opportunity for continued mentorship with geropsychology faculty. Postdoctoral fellowships differ from internships in the increased autonomy of the fellow as well as an increased emphasis on professional development and leadership skills (Hinrichsen et al. 2010). Many clinical fellowships also provide some amount of protected time for the pursuit of clinically relevant research.

In addition to traditional clinical postdoctoral fellowships, there are growing numbers of APA-accredited postdoctoral fellowships with a focus on aging-related clinical research. Many of these clinical research fellowships are hybrids, for example, with 75% of time spent in clinically relevant research and 25% of a fellow's time spent in the delivery of direct clinical services. Fellowships such as these are essential to the field of geropsychology as they provide protected time for trainees to refine a programmatic line of research that will lead to independent funding, thus continuing the tradition of geropsychologists leading in aging-related research.

**Continuing Education.** Most psychologists that treat older adults are not specialized in geropsychology and may have not been exposed to training opportunities with older adults. Continuing Education coursework in aging is becoming more commonplace to address this need. For instance, there has been a workshop titled "What You Need To Know About Working With Older

Adults” continually offered at the past several American Psychological Association conventions, with a high turnout. There are several professional societies that focus on older adults who often take the lead in organizing workshops similar to these, including the Society of Clinical Geropsychology (APA Division 12, Section 2), APA Division 20 (Adult Development and Aging), Psychologists in Long-Term Care, the Gerontological Society of America (GSA), and the APA Committee on Aging. These workshops are available at national or state conferences or in webinars. Most states require continuing education for licensed psychologists, and psychologists can fulfill these requirements by obtaining continuing education coursework in professional geropsychology. Psychologists can seek particular workshops that meet their own training goals as suggested by the Pikes Peak Geropsychology Knowledge and Skill Assessment Tool. In Europe, geropsychologists can become involved with the Standing Committee on Geropsychology within the European Federation of Psychologists’ Associations. Countries within Europe also have national organizations, such as the Portuguese Psychogerontology Association (Ribeiro et al. 2010). In Australia, geropsychologists can find professional opportunities within the Psychology and Ageing Interest Group of the Australian Psychological Society, and in New Zealand, geropsychologists can find similar opportunities with the New Zealand Psychologists of Older People (Pachana 2015).

## Board Certification in Geropsychology

The field of geropsychology reached a significant milestone in 2014, when it was granted board specialty status by the American Board of Professional Psychology (ABPP). Board certification demonstrates an expertise in a specialty area as determined by a series of peer evaluations by specialists in the field. This expertise is acquired through formal education and training in geropsychology as well as experience working with older adults. Interested applicants first complete the initial eligibility screening for

consideration by ABPP. Those applicants which pass this first level then must submit practice samples, which include a professional self-study statement and work examples, for peer review by those in the field. Finally, those who pass this second level of consideration are then approved to participate in an oral examination based partly on information in the practice sample. A complete listing of these requirements can be found on the ABPP website ([www.abpp.org](http://www.abpp.org)).

While board certification is not required for the practice of Clinical Geropsychology, it represents an important benchmark by which others can judge a professional’s expertise. As such, it is expected that more geropsychologists will seek out the training opportunities necessary for board certification in the field. During the development of the geropsychology board certification process, the intent of the American Board of Geropsychology (ABGERO) was to be as inclusive as possible. Thus, board certification should be possible for those with the essential education, training, and experience working with older adults.

## Cross-References

- ▶ [Clinical Issues in Working with Older Adults](#)
- ▶ [History of Clinical Geropsychology, Professional Practice Informed by the Science of Psychology and Aging](#)
- ▶ [Interprofessional Care](#)

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## Traumatic Brain Injury

Thomas J. Farrer

Department of Psychiatry and Behavioral Sciences, Duke University Medical Center, Durham, NC, USA

## Synonyms

Acquired brain injury; Brain injury; Concussion

## Introduction

Traumatic brain injury (TBI) constitutes a significant public health concern at all ages. Among older individuals, it is particularly problematic given the increased risk of mortality and morbidity in this age group. Understanding the impact of TBI on the aging brain is important, particularly given the increasing advancing age of the US population. Recent population-based data confirms that as age increases, patient disability, medical costs, and rates of hospitalization following

acquired brain injuries also increase (Chan et al. 2013). The following section of this *Encyclopedia* will provide a general discussion of TBI as it uniquely impacts older adults.

## Definition

Traumatic brain injury can be defined as damage to the brain after insult from being struck by or against another object or following rapid deceleration. This might include such mechanisms as assaults or motor vehicle accidents (MVA). However, among older adults, falls constitute the most common mechanism of injury.

TBI severity is on a spectrum from mild to severe. Classification of severity is typically characterized by clinical state, as reflected by Glasgow Coma Scale (GCS) score, the presence or absence of post-traumatic amnesia (PTA), and degree of loss of consciousness (LOC). Briefly, the GCS is a scale that measures behavior following a head injury (i.e., spontaneous eye opening, verbalization, and motor behavior upon examination). The score ranges from 3 to 15 and lower scores indicate more severe injury. Classification of mild, moderate, and severe TBI is summarized in Table 1. The GCS is typically assigned at the scene of the injury by medical personnel. PTA and LOC are often documented as well to characterize injury severity. Patients often do not know the history of their GCS scores at injury and in recovery, but may be able to answer questions about PTA and LOC.

Most TBIs are classified as mild, especially among older adults who are more likely to experience a ground-level fall as the source of injury. There is a distinction in the literature between *complicated* and *uncomplicated* mild TBI (mTBI) based on day of injury brain imaging

(CT or MRI scan). Abnormality on imaging is classified as complicated, whereas a negative scan is uncomplicated. Outcomes are typically worse for complicated injuries compared to uncomplicated.

## Pathophysiology

Understanding the pathophysiology of TBI among older adults begins with an appreciation of the natural morphological changes that occur as people age. Specifically, starting at the fourth decade of life, individuals begin to experience gradual cell death and cell morphological changes (Peters 2006), which leads to gradual volume reduction in the brain. This in turn results in reduced efficiency of neurotransmitter systems and synthesis of other brain chemicals important to cellular health and functioning. In addition, there are also substantial cerebrovascular changes that affect physiology and cognitive functioning via attenuated cerebral blood flow, reduced blood/oxygen delivery to brain parenchyma, and increased cerebrovascular burden. All of these changes to the brain occur naturally and account for some of the declines in cognition that occur with normal aging. These changes also result in a unique impact of TBI in the older adult brain and could account for worse outcomes for TBI in this age group.

Due to the nature of TBI, significant biomechanical force is placed on the tissue of the brain, which can impact the delicate cytoskeleton and long coursing axons of the neuron. Thus, brain parenchyma is susceptible to axonal injury from shearing and straining of the tissue. This disruption affects the ions of the cell and, therefore, the physiological functioning of the neuron (Bigler and Maxwell 2012). If injury is mild with minimal morphological change to the cell, the disrupted physiological functioning can normalize with no lasting consequence. However, more severe injuries will damage the cell and lead to loss of function and gradual degeneration of the cell (Maxwell 2013). In fact, traumatic axonal injury, or diffuse axonal injury, is the hallmark injury in TBI and has been documented in all injury severities (Bigler 2015). The effects of this type of

**Traumatic Brain Injury, Table 1** Classification of TBI severity

Severity	GCS	PTA	LOC
Mild	13–15	<1 day	0–30 min
Moderate	9–12	1–7 days	30 min–24 hr
Severe	<9	>7 days	>24 hr

injury are also understood in terms of brain region vulnerability. Bigler (2007) illustrates that the frontal and temporal poles of the brain are differentially affected in TBI due to the position of the brain in the anterior and middle cranial fossa. These areas of greatest biomechanical force in TBI make surrounding white matter and adjacent networks more vulnerable following TBI, including the corona radiata and corpus callosum (Bigler 2015). TBI also has an impact on the vasculature of the brain and capillaries are especially delicate and vulnerable to injury following TBI. Injury to the microvasculature of the brain has a downstream effect of reduced glucose and oxygen delivery and, therefore, attenuated hemodynamic functioning (Bigler 2015).

## Etiology and Epidemiology

The annual cost of TBI in the USA is approximately \$60 billion (\$45,000 per person) (Corrigan et al. 2010). Although relatively little is known about the cost of TBI among older adults, there are higher costs associated with increased complications and utilization in this age group. Specifically, age is associated with increased post-injury medical complications, with older adults having two times the incidence of seizure and urinary tract infection and three times the incidence of cardiopulmonary arrest. Older adults also have an increased length of stay (LOS) with an average of 5 additional days in acute rehabilitation relative to their younger counterparts and more in-hospital procedures (Frankel et al. 2006; Dams-O'Connor et al. 2013). TBI also has a significant long-term impact on functioning. Selassie et al. (2008) reported that 43% of TBI patients continued to have lifelong TBI-related disability. Increased age is associated with higher rates of discharge from acute care to a long-term care facility rather than home.

The etiology of TBI in the general adult populations includes falls (28%), MVA (20%), struck by/against an object (19%), assault (11%), others (13%), and unknown (9%) (Langlois et al. 2006). As noted above, falls are the most common cause of TBI for older adults (61% for

those ages 65+). Research on these mechanisms indicates that as age increases, TBI due to falls increases, while TBI due to MVA declines (Chan et al. 2013). General incidence rates of TBI in the USA are between 1.5 and 2 million new cases per year. Of the 1.4 million emergency room visits for TBI annually, approximately 140,000 constitute older adults age 65+ with a majority being age 75 and older (Coronado et al. 2013). Population data from 2002 to 2006 indicates almost 30% of TBI-related hospital admissions were from older adults age 65+ with a 20–25% increase in trauma center admissions for individuals age  $\geq 75$  years old (Dams-O'Connor et al. 2013). Chan et al. (2013) found a steady rate of increased hospitalization based on age. That is, for ages 65–74, 11% of patients are hospitalized while 50% are hospitalized for ages 75–84 and 63% for those age 85+. In the general population, the annual incidence of TBI-related mortality is approximately 51,000, 27% of which are older adults (Coronado et al. 2013). Mortality risk following TBI increases with hypotension, lower initial GCS scores, and age 85 and higher (Dams-O'Connor et al. 2013). There are several other factors that moderate the incidence and impact of TBI among the general population. Specifically, males are two times more likely to sustain a TBI than females (Frost et al. 2013). Regardless of age, alcohol increases the risk of TBI. Despite lower rates of drinking among older adults, blood alcohol levels are similar among younger adults and older adults who survive TBI (Frankel et al. 2006). Other epidemiology studies indicated that American Indian/Alaska Natives and African Americans sustained higher rates of TBI relative to other groups (Corrigan et al. 2010).

TBI outcomes are largely based on the severity of injury, lesion location, and the general health and comorbidities of the patient. Almost 43% of adult TBI patients will go on to have long-term disability, including changes to cognitive and emotional functioning, activities of daily living, and motor and sensory abilities. TBI also appears to increase the risk of other conditions, including dementia. For older adults in the workforce with TBI, disability status is related to age and gender. Selassie et al. (2008) demonstrated that older

cohorts age 65 and older are nearly four times more likely to have disability than younger individuals age 15–64 and that women are 10% more likely to suffer disability than men. Taken together, this suggests that women age 65 and older are most likely to have long-term disability following TBI. The rate of improvement is also slower post-injury for elders than it is for younger adults. Frankel et al. (2006) compared older adults ages 55–89 to adults age 16–44 and demonstrated that older adults with TBI have reduced cognitive independence and slower recovery of functioning during hospitalization.

Age also seems to impact long-term care and discharge planning for older adults. Older adults are more likely to be discharged to long-term care facilities rather than home (Chan et al. 2013). Similarly, older adults are less likely to discharge to community settings (81%) compared to younger adults with TBI (94%) (Frankel et al. 2006). Multiple factors impact discharge planning for this age group. First, greater length of stay (LOS) from the TBI-related hospitalization is associated with greater chance of discharge to long-term care. Next, the etiology of the injury is also related to discharge in that injuries related to falls suggest pre-existing functional changes, whereas injuries related to MVA suggest higher premorbid functioning. That is, patients who sustained injury due to falls are more likely to be released to long-term care facilities compared to injuries related to MVA. Females are also more likely to be released to long-term care rather than home, ostensibly because they often outlive their male partners and thus do not have a caregiver at home (Brown et al. 2012).

### Diagnosis, Presentation, and Outcomes

A diagnosis of TBI is typically based on clinical variables, such as level of consciousness, which occurs on a continuum of coma, vegetative state, and minimally conscious state (Kwasnica et al. 2008), and imaging variables that reveal acute injury (e.g., hemorrhage/hematoma, skull fracture, and diffuse axonal injury). The severity of the injury is based on GCS, PTA, and LOC, as

discussed above. Educating the patient and family about the nature and severity of the injury is critical to setting realistic expectations for outcomes.

Given that older adults, by a function of age alone, are vulnerable to disorders of aging that affect cognition, it can be challenging for clinicians to differentiate new TBI-related symptoms from a latent degenerative process or whether cognitive decline from a dementia process is being exacerbated by a more recent injury. A careful history of premorbid cognitive and functional status will be essential to determine the time course and possible contributions to cognitive weaknesses.

In younger patients, TBI outcomes are often related to functional goals, such as a return to work or level of independence. Because many elders are retired or already dependent on others for care in some manner, functional outcomes after TBI will again have to consider social, medical, and psychiatric history prior to injury. Careful delineation of demographic variables such as age, education, occupational status, and history, combined with lesion location and size, medications and comorbidities, and substance use history are important when attempting to determine contributing factors and outcomes over time (Moretti et al. 2012). The clinical presentation of TBI is highly variable and is largely dependent on the mechanisms of injury and injury severity.

### Neuropsychological Outcomes

The diffuse nature of axonal injury in TBI often affects the efficiency of network connectivity and results in slowed processing speed. As noted above, the differential impact to frontal and temporal pole regions can lead to focal neurocognitive changes. Briefly, those with orbital and medial frontal lesions often present with sharp changes to affect social/emotional functioning. More dorsolateral frontal lesions can result in changes in attention and executive functioning. Traumatic brain injury is also often associated with irritability and agitation (Flanagan et al. 2008). Individuals with parietal and right

hemisphere lesions may present with anosognosia or lack of awareness of their condition. Sensory and motor changes can occur with focal lesions to either hemisphere, and individuals with left hemisphere lesions may have aphasia or more subtle language changes such as dysnomia, inefficient repetition, or semantic retrieval. Regardless of the injury, acute presentation often results in changes in mental status and reduced decision-making capacity. Patients may also present with hemiparesis, decreased tone, and/or weakness, which can affect critical placement and supervision planning post-discharge. Mental status and PTA can also fluctuate dramatically in the acute stage of injury and stabilize and resolve in part over time. Noncognitive mediator variables such as fatigue, pain, medications, and rehabilitation demands should also be considered in monitoring cognitive and functional outcomes.

As noted briefly above, there is compelling evidence that TBI increases the risk of dementia in elders. Recent research shows that a history of TBI increases the risk of early-onset Alzheimer's disease (Mendez et al. 2015). TBI increases the susceptibility of the brain and may accelerate the onset of dementia (Moretti et al. 2012). In a large study of 164,661 TBI patients, the rate of new dementia diagnosis and age of diagnosis were compared between a TBI group and an orthopedic injury (OI) control group. Here, adults were age 55 or older at baseline and follow-up was done at least one year post-injury. Overall, those with TBI were more likely to have a diagnosis of dementia at follow-up and were more likely to receive a diagnosis at an earlier age of onset relative to the OI controls (Gardner et al. 2014). Also, the severity of injury predicted age of onset with moderate to severe injuries having an earlier impact than mild injuries. In a follow-up study, this same research group found that TBI also increases the risk of Parkinson's disease (PD) and that moderate to severe injuries had increased risk relative to mild injuries and that as the number of injuries increases, so does the risk of PD (Gardner et al. 2015).

In summary, TBI among older adults is unique in terms of etiology, epidemiology, pathophysiology, and impact. Older adults are at an increased

risk of TBI from falls and have a greater risk of long-term physical and cognitive disability and increased risk of dementia following TBI. Given our aging population, additional research is warranted to establish sound risk and prevention measures, as well as evidence-based treatments to manage the sequelae of TBI.

## Cross-References

- ▶ [Aging and Quality of Life](#)
- ▶ [Cognition](#)
- ▶ [Clinical Issues in Working with Older Adults](#)
- ▶ [Caregiving and Carer Stress](#)
- ▶ [Challenging Behavior](#)
- ▶ [Cognitive Compensation](#)
- ▶ [Delirium](#)
- ▶ [Disability and Ageing](#)
- ▶ [Neuropsychological Consequences of Chronic Disease in Older Persons](#)
- ▶ [Pain and Pain Management](#)
- ▶ [Palliative Care](#)

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# V

## Vascular and Mixed Dementia

John M. Starr<sup>1</sup> and Katherine E. Walesby<sup>2</sup>

<sup>1</sup>Alzheimer Scotland Dementia Research Centre, University of Edinburgh, Edinburgh, Scotland, UK

<sup>2</sup>Alzheimer Scotland Dementia Research Centre and Centre for Cognitive Ageing and Cognitive Epidemiology, University of Edinburgh, Edinburgh, Scotland, UK

### Synonyms

Binswanger's disease; Multi-infarct dementia; Poststroke dementia; Vascular dementia; Vascular cognitive dysfunction; Vascular cognitive impairment; Vascular neurocognitive disorder

### Definition

As indicated by the number of synonyms, the definition of vascular dementia (VaD) is yet to be agreed across the world. There are two main issues: first, whether dementia is an appropriate term to capture the state that arises due to cognitive decline and, second, the delimiting of the degree or type of vascular disease that can be said to be causally linked to this state. There is a third, subsidiary issue, and that is whether the definition is being made for the purpose of the rigorous nature of research or the less exacting

requirements of clinical practice. At present, there are three main definitions: (1) the NINDS-AIREN criteria (Roman et al. 1993) for vascular dementia, usually applied in research; (2) the DSM-V criteria (American Psychiatric Association 2013) for vascular neurocognitive disorder, mainly used in the USA; and (3) the ICD-10 criteria for vascular dementia, mainly used in Europe (the WHO is due to release the ICD-11 coding taxonomy in 2018).

The NINDS-AIREN criteria (Roman et al. 1993) comprise three elements. First, there has to be dementia which is defined by decline in memory and *two* other domains of cognitive function to an extent that this interferes with activities of daily living which cannot be attributed to physical impairments (e.g., secondary to stroke). Second, cerebrovascular disease must be present, defined by specific deficits on neurological examination *and* evidence of related vascular insults (infarcts, white matter hyperintensities (WMHs)) on neuroimaging. Third, dementia and cerebrovascular disease must be causally related as inferred by cognitive decline within 3 months of a stroke, abrupt deterioration in cognitive functions, or a stepwise fluctuating course of cognitive decline. The diagnosis requires the exclusion of delirium, severe aphasia, psychosis, or other significant diseases of the brain. The diagnosis is supported by features of early gait disturbance (small steps, Parkinsonian gait), unsteadiness and falls, urinary frequency not associated with urological disorders, pseudobulbar palsy, and

changes in personality or mood (abulia, depression, emotional incontinence). A diagnosis of possible vascular dementia can be made when the clinical features are not supported by neuroimaging evidence, or where a clear temporal relationship with a cerebrovascular event is absent, or the course is of gradual onset and progression but cerebrovascular disease is present. A definite diagnosis can only be confirmed by histopathological examination of brain tissue. The criteria advise against making a diagnosis of mixed dementia when features of vascular dementia occur in the context of Alzheimer's disease (AD), but instead suggest labeling this as Alzheimer's disease with cerebrovascular disease.

The DSM-V criteria (American Psychiatric Association 2013) abandon the term dementia and instead use the term neurocognitive disorder. Neurocognitive disorders can be considered as major or mild. A diagnosis of a major neurocognitive disorder requires cognitive decline to a degree that it interferes with activities of daily living and is not due to delirium or some other brain disorder. In contrast to previous definitions, this can occur if only a single cognitive domain is affected, that is, the historic requirement of "global" cognitive decline required for a diagnosis of dementia is abandoned. By contrast, mild neurocognitive disorders are associated with moderate cognitive decline that does not affect activities of daily living. An example of this would be what was previously termed amnesic mild cognitive impairment. If formal psychometric testing is undertaken, major neurocognitive disorders are those where test scores fall below the third centile or two standard deviations below the population mean. Scores for mild neurocognitive disorders fall between the third and sixteenth centiles, that is, less than one standard deviation below the population mean, but not less than two standard deviations below the population means. However, adjustment may be needed for the effects of premorbid IQ (Rentz et al. 2004; Starr and Lonie 2008), and also the correlation between the degree of cognitive deficit and the impact on activities of daily living is not absolute (Burton et al. 2009).

Moreover, the domains DSM-V considers with regard to psychometric testing are complex attention, executive function, learning and memory, language, perceptual motor, and social cognition. The first five are captured as domains within the commonly used Addenbrooke's Cognitive Examination (and its revised versions) (Mathuranath et al. 2000; Mioshi et al. 2006; Hsieh et al. 2013). DSM-V also allows classification of neurocognitive disorders with or without behavioral disturbance and in terms of severity (mild where instrumental activities of daily living are preserved, moderate where basic activities of daily living are affected, severe where the person is fully dependent). For a diagnosis of vascular neurocognitive disorder, a vascular etiology must be inferred from a temporal relationship of onset to a cerebrovascular event or decline affects mainly complex attention or fronto-executive function. There must be evidence for cerebrovascular disease from history *or* clinical examination *or* neuroimaging that could explain the cognitive deficits. Probable vascular neurocognitive disorder may be diagnosed if one of the three conditions is present: (1) neuroimaging evidence of significant parenchymal injury, (2) temporal relationship of cognitive deficit to a cerebrovascular event, or (3) clinical and genetic evidence for cerebrovascular disease. Possible vascular neurocognitive disorder can be diagnosed with the above criteria in the absence of evidence from neuroimaging and/or temporal relationship. To diagnose vascular neurocognitive disorder with behavioral disturbance, there may be delusions or hallucinations or changes in other behavioral domains of (1) negative emotion (anxiety, depression, anger), (2) detachment (social withdrawal), (3) disinhibition (impulsivity, dangerous risk taking, agitation), and (4) antagonism (disrespectful, irresponsible, violent).

ICD-10 criteria (World Health Organization 1993) state that vascular dementia is the result of infarction of the brain due to vascular disease, including hypertensive cerebrovascular disease. The infarcts are usually small but cumulative in their effect. Onset is usually in later life. There are four possible diagnostic codes:

**Vascular and Mixed Dementia, Table 1** Key differences between the main diagnostic criteria for vascular dementia and its equivalent

	NINDS-AIREN	DSM-V	ICD-10
<b>Cognition</b>	Memory plus two other domains	One domain, memory decline uncharacteristic	Memory plus one domain. Memory decline characteristic
<b>Daily activities</b>	Affected to any degree not due to physical impairments	May only affect instrumental activities. Impact of physical deficits not considered	Defined in terms of impact on social behavior
<b>Behavioral and psychological symptoms</b>	Abulia, emotional incontinence, depression supportive of diagnosis but not necessary	Separate classification if negative emotion, detachment, disinhibition, or antagonism present	Decline in emotional control or motivation or social behavior essential to diagnosis
<b>Neuroimaging</b>	Essential evidence of cerebrovascular disease	Evidence of cerebrovascular disease not essential for diagnosis	Infarcts or foci of destruction essential

- F01.0 Vascular dementia of acute onset usually develops rapidly after a succession of strokes from cerebrovascular thrombosis, embolism, or hemorrhage. In rare cases, a single large infarction may be the cause.
- F01.1 Multi-infarct dementia is largely cortical, gradual in onset, following a number of transient ischemic episodes which produce an accumulation of infarcts in the cerebral parenchyma.
- F01.2 Subcortical vascular dementia includes cases with a history of hypertension and foci of ischemic destruction in the deep white matter of the cerebral hemispheres. The cerebral cortex is usually preserved.
- F01.3 Mixed cortical and subcortical vascular dementia is a mixture of F01.2 with either F01.0 or F01.1.

Codes F01.8 and F01.9 are reserved for rarer or unspecified causes. For an ICD-10 diagnosis of dementia to be made, there must be evidence of decline over at least 6 months in both verbal and nonverbal memory together with deficit in at least one other cognitive domain. In addition there must be decline in emotional control or motivation, or a change in social behavior, manifest as at least one of the following: emotional lability, irritability, apathy, or coarsening of social behavior. ICD-10 dementia can be further coded as mild, moderate, or severe and additional features of delusions, hallucinations, and depression can be appended.

Table 1 summarizes key differences between these criteria. It can be appreciated that DSM-V diagnosis of a vascular neurocognitive disorder is the most encompassing, whereas NINDS-AIREN is strictest in terms of cognitive features and ICD-10 in terms of behavioral and psychological symptoms.

Mixed dementia, which is criticized in the NINDS-AIREN criteria, relates to a state where both Alzheimer’s disease (AD) and vascular dementia (VaD) clinical features and/or pathology is present. ICD-10 does not have a specific classification for mixed dementia, but does have code F03 for unspecified dementia where it is not possible to determine a single dementia etiology. Similarly, there is no specific category in DSM-V.

**Implications arising from the definition**

The major differences in how vascular dementia is defined raise serious challenges for clinicians and researchers. For example, the epidemiology varies depending on the diagnostic criteria applied. Similarly, the effects of interventions in the condition are difficult to generalize from samples diagnosed with one set of criteria to populations diagnosed by another set. Indeed, DSM-V is so recent that few studies have drawn on these criteria as yet, so knowing how many people are affected by a major vascular neurocognitive disorder is problematic let alone extrapolating findings from previous



studies of vascular dementia to decide on appropriate treatments. It is hardly surprising, then, that vascular dementia is relatively under-researched compared with Alzheimer's disease. If the situation is fraught for VaD, how much more so for so-called mixed dementia where a widely agreed set of diagnostic criteria is entirely lacking. Yet, as populations age, this may, in fact, emerge as the commonest form of dementia encountered in clinical practice.

### **Vascular Contributions to Alzheimer's Disease**

Conventionally, Alzheimer's disease is considered to be a neurodegenerative disorder, typified by the presence of senile amyloid plaques and tau containing neurofibrillary tangles in the brain. Diagnostic criteria for AD usually exclude this diagnosis in the presence of significant vascular disease (e.g., a large infarct) on neuroimaging. Nevertheless, the same vascular risk factors that increase risk of VaD – hypertension, diabetes, etc. – also, in midlife, increase the risk of AD. The mechanisms for this remain unclear. Careful neuropathological examination, however, suggests one likely pathway. In the Religious Orders Study (Bennett et al. 2012) set in the USA, AD was more likely to be diagnosed in the presence of cerebral infarcts. Similar findings emerged from the UK-based MRC-CFAS study (Neuropathology Group 2001). Thus, in many cases where AD has been diagnosed clinically, there is, in fact, a mixture of AD and vascular pathology which might be termed a “mixed AD-VaD” dementia. The MRC-CFAS data indicate that white matter hyperintensities (WMHs) on MRI are more common in AD than normal controls, though it is unclear to what extent this indicates cerebral ischemia (Gouw et al. 2008).

### **The Blood–Brain Barrier and Vascular Dementia**

One mechanism proposed by the MRC-CFAS investigators to explain increased WMH in AD

is increased blood–brain barrier (BBB) permeability accompanied by microglial activation. A subsequent study (Viggars et al. 2011) confirmed neuropathological changes to the BBB occurred early in AD and was associated with disease progression. BBB dysfunction is also associated with lacunar infarcts and WMHs where conventional vascular risk factors are less important than they are in large cortical infarction and is therefore proposed as underpinning a different end of the spectrum of VaD (Wardlaw et al. 2003). The key change in the BBB is the loss of tight junctions between endothelial cells. This allows increased passive permeability of water and various ions, but, probably more importantly, the tight junctions serve to ensure the polarity of transport of moieties across the cell. Transporter proteins and ion channels set in the cell's semipermeable membrane are free to move, but the tight junctions act as a barrier to this movement. Hence, a transporter such as the glucose transporter type 1 (GLUT1) will be oriented to transport glucose from outside the cell to inside the cell where the cell membrane is in contact with blood, but from the inside of the cell out to the interstitial fluid on the brain side. With the loss of tight junctions, the transporter is free to float and may end up in the opposite position so that glucose is being transported across the cell in the wrong direction. There is evidence that BBB dysfunction is associated with aging (Starr et al. 2009) and so may, in part, explain why VaD (and other dementia) is more common as people grow older.

### **Cognitive Decline Poststroke**

Having postulated that there is a spectrum of different mechanisms ranging across cortical and subcortical stroke, it is informative to consider whether there are differences in neuropsychological deficits depending on whether infarcts are cortical or subcortical. This is especially germane given that DSM-V criteria would define all poststroke cognitive decline as a vascular neurocognitive disorder, whether mild or major. It should be noted that brief cognitive screening

instruments, such as the Mini-Mental State Examination, do not perform well in the acute phase of a stroke. Fortunately, indirect cognitive assessments such as the Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE) (Jorm 1994), which contains items on both cognitive and activities of daily living performance, correlate well with more detailed directly administered psychometric tests (Starr et al. 2000). Around one-third of people who have a stroke will have persistent cognitive impairment whether the stroke is cortical or lacunar (Leys et al. 2005). Cognitive impairment is common after lacunar strokes, despite the lesions being small, suggesting that the impairment may be more pronounced due to small vessel disease (Makin et al. 2013). Subcortical lesions are typically associated with deficits in information processing speed and executive function. By contrast, cortical lesions may have a more discrete profile of deficits depending on the region affected (e.g., posterior cortical strokes have increased risk of visuospatial decline). However, such distinctions are not always easy since WMHs commonly coexist with cortical infarcts and cognitive decline not infrequently precedes and even predicts stroke. The clinical implications are that a tailored approach is required for communicating with people who have experienced poststroke cognitive decline and, by extension, vascular dementia. For example, people who have had cortical infarcts affecting the left middle cerebral artery territory may have particular difficulties with language, which will be fairly easy to pick up with cognitive assessments in everyday use, but those with right hemisphere infarcts may not have such pronounced language deficits, but may be more impaired in terms of visuospatial abilities (Annoni et al. 2003). It is likely that most patients will have a degree of information processing slowing affecting attentional abilities, hence the need to provide information more slowly and in smaller packages. It also follows that strategies that prevent the risk of stroke will also prevent a fair proportion of VaD, although interventions that ameliorate the deterioration of the BBB with age are as yet unclear.

## Treatment of Vascular Dementia

Although primary prevention by the control of risk factors is the most effective strategy, in terms of the population, many people who develop vascular dementia do not have a high-risk profile in terms of high blood pressure, poorly controlled diabetes, etc. There is evidence that a life-course approach may be beneficial since childhood IQ predicts VaD in later life (McGurn et al. 2008). Treatments of established VaD can be divided into non-pharmacological and pharmacological. Non-pharmacological therapies are not really differentiated from those used in AD or other dementias aiming to support the person to live well: probably, given the nature of cognitive deficits in VaD, reminiscence therapies are less appropriate than in amnesic disorders such as AD. As the disease progresses, this differentiated therapeutic approach is more applicable; for example, therapeutic interventions to ameliorate severe distress whether from physical, mental, or existential causes. There are occasional studies that suggest acupuncture and some forms of Chinese medicine may be effective in improving VaD symptoms (Jianchun Yu et al. 2006), and transcranial magnetic stimulation also appears promising, but as yet no large studies have been performed (Rektorova et al. 2005; Wang et al. 2010).

Pharmacological approaches can, themselves, be divided into those that aim at secondary prevention (e.g., of further strokes) by vascular risk factor control and those that seek to improve cognitive function and activities of daily living. There is a further, hopefully less used, category of drugs used to ameliorate distress due to agitation. With these are antidepressants since depression is relatively common in VaD. Drugs commonly used in AD, cholinesterase inhibitors and memantine, are less effective in VaD and are generally not licensed for use in this condition. One small trial combined nimodipine and acupuncture claimed some therapeutic benefit (Peng et al. 2007; Zhong et al. 2009). All in all, however, given how common VaD is, especially when combined with AD, therapeutic options are lacking.

One difficulty with therapeutic advances for VaD is a suitable animal model. Models based on large infarcts, such as the stroke-prone spontaneously hypertensive rat, do not capture the subcortical pathology that underpins much of VaD. With regard to large infarcts, much is already transferable from human stroke studies. However, hypoperfusion models have recently become available based on partially occluding a carotid artery which induce WMHs (Holland et al. 2011) and which disrupt axon–glial integrity and induce deficits in spatial working and reference memory tasks. Such models are probably better suited to investigate alternative pathways to VaD in humans and to test potential interventions.

In contrast to treatments aimed at improving or alleviating mental symptoms of VaD, treatment of physical aspects is more developed. In particular, impaired mobility, balance, and urinary continence are often features fairly early on in the course of VaD reflecting white matter damage and thus disconnection within the central nervous system. A patient with VaD, therefore, should have a careful assessment to detect, and hopefully correct, any risk factors for falls beyond those directly due to brain disease. These will include visual impairment, peripheral sensory deficits, orthostatic hypotension, inappropriate footwear, environmental hazards (poor lighting as well as physical obstacles), sarcopenia, joint deformities, etc. A simple test of mobility, such as a Timed Up and Go test, can be a good predictor of falls risk (Gunter et al. 2000; Shumway-Cook et al. 2000). If falls risk is high, consequences of falls should be considered such as the ability to call for help (alarm systems, remote falls monitoring systems, etc.) and likelihood of fractures (consider osteoporosis treatment perhaps measuring vitamin D and a DEXA scan). Urinary incontinence is common in all types of dementia and, again, noncentral nervous system factors should be evaluated. There is commonly a mixed picture of urge and stress incontinence in older women, especially those that have had children, and in older men prostatic disorders are highly prevalent. People with diabetes are at higher risk of VaD and may have urinary incontinence due to poor

glycemic control and autonomic neuropathy leading to incomplete bladder emptying. A protocolled continence assessment may make a major difference to quality of life. In short, the assessment of VaD should usually include a more holistic assessment of common age-associated conditions. A holistic assessment can be undertaken through a comprehensive geriatric assessment (CGA) (Ellis et al. 2011).

## Concluding Remarks

This entry discusses the complexity of vascular dementia including the terminology, the varying differences in the diagnostic criteria, and the impact of the degree or type of vascular disease on dementia.

In summary, the reason for defining vascular dementia differs in the context of whether it is for research or clinical practice, as well as in different locations worldwide. This has implications when translating different definitions between the three criteria and in different contexts. DSM-V is the most encompassing criteria; NINDS-AIREN is the strictest in terms of cognitive features; and ICD-10 focuses on behavioral and psychological symptoms.

There is a spectrum of vascular disease. Much is still to be known about how vascular disease impacts on the risk of subsequent vascular dementia. Certain characteristics such as vascular changes are more common in AD than normal controls which again makes understanding the vascular etiology in vascular dementia complex. Often it is difficult to determine a temporal relationship between vascular etiology and cognitive functional decline.

Depending on the diagnostic criteria used, vascular dementia may impact on one activity of daily living or a global impact on an individual's function. This is important when considering the person and the impact that vascular dementia may have on their day-to-day life as the level of cognitive functional deficit and impact on ADLs is not absolute. Indeed, there are a number of factors other than cognition affected in vascular dementia. Therefore, there is a need for a holistic

approach to care in the management of vascular dementia which can be best achieved through a comprehensive geriatric assessment.

## Future Challenges

Dementia remains a major public health concern both now and for the future. To date there has been limited research undertaken in the field of dementia and particularly so within the domain of vascular dementia.

There is an urgent need to know more about worldwide dementia epidemiology to help with planning service provision and health policy and understand the disease trajectory. The difficulty in terms of classification poses a challenge for this. Currently, this is more pronounced due to the inability to compare worldwide changing rates if different classifications are used.

Therefore, the way in which vascular dementia is defined poses future challenges both in research and clinical practice. Cognitive functional decline is often a spectrum of disease and not always easily categorized. For instance, the term “mixed dementia” (mixed AD-VaD dementia) is very common clinically but currently limited by the classification within the three criteria used. This poses a further future challenge. As the worldwide population ages, this may be the future commonest form of dementia encountered in clinical practice. Future studies, if diagnostic criteria for this are tightened, will be difficult to relate to earlier work when this diagnosis was not concrete in any of the three criteria. Likewise, any effects from future interventions will be difficult to generalize from one population to another if different criteria are used.

These are the current and future challenges within this field of dementia.

## Cross-References

- ▶ [Alzheimer’s Disease, Advances in Clinical Diagnosis and Treatment](#)
- ▶ [Delirium](#)
- ▶ [Mild Cognitive Impairment](#)

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## Vision Loss

Bonnie Adele Sturrock, Marian Saeed and Gwyneth Rees

Department of Surgery, Centre for Eye Research Australia, Royal Victorian Eye and Ear Hospital, Ophthalmology, University of Melbourne, Melbourne, VIC, Australia

## Synonyms

Age-related vision loss; Blindness; Eyesight impaired; Low vision; Sightlessness; Vision impairment

## Definition

Vision loss is a deterioration of eyesight or decreased ability to see as distinct from premorbid or normed visual acuity.

## Introduction

Vision loss is a leading cause of disability in older adults, and the prevalence of vision impairment

increases steadily with age. In fact, 285 million people worldwide are visually impaired with 65% of these people aged 50 or over (WHO 2010). While some forms of vision loss are caused by a biological predisposition to disease and may arise early in development, the most frequent causes of vision impairment are age-related eye diseases. Vision loss in older adults is the combination of normal age-related vision changes alongside diseases related to the eye and other systemic causes (Chou et al. 2009). Although 80% of vision impairment is preventable and/or curable, age-related eye disease can often go undetected due to the slow progression and asymptomatic nature of some conditions (Chou et al. 2009). Early detection and treatment for eye disease in older adults are crucial to avoid the detrimental impact of vision loss on quality of life (QoL).

Vision impairment can result in changes (over and above changes due to aging) to physical mobility (e.g., going to the shops), independence (e.g., driving), and accessing information (e.g., reading, watching TV), as well as a burdensome psychological impact made up of increased dependence and poorer QoL and mental health outcomes (Chou et al. 2009; Van Der Aa et al. 2015; Sturrock et al. 2015). Research shows the prevalence of depression to be double in aging persons with vision impairment when compared to matched samples of those without vision loss (Van Der Aa et al. 2015). Unfortunately, poor emotional well-being and mental health problems are often not recognized in this population (Dreer et al. 2008). This has led to recommendations that effective psychological screening measures are needed to bridge the gap and help identify mental health problems and lead the way to access to adequate support (National Institute for Clinical Excellence (NICE) 2009). However, research has identified various barriers to the provision of accessible psychological support for older people with vision impairment, and new models of care are urgently needed.

This entry will provide an overview of (1) age-related vision loss, its main causes, and prevalence; (2) the impact of vision impairment on physical and psychological functioning in older adults; (3) older adults' adaptation to vision

loss; (4) depression and anxiety in older people with vision impairment; and (5) current and novel approaches to the management of the psychosocial impact of vision impairment in older people.

## Understanding Vision Impairment, Its Main Causes, and Prevalence

Visual acuity or the ability to see central fine detail is most commonly measured via the Snellen eye chart or LogMAR chart which examines the ability of the person to identify letters of differing sizes typically from a distance of 6 m or 20 ft (in the USA). Visual acuity is recorded in a fraction with the top number representing the testing distance and the bottom number representing the smallest line read on the chart by the person. For example, a person with 6/6 (20/20) or "normal" vision can see what a normal person can see at a distance of 6 m (or 20 ft). The *International Statistical Classification of Diseases and Related Health Problems – 10th Edition* (WHO 2003) – lists five categories of severity for vision impairment: (1)  $<6/18$  to  $\geq 6/60$ , (2)  $<6/60$  to  $\geq 3/60$ , (3)  $<3/60$  to  $\geq 1/60$ , (4)  $<1/60$  to light perception, and (5) no light perception. The former two categories are colloquial terms for moderate and severe vision impairment, respectively, and the latter three are labeled "blindness." "Low vision" is also a widely used term referring to visual acuity of  $\leq 6/12$  and/or visual field loss of less than  $10^\circ$  from fixation that cannot be corrected with prescription lenses or ophthalmic treatment. A person's visual field is the area that they can see when the eyes are focused in one direction. Visual field loss can occur independently to visual acuity loss, meaning that a person may have good central vision but still have a reduced field of vision and therefore be deemed to have low vision or blindness because of this. Results from a visual field assessment help localize or define where in the visual pathway the vision impairment arises. For example, a lesion or pathology at the occipital cortex of the brain may result in whole right or left side blindness of the visual field (i.e., a hemianopia).

Globally, there are three main causes of vision impairment in older adults; age-related macular degeneration (AMD), glaucoma, and cataract. AMD is the chief cause of blindness in developed countries and the third leading cause of blindness worldwide. AMD results in central vision loss as it affects the macula area in the retina, which is the region responsible for fine detailed vision such as reading and recognizing faces. There are two types of AMD; dry and wet. Dry AMD is the most common form causing a gradual loss of central vision, while wet AMD causes more sudden and obvious central vision loss. Symptoms of AMD are distortion of central vision, blind spots, and loss of clarity and color vision. Approximately 5% of people between the ages 60 and 64 have early signs of the disease, and the prevalence of severe AMD doubles every 10 years after age 60.

Glaucoma is the second most common eye disease that causes vision impairment in older adults in both developed and developing countries. Glaucoma typically occurs when increased pressure in the eye causes damage to the optic nerve, although it can also present without increased eye pressure. The damage to the optic nerve results in visual field or side vision loss. The prevalence of glaucoma is approximately 2% in those aged 70–74, with the rate increasing to 6% of people aged 80 years and older. Due to the asymptomatic nature of glaucoma, a person may be unaware that they have it until they have lost peripheral vision, resulting in the prevalence of glaucoma being underreported.

Cataract is also a main cause of vision impairment in older adults and occurs due to clouding of the eye's clear lens. It is a progressive eye condition that hinders the eye's ability to focus images clearly. Vision with a cataract is often described as looking through a dirty window, and symptoms include blurred vision and light sensitivity. As cataracts are mainly related to the aging process, the prevalence increases from 9% of those aged 50–59 to over 70% of people aged above 80. Spectacle correction may be used in the early stages of cataract to improve vision; however, at the later stages, surgical intervention is required to improve vision. Due to the advances in surgical

techniques and accessibility of cataract surgical services, the rate of vision impairment due to cataracts in developed countries is significantly lower than the rate in developing countries. For example, according to the World Health Organization, 50% of blindness in Africa is a result of cataract as opposed to 5% in the USA and Australia.

Because the taxonomy uses best-corrected visual acuity (i.e., with prescription lenses), worldwide prevalence estimates of vision impairment are likely to be underestimated as they do not currently include those caused by uncorrected refractive error (i.e., without prescription lenses) (Dandona and Dandona 2006). In fact, uncorrected refractive errors, such as astigmatism and myopia, are the leading causes of vision impairment in the general population (Dandona and Dandona 2006), followed by unoperated cataract and glaucoma. Thus, epidemiological figures have been disputed based on out-of-date recommendations of visual acuity assessment and the variation of visual impairment classification currently listed in the nosology (Dandona and Dandona 2006). With increased life expectancy and increased population of older adults in many countries, it is expected that the risk of visual impairment due to these eye diseases will increase substantially in the coming decades. Currently, vision impairment is still a leading cause of disability in older adults and a global health problem. Worldwide estimates of low vision are currently at 246 million people (in addition to 39 million who are blind) with 82% of individuals with blindness being aged 50 years or over. The incidence of severe vision impairment has been found at 20% of those aged 65 and above, with the prevalence of severe vision impairment increasing to one in four people aged 75 years and older (Wahl 2013).

### **Physical and Psychological Functioning in Age-Related Vision Loss**

Aging, like any transition to a different phase of life, can be accompanied by profound change and uncertainty that affects well-being. Importantly, most change in older adulthood is permanent in nature. Older individuals start to increasingly

suffer from physical symptoms and chronic and systemic disease and, therefore, become more dependent on others and also face increasing loss in other forms (e.g., the death of a spouse). In fact, many older adults report decreasing QoL as a result of the aging process. Age-related QoL has been reported to rely on four key determinants: (1) aged persons' demands for specific guarantees, (2) aspirations and expectations for future QoL, (3) fears and anxieties, and (4) external factors presenting a threat to QoL (Fry 2000). In contrast to any stereotypes of older people being vulnerable, one qualitative study showed that aged persons clearly demand autonomy and independence in making decisions, including the decision to terminate life (Fry 2000).

Functional change in older adults is significantly compounded when they experience vision loss. Vision loss can make it more difficult for older adults to take care of their physical health, such as getting to the doctors, identifying poor health (e.g., blood glucose levels), and reading labels on prescriptions. Over and above natural aging, older people with vision impairment can have reduced autonomy and be confronted with immediate or progressive loss of independence in performing certain household tasks, leisure activities, driving a car, employment, or seeing family and friends. Such loss can raise feelings of grief in addition to feelings of sadness, anger, frustration, fear, or guilt related to day-to-day activities. This can often result in further reduced QoL (i.e., on top of health-related aging QoL) and significant psychological distress. Many individuals with vision impairment experience distress specifically related to their vision loss (i.e., "vision-specific distress") including embarrassment, frustration, isolation, sadness, worry, and feeling like a burden because of vision loss.

Because of the varying impact of vision loss across a range of areas of life, there has been a strong focus on the development and use of tools to assess QoL specifically in people with vision loss or with particular eye diseases. QoL is a multidimensional concept, and measures have been developed that capture the impact of vision loss and eye disease on physical, functional, emotional, and social well-being. Vision-related QoL

(VRQoL) is the global effect of vision impairment on emotional well-being, interpersonal relationships, and independence in functional activities. The development of these tools has highlighted the range of areas of life that are affected by vision impairment, including everyday tasks, accessing information, mobility, independence, ocular symptoms, treatment concerns, uncomfortable feelings (e.g., anger, frustration), social relationships, and communication. The tools have also assisted to identify determinants to psychological functioning in vision loss.

Significant determinants of poorer VRQoL found in the literature have included sociodemographic factors (e.g., gender, educational level), clinical factors (e.g., poor health, severity of eye disease and vision loss), and psychosocial factors (e.g., quality of social support and coping strategies). Naturally, there is a complex interplay between distress, QoL, and depressive symptoms in vision loss, and for a proportion of people, vision loss does *not* result in persistent distress or lead to deteriorating mental health outcomes. The type and degree of functional and psychological impairment vary, even in those individuals with comparable diagnoses. Also, severity of vision impairment does not adequately explain the effects of ophthalmologic disease on emotional well-being and functioning (Sturrock et al. 2015).

## Adaptation to Vision Loss

There is much variation in the way individuals adapt to vision loss (Sturrock et al. 2015; Dreer et al. 2008). Older adults may identify with the following psychological stages (Kuhner 2003):

1. *Lack of acceptance, uncertainty, and avoidance* – when a person has been informed of their diagnosis and is or is not attempting to determine the seriousness and extent of their physical impairment. Some people may initially deny their vision loss as a form of natural protection or defense. A person may hold the belief that problems associated with their vision loss are out of their control, are unsolvable, and are to be avoided at all costs.

2. *Acknowledgment of disruption and helplessness* – when the individual has come to a clear understanding that their vision loss is a serious limitation to day-to-day functioning. When this realization is made, some people may feel as if they are experiencing a crisis characterized by intense feelings of stress and dependence on others. They may also report feeling as if their condition controls their life and experience a great deal of pain, sorrow, sadness, and anger in relation to their vision impairment.
3. *Recovery of self-image and coming to terms with vision loss* – when the person acknowledges disruption caused by vision loss and makes various attempts to deal with the new situation, which can also be accompanied by strong emotions. Recovery can be in the form of beginning to adaptively cope with the controllable aspects of vision loss, for example, seeking social support, engaging in vision rehabilitation, or using problem-solving skills.
4. *Restoration of well-being and acceptance* – when the individual has acknowledged their vision loss, commenced using adaptive coping strategies, and begins to make room for painful emotions and thoughts that arise as a result of impairment.

With the aforementioned stages in mind, psychological functioning in vision loss can be impacted by the way the person views themselves in relation to their disability (Kuhner 2003). Because a person's self-worth or identity is partially related to specific roles and skills, such as being useful, being independent, and working toward achieving particular goals, it is likely that people who experience vision loss need to adjust to a new sense of the self. This sense of self is adjusted because the person begins to acknowledge that some of the things they could previously do are now not achievable and that they may need to rely on others to accomplish tasks. A challenge for people with vision loss is to derive self-worth and identity less on what they *do* and more on who they *are*; they are *not* their impairment. People with vision loss have their own personality, knowledge, skills, and goals and can still contribute, just as others without vision loss contribute in

various ways. While some life goals and future outlook may need to be adjusted, a person with vision loss can still rely on their values to guide them in living well.

Older adults with vision loss can still lead a meaningful life and experience satisfaction and happiness. Coming to terms with vision loss is a personal process, and sometimes people will oscillate between accepting their loss and fighting against it. Older adults who experience a gradual deterioration in vision, such as with AMD, may be more likely to experience ongoing loss. Nevertheless, because of their past experiences with loss, they may also become better equipped to deal with it as it occurs. It takes time to adjust to vision loss, and the duration is different for everyone.

The scientific literature has identified specific psychosocial factors that contribute to adaptation to vision impairment. For example, studies have found that adaptive coping strategies (such as using social support and assistive aids) predict better adjustment to vision impairment in adults (>age 18 years) (Senra et al. 2014), whereas avoidant coping has been associated with decline in VRQoL in older adults (mean age = 70 years) (Sturrock et al. 2015). The manner in which people think about their impairment is also important. For example, research has demonstrated that improved psychological adaptation to vision loss is associated with greater acceptance or tolerance of vision impairment, and poorer psychological outcomes in chronic health conditions are related to increased helplessness or perceived interference of symptoms in older individuals (mean age = 71 years) (Dreer et al. 2008). Another study exploring readiness for low-vision interventions, to assist adaptation to vision loss in older adults, demonstrated that the desire to maintain or regain independence, a positive attitude, and the presence of formal social supports served as facilitators, whereas barriers to readiness were limited knowledge of options and activity not being a priority (Mohler et al. 2015).

## Depression and Anxiety in Vision Loss

Emotional disorders in older people with vision impairment are common. Subthreshold anxiety

and depressive symptoms (i.e., symptoms that do not meet the criteria for a psychological disorder) are estimated to be present in approximately 35% of older people with vision impairment (Van Der Aa et al. 2015), which is at least twice as high as the prevalence of the general population. Research has determined that the prevalence of major depressive disorder is approximately 5–7% and anxiety disorders 7%, with agoraphobia and social anxiety disorder being the most prevalent in people with vision impairment (Van Der Aa et al. 2015). These percentages are considerably higher than the prevalence of emotional disorders in the general older population (Beekman et al. 1999). Importantly, depression and/or anxiety in vision loss can be seen as a two- or threefold disability, such that these conditions impact on the person's ability to function (e.g., engage in employment) additional to existing impairments to functioning due to low vision (e.g., ability to read).

Psychological determinants of anxiety symptoms in vision loss research are scant. However, a multitude of dynamic biopsychosocial factors may predict anxiety in older persons with low vision, such as negative social experiences, fear of falling (on top of fear of falling related to general aging), or perceived or actual stigma. One study focused on vision-related biological predictors to mental health with self-reported cataract, motion and contrast sensitivity, and reduced low-contrast visual acuity determining anxiety symptoms (Eramudugolla et al. 2013); nevertheless, psychological contributors were not explored. Depression in vision loss, on the other hand, has had much research attention. Identified predictors for depression in older people (mean age = 71 years) with vision impairment include vision-specific distress (Rees et al. 2013a) and poor adaptation to vision loss (Senra et al. 2014). The research suggests that indicators of detrimental coping and lack of acceptance of vision loss, such as distracting oneself from problems related to vision loss, concealing one's vision diagnosis from others, or withdrawing socially, should be identified and addressed early to prevent the development of mood and anxiety disorders.

## Management of Psychosocial Impact: Past Strategies and Current Novel Approaches

Because of the higher prevalence of emotional disorders in older people with vision impairment, psychological prevention and management strategies are crucial. Reviews of multidisciplinary low-vision rehabilitation services have found that these services primarily focus on functional ability and rarely target psychological outcomes. Low-vision rehabilitation focuses on clinical interventions such as training in visual aids and adaptive devices and skills training to enhance the use of remaining vision by occupational therapists and orientation and mobility specialists. While few “high-quality” outcome studies exist, a systematic review of standard low-vision services, which focused mostly on older adults (mean age of 70 years or over), demonstrated minimal impact on depressive symptoms with some improvements in VRQoL, self-esteem, and adaptation to vision loss (Rees et al. 2010).

Despite the need for support in psychological adjustment to vision loss in aging persons, significant gaps in access to support exist, and the integration of psychological services in vision rehabilitation is scarce. Research indicates that barriers to receiving psychological support in people with vision impairment include *older age*, denying depression, believing that talking therapies are not helpful, and feeling a lack of control over depressive symptoms (Sturrock et al. 2014). External barriers can be a lack of available services and limited numbers of skilled mental health professionals and reaching people residing in rural locations. Studies have indicated that many older people (mean age = 70 years) with low vision desire psychological support, particularly those with higher levels of depressive symptoms who reported poorer coping in relation to low vision (Sturrock et al. 2014). However, in a trial of depression screening plus referral to a GP for further assistance, fewer than half of the aged participants (mean age = 70 years) with low vision who screened positive for clinically significant depressive symptoms followed through with a GP referral (Holloway et al. 2014).

Those participants who did utilize the GP referral were more likely to have been prescribed psychotropic medication despite having expressed a preference for a talking therapy (Holloway et al. 2014). Accordingly, there are further barriers to accepting and accessing external referrals for adequate mental health support. Providing simpler methods for immediate expert care is important to overcome the various psychological, logistical, and external barriers that prevent older people with vision impairment from receiving the support they need.

The National Institute of Clinical Excellence (NICE) depression treatment guidelines recommend that effective screening and low-intensity treatments modeled on cognitive and behavioral treatment (CBT) principles be integrated into all chronic health rehabilitation programs (National Institute for Clinical Excellence (NICE) 2009). Recognizing this need, novel approaches designed to specifically target psychological well-being in older people attending vision rehabilitation settings, such as psycho-educational programs, behavioral activation, and problem-solving therapy (PST), have been trialed. PST has gained the greatest evidence to date, with reviews and meta-analyses suggesting that this approach holds promise for improving functional and emotional outcomes and reducing incidence of depression in people with low vision (Holloway et al. 2015).

PST is a CBT approach that focuses on guiding patients through a series of problem-solving steps to deal with observable problems under one's control, in combination with pleasant daily activities to improve mood. Individuals learn the process of problem identification, goal setting, and action planning in order to identify and cope with everyday problems. Problem solving assists with dealing with functional issues and their emotional consequences by providing patients with the skills to gain more control over their problems and reduce avoidance behavior.

While initial findings regarding CBT approaches are promising, further research is needed to confirm findings, examine the sustainability of such effects, determine for whom such interventions are most effective (e.g., older or

younger persons), and consider how best such approaches can be implemented into practice. Recent and ongoing studies have trained low-vision rehabilitation staff (e.g., occupational therapists) in these approaches and used various modes of delivery such as stepped care and guided self-help (Rees et al. 2013b; Van Der Aa et al. 2013; Rovner et al. 2014). These new models overcome issues of accessibility; however, it is unclear to date if such approaches will be able to deal with broader cognitive issues concerning thoughts of helplessness or acceptance of vision loss and the proportion of older individuals who may need more intense intervention by trained mental health professionals.

Given that how people think about and cope with their vision impairment is critical for mental health, another form of CBT, namely, acceptance and commitment therapy (ACT), may be efficacious in protecting against and reducing depressive symptoms among older individuals with low vision. There is evidence to support the effectiveness of ACT in many other chronic health areas (Wicksell et al. 2012), which are prevalent in older people (i.e., chronic pain). ACT helps people to create a "rich, full, and meaningful life while accepting the pain that life inevitably brings." By defusing helplessness-related cognitions, building acceptance, and designing value-driven goal-directed behavior acting to increase problem-focused coping, people can be gradually activated in a behavioral sense and begin to achieve personal goals. Evidence regarding ACT suggests that emotional suffering will decrease likely along with functional impairment and QoL will improve. Once individuals have been able to reappraise their low vision, they may be more likely to successfully implement other vision rehabilitation strategies (e.g., orientation and mobility, occupational therapy, etc.). It is important to note that aged people with low vision understand that acceptance is not an indicator of weakness or the end to a once satisfying life. Instead, acceptance is about acknowledging reality, learning to live with low vision, and ceasing efforts to control uncontrollable aspects of the condition so that more feasible and value-driven goals can be attained. ACT may be just one such

approach to decrease the detrimental psychological impact that research has shown is so prevalent in low-vision populations.

## Conclusion

Age-related vision loss is a leading global health problem (WHO 2010). The physical, functional, and psychosocial consequences of age-related vision impairment are surmountable, yet left untreated, impact on emotional well-being and mental health (Chou et al. 2009; Van Der Aa et al. 2015; Sturrock et al. 2015). While some older people adapt well to vision loss, many others experience a great deal of distress that can lead to poorer mental health without appropriate intervention (Dreer et al. 2008; Sturrock et al. 2015). With the rates of emotional disorders doubled in this population and substantially higher than rates in the general aged population, current rehabilitation services do not adequately address the need for psychological care for aging individuals with vision loss (Rees et al. 2010). There is a need to overcome the barriers to psychological care and integrate psychological services within vision rehabilitation, either by training staff to provide low-intensity preventative strategies or by establishing collaborations with expert mental health practitioners trained to deliver effective treatments to this group of older people. Delivery of psychological strategies will need to focus on both prevention and treatment in an accessible manner. Current trials of psychological interventions and new modes of delivery that address barriers to uptake and target identified psychosocial determinants of deteriorating well-being in aging and vision loss are promising (Rees et al. 2013b; Van Der Aa et al. 2013, Rovner et al. 2014).

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## Visual and Haptic Perception

J. Farley Norman  
 Department of Psychological Sciences, Ogden  
 College of Science and Engineering, Western  
 Kentucky University, Bowling Green, KY, USA

### Synonyms

Vision; Active Touch

### Definition

People perceive objects (their shape, size, & motion) in the environment through their senses of vision and active touch.

### Introduction

Humans and other animals obtain knowledge about objects in their environment through a variety of distinct sensory modalities. Common modalities throughout the animal kingdom would include, but are not limited to, vision, audition, touch, and olfaction. An animal's survival obviously depends upon such sensory modalities, because without them it would be impossible to locate food objects, navigate safely, make and utilize tools, find potential mates, etc. This review will focus on the senses of vision and touch – one reason for this is that vision and touch are the only sensory modalities by which humans reliably perceive the 3-dimensional (3-D) shape of environmental objects. Other mammals, such as dolphins, can use their sense of echolocation (in addition to vision) to perceive the shape of 3-D objects. A tremendous amount of scientific research investigating the human senses of vision and touch has been conducted over the past 200 years. However, the study of whether and to what extent aging affects visual and tactile abilities is much more recent and has only been the focus of thorough investigation during the past few decades.

### Visual Perception of 3-D Shape

Perceiving the solid (i.e., 3-D) shape of environmental objects is essential for humans and most animals in order to perform their everyday activities. If someone wants, for example, to take a drink, they must visually perceive the solid shape of a mug or cup sitting on their desk as well as its location relative to them in space. Only after visually perceiving the 3-D shape and location of the cup can the appropriate motor movements be programmed to reach for and successfully grasp the cup (humans and animals who

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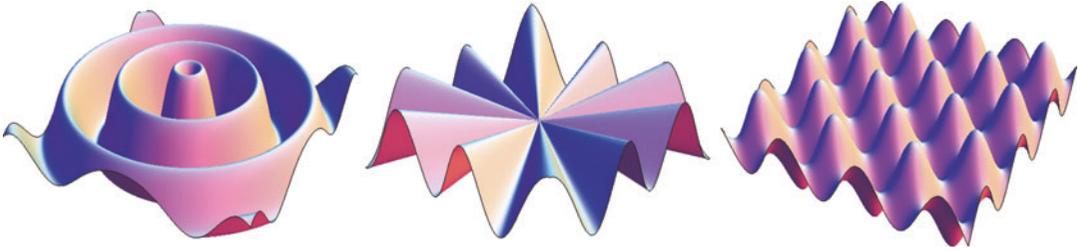
**Perception, Fig. 1** Two of the 100 solid objects used as experimental stimuli by Norman et al. (2008). In this example, the object surfaces are covered with a texture that resembles granite



do not have effective vision often use their sense of touch, or haptics, to perceive 3-D object shape; haptic shape perception will be discussed in a later section). There are many optical sources of information that contribute to the visual perception of an object's 3-D shape. These would include motion, binocular disparity, shading, and specular highlights. When solid objects move relative to an observer (e.g., when they rotate in space), or an observer moves in its environment while viewing an object, the object's projected shape deforms in the visual image detected by the retinal neurons of the eye. This movement, or deformation, in retinal images facilitates the perception of an object's 3-D shape. The perception of 3-D shape from motion has often been referred to as the *kinetic depth effect* (it is also commonly called 3-D SFM, 3-dimensional structure from motion). Consider an experiment performed by Norman et al. (2008). On some trials, two different solid objects were successively presented (for example objects, see Fig. 1). On other trials, the same object was presented twice successively. The observer's task for any given trial was to simply indicate whether the objects they saw possessed the same shape or had different shapes. Of course, the observers' retinal images were different when two differently shaped 3-D objects were presented; the task was challenging, because the retinal images of the two stimulus objects were also different when the same 3-D object was presented twice. This occurred because even when the same 3-D object was presented twice, its orientation in depth was changed between the first and second

presentations (e.g., by a 45° rotation around a Cartesian vertical axis). In some experimental conditions, the two objects presented on any given trial continuously rotated (oscillated) in depth, giving rise to the kinetic depth effect. In other conditions, the two objects presented on any given trial were stationary (no kinetic depth effect). For objects that possessed texture, the younger observers' (mean age was 21.5 years) 3-D shape discrimination performance improved by 32% when the objects moved (i.e., rotated in space) relative to when they were stationary. This improvement in 3-D shape perception/discrimination that occurs in conjunction with object movement is characteristic of the kinetic depth effect. The older observers' (mean age was 72.2 years, range was 62–82 years of age) performance was also facilitated by object movement, but this improvement (21%) was significantly smaller than that exhibited by the younger observers. It is clear that while older adults can perceive 3-D shape from motion, their abilities are reduced relative to younger adults.

The previously discussed study (Norman et al. 2008) demonstrated that older adults' 3-D shape discrimination performance was less enhanced by motion than the performance of younger adults. A study by Andersen and Atchley (1995) found that older adults are also less able to detect the presence of 3-D surfaces defined by motion. On any given trial, Andersen and Atchley presented either a dotted surface shaped like a sine wave modulated in depth or a randomly arranged set of points occupying the same volume of space



**Visual and Haptic Perception, Fig. 2** Drawings of the three differently shaped curved surfaces (from left to right, “bull’s-eye,” “snowflake,” and “egg-crate”) used in the shape discrimination task of Norman et al. (2013)

(as the sine wave). The observers’ task was to indicate for each stimulus display whether or not they saw a sinusoidally shaped 3-D surface. On average, the younger adults’ detection performance was 74% higher than that of the older adults.

If older adults do not detect or discriminate 3-D shape defined by motion as well as younger adults, when in the lifespan does this deterioration begin? A study by Norman et al. (2013) evaluated the shape discrimination abilities of middle-aged adults in addition to younger and older adults (observer ages were continuous between 19 and 84 years). In their experiments, observers were presented with one of three differently shaped surfaces on any given trial. Within these surfaces, the depth varied sinusoidally in various directions creating surface shapes that resembled bull’s-eyes, snowflakes, and egg-crates (see Fig. 2). The observers’ task on any given trial was to indicate which of the three surface shapes had been presented. The difficulty of the task was manipulated by limiting the “lifetime” (or temporal correspondence) of the moving points that defined the surface shapes. In the easiest condition, each of the 800 points defining a shape was visible in a particular surface location across 16 adjacent frames of the motion sequence (i.e., movie), while in the hardest condition, each surface point only “survived” for two adjacent frames. Once any given surface point “died,” it appeared in a new surface location, where it then survived for 2–16 additional frames. This type of stimulus display creates the perception of a continuously moving (rotating) 3-D surface whose constituent points appear and disappear over time. The results for a moderately difficult

(4-frame lifetime) condition (shape discrimination performance was neither near chance levels or perfect levels) were interesting and informative. Although there was considerable interobserver variability in performance within any particular age group (e.g., observers in their 20s, 30s, 40s, 50s, 60s, 70s, 80s, etc.), the observers’ overall shape discrimination performance remained essentially constant from the age of 19 years until about the age of 60 years. Beginning at an approximate age of 65 years, the observers exhibited a decline in performance that was linear with further increases in age. The results of this study demonstrate that the age-related deterioration in the ability to perceive 3-D shape from motion does not generally begin until after the age of 65 years.

Binocular disparity is an additional important source of optical information that helps a variety of animals, including humans, to perceive 3-D shape. The perception of solid shape from binocular disparity is usually referred to as *stereopsis* (i.e., “solid vision”). Because motion also leads to “solid vision” and an enhanced ability to perceive solid (3-D) object shape, the perception of 3-D shape from binocular disparity would be more appropriately described as *binocular stereopsis* (the perception of 3-D shape from motion could be similarly referred to as a form of *monocular stereopsis*, since 3-D SFM does not require the simultaneous use of two eyes). Binocular indicates the use of two eyes, and disparity is a synonym for difference. Binocular disparity, therefore, refers to the small differences that occur between our two eyes’ retinal images when we binocularly view solid environmental objects. The brains of many animals (but not all) contain neurons that



**Visual and Haptic Perception, Fig. 3** A photograph of the 12 plastic replicas of bell peppers (*Capsicum annuum*) used as visual and haptic stimuli in the study by Norman et al. (2006)

are sensitive to, and selective for, binocular disparities. Since binocular disparity refers to the (small) differences that exist between the retinal images of two eyes that simultaneously view environmental objects, binocular stereopsis can only exist for animals that have two eyes located on the front of their head and therefore receive slightly different projective views of the same 3-D scene (animals with eyes on the sides of their heads cannot utilize binocular disparity, because each eye “sees” something totally different, not slightly different views of a single scene). In an experiment reported by Norman and Wiesemann (2007), younger and older observers judged the 3-D orientation of local regions on the surface of solid objects like those shown in Fig. 1; the observers made these judgments both binocularly (stimulus displays contained binocular disparity) and monocularly (stimuli did not contain binocular disparity). The results revealed a significant main effect of age: The errors (differences between actual local surface orientation and judged orientation) made by the older observers were 17.8% higher than those made by the younger observers. Observers in both age groups, however, benefited from the presence of binocular disparity in the

stimulus displays. In the stimulus condition where the object surfaces contained texture, the error magnitudes produced by the younger observers decreased by 36.0% when binocular disparity was available; the corresponding reduction in error magnitudes with binocular disparity for the older observers was 22.1%. While older adults definitely possess binocular stereopsis, they nevertheless do not gain as much information from binocular disparity as younger adults.

Despite the findings of Norman et al. (2008, 2013; Norman and Wiesemann 2007) and Andersen and Atchley (1995), it is important to note that older adults’ ability to visually perceive 3-D shape is not always reduced relative to that of younger adults. Norman et al. (2006) showed observers solid plastic replicas of bell peppers (*Capsicum annuum*, see Fig. 3) and asked them to discriminate shape: On any given trial, the observers were presented with two bell peppers (sequentially, for 3 s each) and were required to indicate whether the objects possessed the same shape or had different 3-D shapes. Since these stimuli were physical objects viewed in natural lighting, the viewing conditions were full cue; many optical sources of information were

available to support the observers' discrimination judgments (e.g., binocular disparity, motion, shading, specular highlights, occlusion boundary contours, etc.). Under these full-cue conditions, the younger and older observers' visual shape discrimination performance was identical (the younger and older observers' performance was 83.8% and 83.9% correct, respectively).

### Haptic Perception of 3-D Shape

Human observers perceive 3-D object shape using multiple sensory modalities: vision and touch. The sense of active touch is called *haptics*. In the study most recently discussed (Norman et al. 2006), observers also made haptic solid shape discrimination judgments. On any given trial, the observers sequentially explored two bell peppers (Fig. 3) for 3 s each; the observers were allowed to feel the objects with both hands, but the bell peppers were not visible because they were presented behind an occluding curtain. Once again, the task was to judge whether the two objects had the same shape or possessed different shapes. The observers' haptic discrimination performance was comparable to the previously mentioned visual discrimination performance, and once again there was no significant difference in performance between younger and older adults (these observers' haptic performance was 84.7% and 81.9% correct, respectively).

It seems clear that haptic shape discrimination is well preserved with increases in age (Norman et al. 2006). A subsequent study evaluated whether the good ability of older adults to discriminate haptic shape extends to haptic shape estimation. Norman et al. (2011a) asked younger and older adults to estimate the shape of quadric surfaces (e.g., convex and concave hemispheres, convex and concave ellipsoids, convex and concave cylinders, as well as a variety of saddle-shaped surfaces) after haptically exploring each one for up to 30 s with one hand. Both the younger and older adults performed very well – when the estimated surface shapes were correlated with the actual surface shapes (for the higher surface curvature condition, 2.0/m), the resulting average

Pearson  $r$  correlation coefficients were 0.94 and 0.88 for the younger and older observers, respectively (Pearson  $r$  values range from zero, no correlation, to 1.0, perfect correlation). It is quite evident from this outcome that the relationship between actual surface shape and perceived surface shape was very strong for all observers, younger and older.

### Visual Perception of Motion: Speed and Collision Detection

While mammalian and human visual systems are obviously sensitive to object shape, they also possess neuronal mechanisms that are sensitive to (and selective for) various aspects of object motion. A study by Norman et al. (2003) was the first to demonstrate that aging adversely affects the ability to visually discriminate the speed of moving objects. In their experiments, observers simultaneously viewed two spatially separated sets of moving objects (low contrast circles or high contrast points); the moving objects translated left or right (in a fronto-parallel plane) at varying speeds. The observers' task on any given trial was to indicate which set of moving points (the set located at the bottom or top of the stimulus display) moved faster. The dependent measure was the smallest difference in speed (between the two sets of moving objects) for which an observer could reliably determine which set was moving faster. Under the best conditions, the younger adults could reliably perform the task with a difference in speed of 5.1% (i.e., in order for a younger adult to reliably see/determine that one set of objects was moving faster than another, it would have to move at least 5.1% faster; younger adults would be unable to reliably perform the task for smaller differences in speed). In contrast, the older adults (on average) required an 8.7% difference in speed; in order to reliably discriminate the speed of moving objects, older adults needed a difference in speed that was 71% higher than that needed by younger adults.

A subsequent experiment by Snowden and Kavanagh (2006) evaluated aging and speed discrimination using very different stimuli and

methodology. In their experiment, younger and older observers viewed moving sinusoidal luminance gratings (visual patterns where light intensity varies sinusoidally across space). Two translating gratings were presented sequentially on any given trial, and the observers were required to judge which of the two (the first or second) moved faster. As in the study by Nonman et al. (2003), Snowden and Kavanagh found older adults to be substantially less sensitive to differences in speed than younger adults. The similarity in outcome of the two studies despite the differences in type of visual stimuli and methodology (simultaneous versus successive stimulus presentations) indicates that the deterioration in speed perception that accompanies aging is a significant and robust phenomenon.

A number of studies have asked younger and older adults to either detect whether approaching objects would collide with them or to discriminate which of two oncoming vehicles approach faster; such abilities are obviously critical for maintaining safety while driving. For example, in an experiment by Andersen and Enriquez (2006) observers were presented with a simulated roadway; on any given trial, an approaching object moved at a variety of speeds (30, 45, and 60 miles per hour, mph) and the object would either collide or pass by the observer in either 2, 3.5, or 5 s. The observers judged whether the object would collide with them or safely pass by to the side. The results were interesting and informative: There were effects of age, but their magnitude depended upon both the speed of the approaching objects as well as the simulated time to contact (TTC). The older adults' judgments were most impaired in the 60 mph, 5-s TTC condition: Under these circumstances, the younger adults' ability to detect the collision events was more than twice the ability of the older adults ( $d'$ , or perceptual sensitivity values, were 2.95 and 1.37 for the younger and older observers, respectively). In contrast, for the slowest approach speeds and shortest TTC (30 mph and 2-s TTC), there was no significant difference between the collision detection abilities of younger and older adults. In a later study, Ni et al. (2012) evaluated

collision detectability when observers' vision was obscured by varying degrees of fog. Ni et al. found that the older adults' detection performance deteriorated as the simulated fog density was increased; this deterioration did not occur for the younger adults.

In an experiment conducted by Poulter and Wann (2013), observers viewed simulations that included either two approaching cars or a car and a motorcycle; the observers' task was to decide which of the approaching vehicles was moving the fastest. For each observer and condition, the smallest difference in speed (e.g., between the car and motorcycle) for which correct judgments could reliably be made was determined. Adverse effects of age were found in both vehicle conditions. As an example, Poulter and Wann found that adults older than 75 years of age were unable to reliably distinguish between one car approaching at 20 mph and another that approached at 40 mph.

### Visual Perception of Motion: Direction

The studies discussed in the previous section demonstrate that older adults have difficulty in detecting collisions and discriminating the speed of moving objects. Older adults also perform more poorly (than younger adults) when judging the direction of moving objects. Roudaia et al. (2010) used stimulus displays that depicted 2-frame apparent movement. Three hundred dots were initially presented for 100 ms; after a variable inter-stimulus-interval (ISI), a second pattern of 300 dots appeared that was displaced by some amount to the left or right. The observers judged whether the direction of movement was either to the left or right. Roudaia et al. found that age differences in direction discrimination performance occurred for many different combinations of ISI and displacement (e.g., for large displacements, 0.51–0.64° visual angle, across a wide variety of ISIs, and for medium ISIs, 0.06–0.16 s, across a wide variety of displacements). The authors concluded (p. 10) that their results “provide evidence of decreased functioning of low-level motion detectors.”

In a study by Billino et al. (2008), observers also discriminated the direction of movement in apparent motion displays. In their stimuli, however, only a subset of the total 100 dots moved coherently to either the left or right; the remainder of the dots moved in random directions. For each individual observer, the smallest number of coherently moving points needed to reliably judge the direction of left/right motion (i.e., the detection threshold) was identified. Older adults needed 67% more coherently moving points in order to successfully determine the direction of stimulus motion – the Pearson  $r$  correlation coefficient between the observers' chronological ages and their detection thresholds was 0.51.

### Biological Motion Perception

Optical motion contains a wealth of important information that is available to animal and human observers. As we have seen, motion facilitates the ability to perceive the 3-D shape of environmental objects, and it allows us to know in advance about the possibility and timing of impending collisions. Retinal motion also enables us to perceive and recognize the behavioral activities of others. Imagine, for example, that 13 very small (and dim) lights are attached to another person's joints (Norman et al. 2004), such as their shoulders, elbows, wrists, hips, knees, and ankles. Now consider what this configuration of lighted points would look like if the environmental illumination (e.g., indoor room lights) was turned off – you would only see 13 small points of light floating in space, nothing else. When the person “wearing” the lights begins to move, however, an observer viewing this situation would immediately perceive the 13 moving lights in the dark to be a human being carrying out some meaningful activity (e.g., walking, dancing, exercising, etc.); this phenomenon is called *biological motion*. While biological motion has been appreciated and studied for more than 40 years, experiments evaluating whether and to what extent aging affects the perception of biological motion were not performed until 2004 (Norman et al. 2004). In this study, younger and older

observers viewed apparent motion sequences depicting actual biological motion: The joint motions of a human model performing various activities in the dark were recorded using a video camera. On any given trial, the observers were required to identify from the presented motion sequence whether the depicted action was walking, jogging, or skipping. The duration of the biological motion stimuli presented to the observers was very short – either 400 or 120 ms. For the longer durations of biological motion, the younger and older observers' discrimination performance was comparable: The younger observers' judgments were only 5.5% more accurate than those of the older observers (98.0 versus 92.9% correct). When the duration of the biological motion was reduced to 120 ms, the difference in recognition performance between the younger and older observers became much larger, such that the younger adults' judgments were 33.3% more accurate than those of the older adults (discrimination performance was 85.7% and 64.3% correct for the younger and older adults, respectively). Nevertheless, even for these very short stimulus durations (about a tenth of a second), the older adults were performing well, at much higher levels than chance (guessing would correspond to a performance of 33.3% correct).

Later investigations of aging and the perception of biological motion (Billino et al. 2008; Pilz et al. 2010) did not record and utilize actual human biological motion like Norman et al. (2004) but instead used a computer algorithm that simulated the movements produced during walking. On any given trial, Billino et al. (2008) presented two motion displays (for 400 ms) to their observers – the task was to judge which display (the one to the left or right of center) contained a “point-light walker” (only biological motion displays depicting walking were used). The two side-by-side displays were identical, except that in one, the positions of the dots forming the point-light walker were spatially “scrambled” so that the motions no longer simulated those of a walking human. The 11 dots whose motion defined the point-light walkers (signal dots) were embedded within varying numbers of “masking dots” (the “noise,” which moved

in random directions) in order to study the effects of a variety of signal-to-noise ratios. Billino et al. found modest effects of age: In general, the older observers needed somewhat higher signal-to-noise ratios (e.g., 20%) than younger observers (e.g., 13%) in order to successfully detect which displays contained the biological motion.

Pilz et al. (2010) used stimuli that were similar to those of Billino et al. (2008) (computer-generated point-light walkers, where the 11 points defining the walkers were embedded within 44 masking points). In this study, the observers judged the direction of biological motion – i.e., determined whether the point-light walker presented on any given trial (within a single stimulus display) moved towards the left or right. Following up and extending the experiments by Norman et al. (2004), Pilz et al. varied the duration of biological motion over a wide range from 80 ms to 3.2 s. The results of this newer study demonstrated that there was a large effect of age for all stimulus durations, short, medium, and long. As an example, for a duration of 400 ms, the younger adults' performance was approximately 93% correct (for upright point-light walkers) whereas the analogous performance for the older adults was approximately 63% correct. It is clear that the effect of age for this biological motion task was quite substantial. At shorter stimulus durations (80–200 ms), the older adults' performance (but not that of the younger adults) dropped even further, to near chance levels.

### Visual Perception of Distance: Discrimination

In addition to perceiving solid objects and their motions within the environment, humans and other animals also use vision to perceive environmental distances. In 2011, Norman et al. (2011b) evaluated younger and older adults' ability to visually discriminate length/distance; they used the method of constant stimuli and the method of single stimuli. In the first method, observers saw two lengths (line segments) successively on any given trial and were required to judge which of the two (the first or second) was longer. One of the

two lines (the “standard” line) possessed a length of 9.0 cm, while the length of the other line (the “test” line) was longer or shorter (than 9.0 cm) by 1.6%, 4.8%, or 8.0%. Each participant made 300 length comparisons. The results indicated that older adults could visually discriminate length as well as younger adults – the younger and older adults needed differences in length of 6.3% and 5.4%, respectively, in order to reliably judge which of the two lengths presented on any given trial was longer (the smaller the difference one can detect, the more perceptually sensitive they are). In the other method (method of single stimuli), all aspects of the procedure were identical to those used for the method of constant stimuli, except that the standard line was never explicitly shown; its length had to be learned from feedback provided on prior trials. Although this method sounds odd (judging whether single test lines are shorter or longer than a standard length that is never explicitly presented), observers can effectively learn the magnitude of the “implicit” standard from prior feedback and use it to effectively evaluate test lengths. The results obtained using this method were similar to those obtained for the method of constant stimuli: no age differences in length discrimination ability occurred. Both the younger and older age groups needed differences in length of 4.6% (from the implicit standard) in order to reliably discriminate visual length.

### Visual Perception of Distance: Estimation

As reviewed in the previous section, it was demonstrated in 2011 that older adults effectively discriminate visual length; they can, for example, compare the lengths of two stimuli just as precisely as younger adults. In 2013, Bian and Andersen (2013) found that older adults estimate egocentric distances much more accurately than younger adults. In their study, older and younger observers viewed and estimated distances outdoors (in a grassy field), from themselves to a single brick placed on the ground. The distances evaluated were 4, 6, 8, 10, and 12 m. The



**Visual and Haptic Perception, Fig. 4** A photograph of the in-depth and fronto-parallel spatial intervals used as stimuli in the experiment by Norman et al. (2015). The endpoints of the spatial intervals were defined by the placement of 24 light-emitting diodes (LEDs). The LEDs

were located above a textured piece of fabric. The adjustable line segment used in the distance matching task is visible on the computer monitor located behind the array of LEDs

observers' estimates (perceived distances) were plotted as a function of the actual distances. Perfectly accurate performance would be indicated if the observers' estimates exhibited a linear relationship (with actual distance) with a slope of one. In Bian and Andersen's Experiment 1, the older adults' judgments were linear with actual distance, and the resulting regression line had a slope of 0.95; the analogous slope for younger adults was 0.56. These results conclusively indicate that older adults, on average, are almost perfectly accurate when making estimates of egocentric environmental distances. In contrast, the judgments of younger adults are far less accurate – the younger observers in Bian and Andersen's experiment, on average, only perceived about half of the distance in depth that was actually present (i.e., the younger observers perceived a 10 m physical egocentric distance as being only 5.6 m long).

Bian and Andersen (2013) evaluated how well observers could perceive large (4–12 m) egocentric distances outdoors. A subsequent experiment by Norman et al. (2015) sought to determine whether the results obtained by Bian and Andersen generalized to the perception of smaller exocentric distances (distances between objects or points in space without regards to one's self) that exist within indoor environments. In the Norman et al. study, observers viewed small distances

(approximately 10–20 cm) that were either aligned in depth (along an observer's line of sight) or possessed a frontal (fronto-parallel) orientation. The stimulus distances were defined by the spatial arrangement of 24 green light-emitting diodes (LEDs, see Fig. 4). On each trial, a single pair of LEDs was illuminated; these LEDs defined the endpoints of a particular environmental distance to be judged. There were 22 stimulus distances, which the observers judged five times each. The observers' task on any given trial was to adjust the length of a line segment displayed on a computer monitor until it appeared to match the physical distance between the two illuminated LEDs. Norman et al. found that the observers generally underestimated the stimulus distances and perceived them to be significantly shorter than they actually were. This was especially true for the younger observers – on average, they perceived the in-depth distances to be only 59.4% of their actual length. While the older observers' judgments were not entirely accurate, they were nevertheless more accurate in their perceptions of exocentric distance than the younger observers (on average, the older observers perceived the in-depth distances to be 79.8% of their actual length). The frontal distances (those not aligned in depth) were perceived more accurately than the in-depth distances: On average, the younger and older observers perceived their extents to be

77.9% and 85.7% of the actual distances, respectively. The judgments of the older adults were more accurate for both the in-depth and frontal distances.

### **Discrimination and Perception of Lifted Weight**

When we pick up and haptically interact with objects using our sense of touch, we perceive their weight as well as their shape. An experiment was conducted in 2009 by Norman et al. (2009) to determine whether and to what extent aging affects the human ability to discriminate lifted weight. The method of constant stimuli was used in this study; the standard weight was 100 g. Six test weights were used by both the younger and older participants (younger participants: 90, 94, 98, 102, 106, and 110 g; older participants: 85, 91, 97, 103, 109, and 115 g). All objects possessed the same size and shape, but had differing weights. On any given trial, the participants were given two objects to lift in succession. One object had the standard weight while the other possessed a test weight; the participants' task was to judge which of the two objects, the first or the second, was heavier. In estimating the weight of any given object, the participants were only allowed to lift it once off the table and put it back down. Each participant performed a total of 216 judgments (each test weight was presented 36 times in a random order). The goal of the study was to determine each participant's difference threshold (the smallest difference in weight needed for them to make reliable judgments). At the end of the experiment, the difference thresholds for the younger and older adults were determined to be 6.6% and 10.4% of the standard, respectively. Thus the older observers needed either a 10.4% increase in weight or a 10.4% decrease in weight (relative to the standard) in order to reliably discriminate on any given trial which of the two presented weights, the first or the second, was heavier. These results indicate that older adults need much larger differences in object weight in order to perform well and make reliable judgments; the older participants' difference thresholds were 57.6% higher than those obtained for the younger adults.

The outcome of the previously described study (Norman et al. 2009) clearly demonstrates that aging is accompanied by a deterioration in the ability to discriminate small differences in object weight. However, this does not necessarily indicate that aging reduces the ability to compare the weights of two objects that differ substantially. The purpose of the experiment by Holmin and Norman (2012) was to evaluate how well younger and older adults can perceive and estimate weight ratios, how much heavier one object is relative to another (e.g., twice as heavy, five times as heavy, 50% heavier, etc.). Participants in this experiment lifted two objects (same size and same shape) successively on any given trial and gave a numerical estimate of the weight ratio. There were 16 actual weight ratios that ranged from 1:1 (the two objects had the same weight) to 10:1 (one object was 10 times heavier than the other). The participants were allowed to lift each object as many times as they wanted within 30 s; they grasped the stimuli with the thumb and first two fingers of their preferred hand and lifted with the forearm (while keeping the elbow on the table). Each participant estimated the weight ratios of 108 pairs of objects. In assessing the results of the experiment, the individual younger and older participants' perceived weight ratios were plotted as functions of the actual stimulus weight ratios – accurate performance would be indicated if the resulting best-fitting regression lines possessed a slope of one. The outcome of the experiment demonstrated that while the younger participants were able to estimate object weight ratios reasonably accurately (average slope of 1.32), the older participants' judgments were highly inaccurate (average slope of 4.64). This result demonstrates that the older participants, on average, perceived the weight ratios to be much higher than they actually were.

### **Discussion**

As we have seen, there is no general across-the-board deterioration in perceptual functioning as human adults become older. It is true that large age-related deficits (Norman et al. 2003; Snowden and Kavanagh 2006; Andersen and Enriquez

2006; Ni et al. 2012; Poulter and Wann 2013; Pilz et al. 2010) do exist for many motion-related tasks (e.g., visual speed discrimination, detection of collision events, etc.). However, it is also true that under favorable circumstances older adults can effectively perceive 3-dimensional object shape from motion, binocular disparity, image shading, specular highlights, and object boundary contours (Norman et al. 2008, 2013; Norman and Wiesemann 2007). Under full-cue conditions where many optical sources of information are simultaneously available to support perception, older adults can visually discriminate 3-D object shape as well as younger adults (Norman et al. 2006). The situation for haptic perception of 3-D shape (Norman et al. 2006, 2011a) is even more encouraging: The haptic shape discrimination and estimation abilities of older adults have been demonstrated to be equivalent to those of younger adults.

With regard to other types of judgments, those not related to motion or the perception of shape, the situation is similar. Significant age-related impairments occur, for example, when human adults are required to discriminate or make judgments about the weight of lifted objects (Norman et al. 2009; Holmin and Norman 2012). However, when it comes to visually perceiving environmental distances (Norman et al. 2011b, 2015; Bian and Andersen 2013), the performance of older adults is as good as, or substantially better, than that of younger adults. Contrary to conventional wisdom, aging does not necessarily lead to declines in human perception. We can be confident that further research into the perceptual capabilities of older adults will continue to provide surprising and important insights into the human condition.

## Cross-References

► [Spatial Cognition and Wayfinding](#)

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## Volunteering in Older Adults in Retirement

Patrick Dulin  
Department of Psychology, University of Alaska,  
Anchorage, AK, USA

### Synonyms

Altruism; Community service; Elderly; Happiness

### Definition

Volunteering is the provision of unpaid services to organizations, community groups, or individuals.

### Introduction

A recent and important trend in geropsychology that has emerged during the last 20 years termed positive aging addresses behavioral, psychological, and social factors that hold the potential to enhance the physical and mental well-being of older adults. This recent trend shifts the focus from aging-related decline to older adulthood as a stage that holds potential for contribution, adaptation, and success (Johnson and Mutchler 2013). Not surprisingly, maintaining a physically and mentally active lifestyle has repeatedly been noted to enhanced health and overall well-being during the later years. As this research domain has become more sophisticated, it has become clear that not all types of activity are equally beneficial; certain types of activity are more robustly related to enhance well-being among older adults than

others. Volunteering, the provision of unpaid services to organizations, community groups, or individuals, has been shown to be one of the most salubrious types of activity a postretirement older adult can engage in (Anderson et al. 2014). This entry will provide an overview of the current understanding of the relationship between older-adult volunteering and physical and mental well-being, theoretical explanations of why volunteering benefits older adults, how volunteering can be encouraged in the elderly with brief intervention, and concludes with a discussion of how the enthusiasm surrounding older-adult volunteering as a public health strategy should be tempered with caution, particularly among elderly from diverse backgrounds.

### Volunteering and Mortality

Gerontology researchers have explored the possibility that engaging in voluntary activities in the later years is related to reduced mortality and have found encouraging results. One of the early, scientifically robust studies of the influence of volunteering on mortality conducted over an 8-year period in the USA found that engaging in substantial amounts of volunteer activities (volunteering concurrently for two or more organizations) reduced mortality in an older-adult sample by 44%, even while controlling for initial health status, health habits, and social support (Oman et al. 1999). The authors noted that in comparison to variables that have historically been associated with reduced mortality, the effect of volunteering was impressive. Volunteering's beneficial influence on mortality was greater than that for exercising four times per week and attendance at religious services; it was found to be roughly equivalent to the mortality benefits of not smoking.

Since this seminal study on the mortality benefits of volunteering, there have been numerous other well-designed, large-scale studies performed with older-adult participants. Okun et al. (2013) performed a meta-analysis of studies that have examined the influence of organizational volunteering on mortality among older

adults (55 years and older). They utilized findings from 14 prospective studies in which volunteering was measured prior to an ongoing surveillance period. Estimated unadjusted (no other variables were controlled for) and adjusted (other variables such as gender, health, economic status, etc. controlled for) effect sizes were calculated in this study. Regarding the unadjusted effect size, volunteering reduced mortality risk by 47%, and the adjusted effect size indicated a mortality risk reduction of approximately 24%. In other words, even when controlling for other important variables related to mortality (health, gender, etc.), engaging in volunteer activities in older adulthood reduced mortality by 24%. This meta-analysis suggests that across numerous studies, volunteering exerts an important and unique effect on mortality among older individuals. It has also come to light that the motivation behind engaging in volunteering may be an important mediator of mortality outcomes. Konras et al. (2012) indicated in their analysis of data from the Wisconsin Longitudinal Study that older-adult research participants who engaged in volunteer behaviors for self-oriented reasons had the same mortality risk as non-volunteers, but those who volunteered for other-oriented reasons evidenced substantial reductions in mortality. An altruistic, other-oriented motivation may thus be a key element in producing enhanced health functioning among older volunteers.

While research is still ongoing regarding exactly how engaging in helping behaviors can result in improved mortality, research has suggested that one pathway may be through improved cerebrovascular functioning. Heisler et al. (2012) found among a US nationally representative sample that older adults who reported providing helpful services to others (excluding immediate family) evidenced a reduced chance of having a cerebrovascular disease event in comparison to those who did not provide help to others.

## Volunteering and Mental Health

In addition to examining volunteering's potential to reduce mortality and enhance physical health

functioning among older adults, research has also highlighted volunteering as an important contributor to late-life emotional well-being. Musick and Wilson (2003) found in their analysis of a large, US nationally representative sample of older adults that volunteering reduced depression among participants over a 5-year time period, while controlling for other factors also related to depression. This study also examined potential mediators of volunteering on depression, focusing on social and psychological variables. They found that the enhanced social resources that occurred in tandem with volunteering mediated the effect of volunteering on mood whereas enhanced self-esteem did not. As older individuals engage in volunteering organizations, they also attend meetings, make new acquaintances, and potentially replace previously lost social roles, which in turn bolsters mood. Numerous other longitudinal studies have demonstrated the beneficial effect of volunteering on depressive symptoms among older adults and have indicated that the effect is strongest for individuals in the postretirement compared with younger groups (Kim and Pai 2010; Morrow-Howell et al. 2003). While research into the influence of volunteering on mood functioning among individuals of different ages is at an early stage and more studies are needed, it appears likely that younger adult volunteering may actually be an added stressor to an already busy work and family life, whereas in the older-adult context, it may help to fill social roles that were lost upon retirement.

Research has also examined how older-adult volunteering can enhance levels of happiness among older adults (Midlarsky and Kahana 2007). Happiness has been highlighted as not just the absence of depression but the presence of enhanced energy, joy, and engagement with the moment (Fredrickson 2001). Results from numerous studies suggest that volunteering and providing helpful services to others specifically enhances levels of happiness. Dulin and Hill (2003) indicated in a study examining older-adult volunteers that hours spent providing services were related to positive but not negative affect. This study indicated that volunteering likely leads to increased joy and happiness, but

does not reduce distressful states such as irritability and anxiety. Morrow-Howell et al. (2003) suggested that results from their study, in combination with numerous other studies, provide a high degree of confidence that volunteering positively influences emotional well-being among the elderly. In fact, they call for a reduced focus on whether or not volunteering can reduce depression among older adults as so many studies are pointing to the same conclusion. They suggest that the more interesting and currently relevant question is under what conditions and for whom volunteering is beneficial.

Research into the beneficial effects of mood from engaging in volunteering among older adults has indicated a particular relevance of volunteering to individuals in the lower rungs of the socioeconomic ladder, which is intriguing because low socioeconomic status has been shown to be a robust predictor of physical and mental health impairment among the elderly (Marmot 2006). Results from a study of positive aging factors that utilized a representative sample of older adults in New Zealand found that volunteering had the strongest relationship with happiness among all variables included in the analysis and that economic living standards moderated the relationship between volunteering and happiness. Results from this study showed a strong relationship between volunteering and happiness among individuals in the lowest levels of economic living standards but not among individuals from the highest economic levels (Dulin et al. 2012). In this study, volunteering helped to equalize the distance in mental well-being between the haves and the have-nots. Borgonovi (2008) and Morrow-Howell et al. (2009) also found that volunteering was associated with enhanced happiness and perceived benefits among individuals with lower incomes and education and that differences between wealthy and poor older adults regarding mental well-being disappeared if older adults in the lower ranges of economic resources were engaged in volunteering. These findings are particularly important as many of the predictors of well-being among older adults are essentially fixed, whereas volunteering is a behavior that can be initiated by elderly adults that can help to bridge the well-being gap between wealthy and poor older individuals.

## Ageing, Volunteering, and Health: Explanatory Models

As numerous studies have demonstrated, older adults are engaged in substantial amounts of volunteering and that seniors who choose to volunteer commit more time to their volunteer activities than all other age groups do (Anderson et al. 2014). Socioemotional selectivity theory (SST) is an older-adult-focused, empirically supported developmental theory that helps to explain why older adults volunteer, despite the presence of dwindling physical health and reduced energy levels that accompany the aging process. According to SST, as the end of life approaches and it becomes obvious that one's time is limited, goals become reprioritized with a greater importance placed on activities that are emotionally meaningful and a lower priority given to the pursuit of goals concerned with future achievements. SST suggests that this late-life shift is accompanied by greater importance being placed on developing and maintaining meaningful social relationships. Instead of focusing, as younger cohorts tend to, on personal ambition, older adults derive increasing satisfaction from helping others and the experience of present-focused emotional well-being (Carstensen and Lockenhoff 2003). Volunteering, according to SST, provides an important means for contributing to the lives of others that is consistent with an older adult focus on emotionally meaningful goals.

While SST provides a theoretical justification for why older adults volunteer, it does not address how older-adult volunteering results in the oft-cited benefits to physical and emotional health. As mentioned previously, a repeated finding in older-adult volunteering research is that volunteering enhances positive emotions. The broaden-and-build theory of positive emotions (Fredrickson 2001) suggests that positive emotions tend to broaden behavioral repertoires, which in turn builds health-enhancing resources and in a synergistic fashion, results in more positive emotions. Positive emotions, while important end points, have also been associated with increased longevity and potential health-protective effects such as improved immune responses. Pressman and Cohen (2005) highlighted the effects of positive

emotions on a number of physical health outcomes, including mortality, morbidity, and survival of serious illness. Similar to the broaden-and-build theory, they hypothesize that positive emotions lead to more adaptive health behaviors, decreased sympathetic nervous system arousal, better immune and cardiovascular system functioning, and improved quality and quantity of social relationships.

Brown and Okun (2014) have postulated what they term a “caregiver system” that when activated produces health benefits for older adults who volunteer. Their framework integrates animal models of parenting with nurturing-type responses within human neuroimaging studies to identify the neuroanatomical functioning and environmental conditions related to prosocial behavior. Their model suggests that perceptions of another’s need in combination with the ability to meet the need trigger a motivation to help. The help trigger then activates neural circuits related to parenting that produce hormones such as progesterone and oxytocin. The authors note that these hormones, while encouraging nurturing-type behavioral responses, also regulate stress and downregulate inflammation, both of which are related to improved health functioning. The caregiving system model thus indicates that volunteering is mediated by inherited neural mechanisms that activate natural dispositions toward caring for others. This model also indicates that certain preconditions determine if volunteering will produce health benefits. In addition to the volunteers believing that they have at least minimal resources to provide (i.e., skills, information, etc.), the authenticity of the need for assistance is also vital. In other words, the volunteering environment should be trustworthy and have a minimal possibility for exploitation.

### **Encouraging Volunteering Among Older Adults**

Current research has also focused on intervention strategies aimed at encouraging older adults to volunteer. Warner et al. (2014) tested a social-cognitive intervention for increasing volunteering

in older adults in a randomized control trial. They found that a group-based, single session intervention with community-dwelling older adults that was focused on providing information about the benefits of volunteering in old age, enhanced self-efficacy for volunteering and modeled volunteering behavior resulted in substantially more engagement in volunteer activities over the course of 6 weeks than control groups. This study also demonstrated that the intervention group evidenced a higher degree of volunteering among current volunteers as well as higher rates of beginning volunteering among non-volunteers. They note that these effects may take some time to manifest; in their study there were no differences between groups at 2 weeks, but substantial volunteering differences at 6 weeks. This study is encouraging to community organizations interested in enhancing the well-being of elderly adults through volunteering in that it shows that simple and very brief group-level interventions can meaningfully increase volunteering among older adults.

### **Caveats to Older-Adult Volunteering**

As research has underscored, volunteering has numerous benefits for older adults in terms of maintaining and even bolstering physical health and emotional well-being. Not surprisingly, enthusiasm regarding older-age volunteering as a public health intervention is high as evidenced by the increase in research and policy attention during the last 10 years. The economic benefits to societies of older-adult volunteering are another factor that motivates a drive to encourage older-adult volunteering. It is estimated that older-adult volunteering results in approximately \$19 billion in provided service annually in the USA alone (Anderson et al. 2014). This enthusiasm, however, needs to be tempered with some caution as older adults, even if happily engaged in volunteering, experience age-related reductions in energy levels, decreased ability to manage stressful schedules, and often have multiple caregiving duties within their own families.

Research has demonstrated that at high levels of volunteering, the benefits to health and well-being begin to decrease (Musick et al. 1999). For instance, Windsor et al. (2008) indicated that an inverted U shape emerges when emotional well-being is plotted against amount of volunteering among older individuals. Older adults who reported moderate amounts of volunteering had the highest levels of emotional well-being while those who reported no volunteering and high levels of volunteering evidenced similarly lower levels. This study utilized a sample of young-old adults (between 64 and 68 years of age) and found that more than about 15 hours of volunteering per week was associated with reduced well-being. While data are not available, it stands to reason that adults in the older and oldest-adult categories would need to moderate their volunteer hours even further to avoid volunteering becoming burdensome and stress inducing.

Most studies of volunteering have also been undertaken among older adults in the USA, Europe, and other developed Western countries. At this point in time, little is known about volunteering and older adults in other cultural contexts. Volunteering has been discussed as a term that has divergent meanings across cultures, particularly in the context of indigenous groups (Anheier and Salamon 1998). For example, the New Zealand Māori are thought to have a fundamentally different conception of what it means to volunteer. Robinson and Williams (2001) suggest that Māori tend to view family and community as intertwined, particularly in a small community context in which they have many familial connections. Within this context, providing unpaid help to others in their local community is considered to be a cultural norm in which older Māori often feel that their service activities are proscribed. Among Māori and other non-Western and indigenous groups (i.e., Alaska Natives), older adults may be highly active in their community, given their status as community leaders, and may have little time and energy for community volunteering. Caution should thus be exercised when considering recommending volunteering among older adults in non-European and indigenous cultural groups.

## Conclusion

After decades of scientific study, it is now well understood that engaging in volunteer activities can lead to enhanced physical and mental well-being among individuals in their postretirement years. Volunteering as a means to encourage positive aging is particularly intriguing because it contains the possibility for a double benefit; individuals and communities receive benefit from older adults providing helpful, free services, and older-adult volunteers maintain or even enhance their overall health in the process. The same cannot be said for other positive aging factors such as a regular exercise routine or maintaining a healthy diet. While research has come far in highlighting the salubrious nature of volunteering among the elderly, there are still many unanswered questions regarding mediators of the effect and for whom volunteering is indicated. As this field of research progresses, more information will undoubtedly emerge regarding how much volunteering is indicated for different age groups, the type of volunteering that is most beneficial for older adults, and the cultural aspects of engaging in volunteer activities, particularly for members of non-Western, indigenous populations.

## Cross-References

- ▶ [Age-Related Positivity Effect and Its Implications for Social and Health Gerontology](#)
- ▶ [Altruism and Prosocial Behavior](#)
- ▶ [Late Life Transitions](#)

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## Well-Being in Centenarians

Daniela S. Jopp<sup>1,3</sup>, Stephanie Hicks<sup>4</sup> and Seojung Jung<sup>2</sup>

<sup>1</sup>Institute of Psychology, University of Lausanne, Lausanne, Switzerland

<sup>2</sup>Fordham University, New York, NY, USA

<sup>3</sup>Swiss Centre of Competence in Research LIVES, Overcoming Vulnerability: Life Course Perspectives, Lausanne, Switzerland

<sup>4</sup>Psychology Department, Fordham University, Bronx, NY, USA

### Definitions

Well-being is a key dimension of successful aging. Centenarians have high levels of life satisfaction and happiness, which are similar to middle-aged and younger-older individuals. Positive affect has been found to be lower in centenarians compared to octogenarians, but the differences are not strong; no differences were observed for negative affect. The majority of centenarians have low levels of depression, while findings on age differences are inconclusive to date. Factors associated with these well-being dimensions are, in line with suggestions of high psychological resilience in very old age, more often subjective evaluations than objective facts (e.g., subjective health being linked to well-being, but not number of illnesses). More objective factors predicting well-being included functional

health and some social factors. Psychological strengths such as optimistic outlook were found to have particularly strong associations with well-being. In sum, findings indicate that centenarians are quite able to deal with health issues and resource restrictions that seem to play only a limited role in their subjective well-being. Psychological strengths seem of key importance for well-being in very advanced age, but more research is needed to confirm and develop this picture.

### Introduction

How advanced-age individuals feel about themselves and evaluate their lives is an important topic that is central to many discussions about quality of life in old age and successful aging. With the current increase in numbers of very old individuals and future projections indicating that every second child born after the year 2000 is likely to become a centenarian (Christensen et al. 2009), the question about whether life at age 100 is still worth living is gaining relevance for more and more individuals.

Questions about well-being (or morale) were asked at the outset of research on successful aging in the 1960s; “adding life to years, not just more years to life” was the motto of the first conference of the Gerontological Society of America. However, after all these years, the debate about what successful aging is – healthy aging, being cognitively intact, and socially active and

embedded – is still ongoing and has just recently gained more attention, also in the context of centenarian research. Interestingly, despite the fact that most laypeople tend to mention well-being when asked to define successful aging (e.g., Jopp et al. 2015), well-being has not been among the key factors in the most renowned models of successful aging. Yet, well-being has certainly been among the most investigated outcomes of empirical studies, particularly those which define successful aging in the tradition of resilience and adaptation.

Investigation of well-being aspects in centenarians is not only important because of its relevance for the many individuals who are likely to reach this age in the near future but because this research could help to better understand resilience and its underlying mechanisms under particularly difficult conditions. Although centenarians have long been discussed as models of successful aging given that they have outlived most of their cohort members, their physical, cognitive, and social functioning may be quite limited. For instance, studies from around the globe document that very few centenarians are in good health once they reach age 100. Centenarians are affected on average by about four to five diseases, particularly chronic diseases, which represent a considerable burden (e.g., Andersen-Ranberg et al. 2001; Jopp et al. 2016). Considering cognitive functioning, about half of centenarians have moderate to strong cognitive impairment or dementia (e.g., Kliegel et al. 2004). Regarding their social network, loss of loved ones is a central negative consequence of extreme longevity: many centenarians have outlived not only spouse, friends, and acquaintances but also some of their children (e.g., Boerner et al. *in press*; Martin et al. 1996). Thus, a key question is whether centenarians are able to cope with these challenges, and if so, which factors enable them to do so.

In the younger phases of old age, an astonishing discrepancy has been observed between, on the one hand, poor levels of functioning and lack of resources in central areas of life (e.g., health, cognitive capacity, and social function) and, on the other hand, rather high levels of well-being. That the poor resources do not translate into

equally poor levels of well-being has been termed the well-being paradox (e.g., Staudinger et al. 1995), and the investigation of underlying mechanisms is ongoing. Potential mechanisms are likely to be psychological in nature, such as life management or coping strategies which have been found to buffer poor resources in very old age (e.g., Jopp & Smith 2006). Thus, for centenarians, key research questions are whether they indeed experience decent levels of well-being at this advanced age despite very limited resources and which factors are associated with well-being at this age.

Given that the investigation of well-being was not a central theme in centenarian studies so far, the empirical basis is currently somewhat limited. Studies available offer findings on different facets of subjective well-being that are divergent in nature and could therefore lead to different findings. Furthermore, as research has shown that positive emotions and negative emotions are not different sides of a medal but rather independent, and both are likely to be affected by different factors, we included more positive as well as negative dimensions. Thus, the present entry considered different types of subjective well-being constructs: *cognitive well-being*, such as life satisfaction or morale, which represents the (somewhat more stable) outcome of a complex mental (cognitive) computation that is based on the evaluation of various aspects of life; *affective well-being*, including constructs such as happiness or affect, as expressions of (possibly fluctuating) positive or negative emotions; and *depressive symptoms*, representing a more negative aspect that has been used as a key outcome of many studies on adaptation and resilience.

### High Level of Well-Being at Age 100 Is Possible

Against prejudice many people hold about very old age, several studies have documented that high well-being at age 100 seems possible. Considering life satisfaction first, a majority of centenarians are quite satisfied with their lives. A total of 80% of the participants of the Second

Heidelberg Centenarian Study reported to be moderately to strongly satisfied with their life, using the life satisfaction scale by Pavot and Diener (1993).

In an Italian study, Buono et al. (1998) compared life satisfaction levels of 38 centenarians with two younger age groups (young olds, aged 75–85, and old olds, aged 86–99). In this study, life satisfaction (assessed as part of the LEIPAD scale; De Leo et al. 1994) was positively related to increasing age, and this effect was significant even after controlling for education, suggesting greater life satisfaction with advancing age. The Second Heidelberg Centenarian Study did not find higher life satisfaction in centenarians: When comparing the centenarians with younger older adults, old-old (80–95 years old) individuals were found to have lower levels of life satisfaction compared to young-old individuals (65–79 years old), but there was no difference between centenarians and the two younger control groups (Jopp et al. 2013). Similarly, when comparing near-centenarians (aged 95–99) and centenarians (aged 100–108), no mean level differences in life satisfaction, assessed with Pavot's and Diener's (1993) scale, were found (Jopp et al. 2016).

An interesting question is whether more recently born centenarians show similar or maybe even higher levels of well-being. Cho et al. (2012) examined cohort differences in life satisfaction by comparing the later cohort (centenarians born between 1901 and 1907) and the earlier cohort (centenarians born between 1881 and 1895) from the Georgia Centenarian Study. They found a significant mean level difference in life satisfaction (as measured by the Life Satisfaction Index A (LSI-A), Neugarten et al. 1961). The later-born cohort of centenarians showed higher life satisfaction (.56 z-score) than the younger cohort, suggesting that more recent cohorts of centenarians are more satisfied with their life and may be better off in terms of quality of life than previous cohorts.

Considering happiness, a more emotional facet of well-being, studies indicate that centenarians tend to feel quite happy and even as happy as middle-aged adults. Jopp and Rott (2006) examined happiness in 56 German centenarians from

the First Heidelberg Centenarian Study, using single items from the Life Satisfaction Index A (LSI-A; Neugarten et al. 1961), as well as questions asking whether individuals laughed often and whether they felt mostly happy (yes/no). Descriptively, 71.4% of the centenarians indicated that they felt mostly happy, 54.0% reported that they were as happy as they were at younger ages, and 67.9% said that they would laugh easily. In order to determine potential age-related differences in happiness, comparison groups of middle-aged (43–46 years old) and older adults (aged 61–65) were drawn from the representative Interdisciplinary Longitudinal Study of Adult Development (ILSE). Group comparisons revealed no significant differences regarding being as happy as when they were younger: Centenarians reported feeling just as happy as at younger ages as did the middle-aged and older adults. Furthermore, centenarians and middle-aged adults indicated being significantly more often able to laugh easily than the group of older adults.

Comparisons between individuals in the fourth age (80+ years old) and centenarians are available from the USA: In the Georgia Centenarian Study, Cho et al. (2012) examined happiness in 234 centenarians and 72 octogenarians. The results revealed that 89.8% of the octogenarians and 89.7% of the centenarians were categorized as having a high level of happiness, showing no significant group difference.

The extent to which centenarians experience positive or negative affect was investigated within the Georgia Centenarian Study, which used the Bradburn Affect Balance Scale (Bradburn 1969), comparing centenarians and octogenarians. As reported in the analysis by Margrett and colleagues (2011), centenarians had significantly lower levels of positive affect than octogenarians, but there was no significant difference in negative affect. Longitudinally, Martin et al. (2012) assessed positive and negative affect for 19 centenarians during four time points over a 6-month period. Although there was individual variability, the mean scores for positive affect significantly declined over time, while no significant change was seen in negative affect.

## Depressive Symptoms at Age 100 Are Not the Norm

Research on centenarians and near-centenarians shows that depressive symptoms are not typical in this advanced-age population. In contrast, mean scores on the commonly used Geriatric Depression Scale (GDS) generally fall in the nondepressed range (Yesavage et al. 1983). Similar levels of depressive symptomatology have been shown in American (Jang et al. 2004), Chinese (Wen et al. 2010), and Italian (Bauco et al. 1996) centenarian and near-centenarian samples. However, that is not to say that individuals with elevated depressive symptoms are nonexistent. Rates of depression have been shown to vary by country. For example, Infusino et al. (1996) found that the vast majority (80%) of Italian centenarians were not depressed, and the remaining 20% were moderately depressed, with no centenarians indicating severe depression, as assessed by the 30-item GDS. Even lower prevalence rates have been found among Australian centenarians, with only 13.5% showing any depressive symptomatology (Richmond et al. 2011). On the contrary, depression rates appear to be higher among Chinese centenarians, namely, about 25.5%, when considering a score of 10 or above on the Chinese version of the GDS (Wen et al. 2010).

Although research shows that the majority of centenarians are not depressed, studies that have examined differences in depressive symptomatology between centenarians and other older adult age groups have produced mixed findings. Buono et al. (1998) compared centenarians' levels of depressive symptoms to that of adults aged 75–85, as well as 86–99. They found no significant differences among the three age groups on two measures of depression (the LEIPAD depression and Anxiety subscales [De Leon et al. 1994] and the Brief Symptom Inventory depression subscale [Derogatis and Melisaratos 1983]). However, other research has shown that American centenarians have higher depressive symptomatology than octogenarians and sexagenarians (Jang et al. 2004). Data from the Fordham Centenarian Study (Jopp et al. 2016) further

indicates that although depression levels were low overall (72% had few or no depressive symptoms [GDS scores 0–4]; over 80% did not meet the criteria of clinical depression [GDS scores 8 and higher]), centenarians had higher levels of depressive symptoms than near-centenarians.

## Predictors of Well-Being in Centenarians

Given that centenarians seem to experience rather high levels of well-being, the following question is which factors are associated with this phenomenon, in order to identify potential underlying mechanisms. Considering life satisfaction first, studies have considered different types of basic personal characteristics and psychological aspects. In the Fordham Centenarian Study, for instance, the predictive validity of various resources, including demographic variables (e.g., age, gender, marital status, education), health (number of illnesses, subjective health, activities of daily living), cognitive functioning, and social resources (number of living children, support by family, support by friends) for life satisfaction was tested in near-centenarians and centenarians (Jopp et al. 2016). Only three significant predictors emerged in the regression analysis: the strongest predictor was subjective health, followed by number of living children and basic activities of daily living.

In line with the finding that health perceptions are playing a role, Bishop et al. (2012) showed that a higher level of fatigue was significantly associated with lower levels of life satisfaction. Also, negative affect had a significant negative association with life satisfaction, while positive affect was not significantly associated with life satisfaction. When examining the mediating role of positive and negative affect between various predictors (i.e., perceived health status, functional health, cognition, fatigue, distal stress) on life satisfaction, perceived health, functional health, and fatigue each had significant indirect effects on life satisfaction via negative affect but not via positive affect. Thus, the findings suggest that negative affect plays a more pronounced role in linking health-related factors to centenarians' life

satisfaction. In Bishop et al.'s (2011) study with two measurement points over an 18-month period, a higher level of negative affect at baseline significantly predicted a lower level of life satisfaction 18 months later.

In the Second Heidelberg Centenarian Study, findings strengthen the impression that basic resources are less important than psychological aspects. Considering various demographic, health, social, and psychological variables, psychological strengths including self-efficacy, optimistic outlook, meaning in life, and will to live had the strongest links to life satisfaction. Concurrent examinations in the context of regression analysis revealed that optimistic outlook was the strongest significant predictor of individual differences in life satisfaction (Jopp et al. 2013).

Considering predictors of happiness, Jopp and Rott (2006) examined the predictive values of resources (i.e., job training, cognition, health, social network, extraverted personality) and self-referent beliefs and attitudes (i.e., self-efficacy, optimistic outlook) on happiness. Positive self-referent beliefs and attitudes, such as having high levels of self-efficacy and optimistic outlook, were positively linked to higher levels of happiness. Among basic resources, job training had a significant negative direct effect on happiness. Follow-up analyses suggested that female centenarians who managed to receive job-related education in Germany around 1915 were very autonomy oriented, which was a beneficial trait in younger years, but maybe was maladaptive when having to accept loss of autonomy in old age. Another basic resource, social network aspects, had a positive direct effect on happiness. At the same time, self-referent beliefs and attitudes were more powerful predictors of happiness than basic resources. These psychological factors and attitudes also had mediating roles between some of the basic resources and happiness. For instance, cognitive resource and extraversion had a significant impact on happiness mediated by self-efficacy. In another mediator model focusing on optimistic outlook as a mediating factor, extraversion showed a significant positive direct effect on happiness, and prior job training and social

resources had indirect effects on happiness through optimistic outlook.

In the Georgia Centenarian Study, Bishop et al. (2010) tested a structural equation model predicting happiness with the direct and indirect effects of congruence (satisfaction with life in the past), perceived economic status, social provisions, and perceived health. Specifically, congruence had a significant direct association with current happiness, while perceived economic status, social provisions, and perceived health were not significant predictors of happiness. Taken together, psychological factors, such as positive beliefs and attitudes, and positive appraisals of one's past, play important roles in centenarians' levels of happiness.

Considering positive and negative affect, Margrett et al. (2011) examined the effects of various demographics (i.e., age, sex, residential status, ethnicity) and functioning variables (i.e., perceived ease in completing desired activities despite health issues, ability to perform activities in daily life), cognition, social functioning (i.e., social provisions, social resources), and personality factors (i.e., extraversion, neuroticism) on positive and negative affect in the Georgia Centenarian Study. Predicting individual differences in negative affect with regression analysis, they showed that neuroticism was significantly associated with higher levels of negative affect and social functioning was associated with lower levels of negative affect in centenarians, while none of the demographic, functioning, or cognition factors emerged as significant predictors. Regressions predicting positive affect, centenarians with higher cognitive functioning and those with greater social provisions reported higher levels of positive affect.

Using the same sample, Cho et al. (2013) examined the effect of proximal (i.e., physical functioning, cognitive functioning, subjective health, health problems, social resources, perceived economic status) and distal influences (i.e., education, social productive activities, management of personal assets, learning experiences) on positive and negative affect. For positive affect, cognitive functioning emerged as a significant predictor, after controlling for gender,

ethnicity, marital status, age, and type of residence. For negative affect, the number of health problems was positively related. This is in line with the theoretical assumption that affect (as an indicator of the emotional well-being dimension) is more variable than other, more cognitive well-being constructs (such as life satisfaction which is the result of complex mental processing of specific evaluations), and may therefore be influenced more strongly by current experiences. Also in line with this assumption were the findings indicating that none of the distal variables had significant effects on positive or negative affect, supporting the idea that proximal experiences may play more important roles in centenarians' affect than distal experiences. When interaction effects between age and predictor variables were examined, lower physical functioning and lower cognitive functioning had negative effects on positive affect among centenarians, but not in octogenarians.

Bishop and colleagues (2011, 2012) examined the relationship among resources, positive and negative affect, and life satisfaction in the Georgia Centenarian Study. Bishop et al. (2012) tested the mediating role of positive and negative affect between various predictors (perceived health status, functional health, cognition, fatigue, distal stress) on life satisfaction. Based on a path analysis, perceived health and fatigue had direct significant effects on positive affect. For negative affect, perceived health, functional health, cognition, and fatigue had significant direct effects. Longitudinally, Bishop et al. (2011) examined 137 cognitively intact centenarians at baseline and at 18-month follow-up (68 survivors at Time 2). Poorer cognitive functioning at baseline was negatively linked to positive affect at the follow-up, but not to negative affect.

In a longitudinal study, Martin et al. (2012) examined predictors (i.e., walking activity, financial resources, self-rated health) on growth curve changes in positive and negative affect. For positive affect, walking activity and financial resources were significantly associated, while walking activity and self-rated health emerged as significant predictors for negative affect. Overall, this longitudinal finding complements previous

cross-sectional findings suggesting that centenarians with fewer resources, particularly proximal resources, tend to show decreasing levels of positive affect and increasing levels of negative affect.

### Predictors of Depressive Symptoms

Experience of depressive symptomology may be less related to chronological age, but is likely to be the result of other age-associated interacting factors. One influential predictor of depression among the oldest old appears to be physical health and illness. Jang et al. (2004) found that disease and disability each independently predicted depressive symptomology among their sample of American older adults, including centenarians. However, this relationship is not straightforward, and factors such as illness type, gender, genetics, and personal beliefs appear to be influential. For example, Chang-Quan and colleagues (2008) also found that medical impairments were related to depression among Chinese older adults. However, this relationship was found only for certain types of illnesses and impairments. Specifically, out of 13 medical illnesses, only chronic lung disease, hypertension, arthritis, and hearing loss were associated with increased risk for depression. Gender also moderated this association; increased risk for depression was only observed among older Chinese women with these conditions. Depression was not related to any medical illness among older Chinese men. However, Chinese nonagenarians and centenarians with hypertension were not found to have an increased risk of depression compared to those without hypertension (Wen et al. 2010), prompting a need for further research in relation to certain medical illnesses and depression.

In the Fordham Centenarian Study, subjective health was the strongest predictor of individual differences in depressive symptoms: a more positive health evaluation was associated with fewer depressive symptoms (Jopp et al. 2016). Competence regarding instrumental activities of daily living had an independent negative and somewhat weaker effect. Social support through family and

relatives emerged as the third independent predictor, also being negatively associated. Other health aspects such as number of illnesses or personal activities of daily living were not associated with depressive symptoms.

There is further evidence that personal health beliefs are an important mechanism that may be responsible for buffering the effect of objective health issues, such as number of diseases, as they seem to contribute to the relationship between illness and depression among centenarians. Jang et al. (2004) found subjective health to mediate this relationship among American older adults, with the largest effects seen among centenarians. This finding might help explain the low rates of severe depression among this age group. For instance, only about 10% of participants perceived their health as poor among a sample of Italian centenarians whose mean GDS score was in the nondepressed range (Bauco et al. 1996). Thus, centenarians' health perceptions could protect against the effects of physical impairment on mental health.

Other factors such as personality and living environment have been shown to contribute to depression among centenarians as well. For instance, the personality trait neuroticism was found to relate to elevated depressive symptomology among American centenarians (Margrett et al. 2010). Furthermore, Margrett et al. (2010) reported that institutionalization status among American centenarians and near-centenarians ( $\geq 98$  years) predicted greater depressive symptomology. However, living in an institution was not associated with depressive symptoms in the Fordham Centenarian Study (Jopp et al. 2016). Also, only 10% of Australian centenarians who resided in nursing homes or hostels met the criteria for depression in Richmond et al.'s (2011) study. Thus, in conclusion, evidence regarding predictors of depression in centenarians seems somewhat mixed.

## Conclusion and Future Outlook

In sum, centenarians express high levels of well-being, and they show quite low levels of

depressive symptoms, both suggesting that psychological resilience is quite substantial at age 100. Notably, centenarians have high cognitive well-being, such as life satisfaction, and they feel as satisfied as younger-older adults and even middle-aged individuals. This indicates that the computation of overall life satisfaction, which is likely to take into account past and present aspects of different domains of living (e.g., life accomplishments, health, social and family relations, and other domains) is still working rather well in the sense that those domains with poorer evaluations get compensated by domains with more positive evaluations, allowing centenarians to maintain a rather positive evaluation. Findings are similar for happiness, representing a somewhat more emotional (and less computational cognitive) dimension of well-being. Regarding more emotion-centered fluctuating well-being dimensions, centenarians have lower levels of positive affect than octogenarians, although the differences are not large. Also, a reduction of positive affect has been documented over time, which suggests that difficulties encountered in life at age 100 result in the experience of less frequent positive emotions, maybe because instances that tended to be associated with moments of joy and enjoyment become fewer; yet, such differences or changes have not been observed with respect to negative affect which is experienced at a similar rate compared to younger-older adults and is stable over time. Together, these latter findings can also be interpreted as an indication that the mechanisms which buffer the influences of day-to-day experience still function quite well, so that challenging experiences do not result in an augmentation of negative feelings. As for depression, there seems to be no comprehensive evidence base today regarding higher or lower levels of depressive symptoms in centenarians; however, findings clearly indicate that only a minority of centenarians show elevated levels of depressive symptoms, underscoring that depression is not a normal part of reaching very advanced age.

These findings on high average levels of well-being are encouraging, yet there are of course individual differences. As for the factors that contribute to well-being, findings suggest that

objective factors, such as multimorbidity indicated by number of illnesses, play less of a role for positive well-being dimensions. Health variables that are related to cognitive well-being were functional aspects, which reflect the amount of autonomy a centenarian is still able to maintain despite health problems, as well as the evaluation of one's health, which depends only in part on objective health conditions but reflects the centenarian's capacity to cope with them, for example, by changing evaluative standards and expectations (i.e., judging one's health at age 100 as good, as all peers have already passed away). Social aspects, such as the number of living children, also were significant in some studies. Notably, for affect, more direct effects of proximal resources (instead of more distal) were found, including baseline walking capacity for changes in both affects, and financial means was further important for change in positive affect, but not for negative affect, underscoring differential effects for both affects. Yet, findings confirm that psychological strengths such as optimistic outlook have a strong direct influence and also mediate the effect of other, more objective resources on well-being, suggesting that these factors may be of particular importance. Thus, the well-being paradox apparently not only holds at age 100, but the psychological mechanisms that may be responsible for it are still in place and functioning quite well. Whether the same strengths are responsible and whether their effects are similar to those of younger ages warrant further examination.

Depressive symptoms, instead, seem to be more strongly associated with objective health issues such as number of illnesses. However, in some studies, only specific medical conditions were significant, and some effects were only found in women. Similar to the well-being dimensions, subjective health was also an important predictor for depressive symptoms across different studies. Single studies also report on the effects of neuroticism, social aspects, and living conditions, but more research is needed to clarify their potential influences. Thus, currently available studies seem to indicate similarities but also differences in the predictive patterns, yet this may

be, at least in part, a function of the predictors included in the study or analysis.

Limitations of the presented findings include that they stem from a small number of studies to date; thus, study characteristics such as sample representativeness need to be kept in mind. More research efforts are needed that investigate well-being dimensions at age 100 to strengthen the evidence available. Furthermore, the evaluation of some of the findings is difficult as these studies used different predictors and measures. More systematic efforts are required, for example, to determine the predictive validity of similar predictor sets for cognitive and emotional well-being dimensions and depressive symptoms within the same sample, to gain a better understanding of differential effects, and, across different samples, to ensure generalizability. In addition, comparing well-being levels and predictors across centenarian samples from different countries would help to examine which factors are relevant across and within specific cultural settings, given that not only person factors but also societal or cultural frameworks may be of influence. Currently, several efforts are undertaken to pool existing data to investigate, for example, depressive symptoms and their predictors in the context of a centenarian consortium. In addition, data from some centenarian studies are now also available which used similar recruitment and measurement and included various psychological constructs (Jopp et al. *in press*), which will not only result in findings on cultural specificity but will also enable testing more complex models predicting well-being, given they will be able to draw on larger samples. Moreover, studies are needed that address well-being predictors not only in centenarians but also in younger age groups in parallel, in order to determine which variables may contribute to well-being at different ages and which have unique contributions at age 100. And, of course, longitudinal studies in very old age would be important to address in more detail the dynamics of the mechanisms, such as, for instance, how changes in predictors (e.g., loss of meaning in life) may be related to change in well-being dimensions (such as depression). This could add to urgently needed groundwork regarding

development of preventions and interventions, as psychosocial interventions may be much cheaper to help older individuals in crisis, compared to paying for resulting costly medical interventions. Finally, long-term prospective studies will be instrumental in clarifying the extent to which well-being and psychological strengths facilitate reaching very advanced age and whether centenarians have a specific psychological makeup that has helped contribute to their exceptional survival.

Together, these research efforts will hopefully increase the understanding of centenarians' well-being and contributing factors and lead to a strong knowledge base that can be used for prevention and intervention efforts. In the end, maybe, the findings will confirm that successful aging in centenarians should be conceptualized as the amazing capacity of these extremely old individuals to cope with the challenges of their exceptional longevity, as a true victory of the human mind over age-related adversity.

## Cross-References

- ▶ [Fordham Centenarian Study](#)
- ▶ [Health in Centenarians](#)
- ▶ [Heidelberg Centenarian Studies](#)
- ▶ [Social Resources and Centenarians](#)

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## Widowhood in Late Life

Laura K. Soulsby<sup>1</sup> and Kate M. Bennett<sup>2</sup>

<sup>1</sup>School of Psychology, Eleanor Rathbone Building, Liverpool, UK

<sup>2</sup>Department of Psychological Sciences, University of Liverpool, Liverpool, UK

## Synonyms

Bereavement; Death; Loss; Spousal bereavement; Widow; Widower

## Definition

The death of a spouse is considered one of life's most stressful experiences yet it is, for many, a central experience of growing older. The terms "spousal bereavement" and "widowhood" are often used interchangeably in the literature. Both are marked by the death of a spouse but while spousal bereavement is generally understood to be a short-term state, *widowhood* refers to the ongoing, longer-term experience which requires an individual to reestablish their life in their new status as a widow, a woman whose husband has died, or a widower, a man whose wife has died. The death of a spouse has immediate and

longer-term consequences for many aspects of the surviving spouse's life, including their health and well-being, their personal relationships, how they spend their time, and their sense of self. The experience following the death of a spouse is personal and is influenced by a wide range of factors including prebereavement health, access to support, features of the married relationship, and characteristics of the surviving spouse. It is important to distinguish between these two distinct though related terms, bereavement and widowhood, since the effects of one may differ from the effects of the other. For example, shorter-term disruptions in sleeping and eating patterns are common following spousal loss, but these do not typically continue, longer term (Stroebe et al. 2001). The typical cut timescale of bereavement effects is around 2 years, after which effects are usually attributed to nonbereavement events.

### Theoretical Perspectives

The experience of the death of a husband or wife, or spousal bereavement, is a high probability event in later life, particularly for women. In developed countries, people are living longer and the proportion of older adults is increasing. In the UK, recent statistics suggest that around 30% of women aged between 65 and 74 are widowed, compared to around 10% of men of the same age. Among those aged 85 and over, while 44% of men are still married, nearly 80% of women are widowed (Office for National Statistics 2005). These patterns may be explained by higher life expectancy for women, women tending to marry older men and women remarrying after bereavement less frequently than men. Thus, men do not expect to be widowers as much as women expect to be widows. In line with demographic trends, much of the literature on widowhood focuses on women.

As early as 1917, Sigmund Freud (1953/1974) considered the impact of the death of a loved one on mood and the complex process involved in overcoming grief. Bereavement research traditionally categorized the experience of loss as prescriptive stages. In order to "recover" from their

bereavement, a person should confront their grief by moving through a series of ordered emotional states within a particular timeframe. Both the absence of grief, or prolonged distress, would be viewed as dysfunctional. However, these approaches tend to medicalize the experience of bereavement and fail to address the complex personal adaptation process. Colin Murray Parkes (1996) examined the effects of bereavement, with a focus on people widowed at a younger age, identifying the features of grief and the ways in which the bereaved could be better supported. The majority of research on spousal loss examines the effects up to 2 years after bereavement.

Helena Znaniecka Lopata was the first scholar to study, in detail, the experience of widowhood for older American women. In her book, *Widowhood in an American City* (Lopata 1973), Lopata made significant contributions to the understanding of the emotional and the social consequences of losing a husband. Stroebe and Schut drew on the large literature on coping with stress to develop the Dual Process Model of bereavement. The Dual Process Model (Stroebe and Schut 1999) attempts to explain the ways in which people adapt to bereavement. It outlines two types of coping: loss oriented and restoration oriented. Loss-oriented coping is characterized by grief work, which involves working through feelings, memories, and thoughts associated with both the spouse and their death itself. Clearing the deceased spouse's possessions or moving to a new home would be examples of loss-oriented coping. Restoration oriented, by contrast, comprises activity which facilitates change, such as taking up new hobbies, forming new relationships. It also involves avoiding things that serve as reminders of grief. For example, trying to keep busy so that there is little time to think. In this conceptual model of bereavement, coping moves, or oscillates, between loss- and restoration-oriented coping tasks, Stroebe and Schut argue that loss-orientated behaviors are more common in the period following bereavement, with more restoration-oriented behaviors as time progresses.

Contemporary research continues to extend the understanding of the experience of bereavement

and widowhood. While many studies of bereavement are limited by their cross-sectional design, a team of researchers at the University of Michigan designed the Changing Lives of Older Couples (CLOC) study (Carr et al. 2006) – a large-scale prospective longitudinal study which tracked the experiences of older widows and widowers over a 4-year period following the death of their spouse. The CLOC data has revealed the complex associations between variables including marital quality, level of forewarning, economic resources, and a wide range of health and social outcomes, such as depression, health behaviors and relationships, following spousal death. The knowledge offered by this, and other research on the experience of spousal bereavement and widowhood is summarized below.

### Challenges in Late Life Widowhood

**Health challenges** Widowhood represents a decline in health, both psychologically and physically. Marriage has a protective effect on health. Research demonstrates that, at least in the shorter term, the death of a spouse causes lowered levels of psychological well-being (Soulsby and Bennett 2012). Widowed older adults report higher levels of mood and anxiety disorders, lower levels of life satisfaction, and elevated levels of loneliness. A much smaller proportion experience clinical levels of depression, contradicting the view of bereavement as an “illness.” Marriage can provide a sense of meaning and has been found to influence feelings of mastery and self-esteem. Evidence shows that spousal death has the potential to cause feelings of worthlessness and reduced morale for older adults, which persist even after several years (Soulsby and Bennett 2012). Further, psychological stress has a physical impact. Thus, it is perhaps not surprising that, since widowhood is regarded as one of the most stressful life experiences, older widowed adults, who may already be experiencing failing health, report a higher number of health problems and more disturbed patterns of sleeping, and are more likely to engage in health poor behaviors (e.g., poor diet, lower levels of exercise and substance use)

compared to their married counterparts. The relationship with medical support is less clear: for some, use of medical support increases, while for others, widowhood represents a decline in the maintenance of health behaviors. People often talk about spouses dying from “broken hearts” after the death of their spouse and research shows that widowed adults, and men in particular, have a higher mortality risk compared with married people, especially in the immediate period following bereavement (Stroebe et al. 2007). However, while physical health impacts may persist alongside an age-related decline in health, the psychological impact of the death of a spouse is typically acute with significant psychological disruption in the immediate period following bereavement, which usually resolves over time.

**Social challenges** One mechanism explaining psychological and physical health changes in widowhood is the loss of support associated with spousal death. Relationships are important to health, independent of a person’s marital status, and it is well established that greater access to support allows for better levels of health by providing a sense of self-worth, for example, or helping us to cope during times of stress. The way people organize their personal relationships, including how and how often they interact with family and friends, vary by marital status. For example, there is evidence that widowed women develop a preference for friendships with other widows (Morgan et al. 1997). Marriage is often regarded as a fundamental basis for support and integrates people into wider social networks. Not only is widowhood marked by the death of a primary source of support, the spouse, it also causes significant changes in the wider social network. Thus, social changes in widowhood have implications for health. The structure of the social network changes with increasing age, and older adults typically report a smaller network, comprised of more fulfilling relationships. Widowhood has been called a “social crisis”: the bereaved must learn to socialize as a single person, renegotiate relationships with friends and kin, weakening some ties while strengthening others, and may face the loss of relationships with married couples and shared friends. Often,

changes in social relationships occur not only after spousal bereavement but also before the loss where there is a period of illness (Carr et al. 2006). In the immediate period after spousal bereavement, family members are the central support providers and an important center of social activity, especially as the widowed manage the tasks and ceremonies associated with death. The widowed have reduced involvement in leisure activities, which may result from reduced desire to socialize, loss of a leisure partner, or the practical barriers, such as money or transport. This, in turn, can have a negative impact on well-being. Over time, the social network then evolves and the duration of widowhood is positively related to the likelihood of contact with friends, forming new friendships and, for some, development of new romantic relationships.

**Renegotiating identity** A person's sense of self is challenged following the death of a spouse. The married relationship is a central source of identity, both privately and publically, and it is common for the death of a spouse to be compared to the loss of a limb. Widowhood prompts a process of identity reconstruction through the loss of the coupled identity, the performance of day-to-day activities as a spouse, and the social meaning of being married. The surviving spouse must adjust to the new status as a widow or widower. This involves the loss of an often long established identity as a wife or husband, accommodating new roles and responsibilities and adjusting to changed relationships with family and friends. The experience of widowhood is assimilated into a person's understanding of themselves. For older widowers, becoming a widower is usually in addition to the negative identity consequences of the transition out of work through retirement. There is evidence that the loss of the married relationship threatens men's masculinity and that, often, men find ways to maintain a masculine identity, including remarriage (Hoonard 2010). Yet, the status of "widow" or "widower" allows the surviving spouse to maintain a bond with their spouse and is an acknowledgement of their married relationship, as someone who was married and experienced spousal death. Indeed, research demonstrates that those who continue to

communicate with their deceased spouse appear to cope better than those who do not. In one British study, older widows spoke about the way their identities had changed as a consequence of their widowhood. The women reported an augmented identity. That is, they described not having a sole identity as a widow, but having an identity as a widow whilst retaining their identity as a wife (Bennett 2010a). As this suggests, coping is associated with the widowed trying to establish a new autonomous identity. Researchers have argued that widowhood provides an opportunity for the widowed to learn new skills and the experience of personal growth is not uncommon. For example, older widowed adults might experience a sense of achievement, or describe themselves as a stronger, more independent or a better person having experienced this loss. Older women tend to describe these changes more frequently than do older men. Continuity of relationships with family and friends, as well as having opportunities to develop independence and a sense of personal autonomy may all facilitate better adjustment in widowhood.

**Practical challenges** As well as changes in the social resources described above, older widowed adults face a loss of economic and practical resources, and significant changes to their daily routine. There is usually reduced financial security; they may need to relocate physically; and must learn to live alone, reconstructing their daily lives to account for the changing responsibilities. Widowhood affects the performance of day-to-day household tasks, particularly for older men (Carr et al. 2006). Gender-based household responsibilities are typical in this cohort of older adults and, while friends and family may assist with instrumental tasks in the early stages following bereavement, the widowed must learn to adapt to new domestic responsibilities that were previously performed by their spouse. Widows describe learning how to manage their finances and home maintenance, while the amount of housework performed by men typically increases. The quality of the married relationship influences the ease with which people manage these practical adjustments in widowhood. For example, higher levels of anxiety have been found among those who were highly dependent on their spouse for

household tasks (Carr et al. 2000). Adult children are usually a central source of instrumental support for older widowed. While research suggests that widows are more likely to give and receive higher levels of support from adult children than widowers, there is evidence that men are perceived to receive more support than women after the death of a spouse. As time passes, the provision of support typically declines, as the widowed adapt and no longer need as much support. However, declining health remains a physical barrier to instrumental independence among the older widowed.

### Factors Influencing Adjustment in Late Life Widowhood

The experience of widowhood is complex and may vary considerably from person to person, depending on situational factors surrounding the death, access to the resources needed to support adjustment and individual-level factors, such as gender and age.

**Circumstances of the death** Situational variables, including forewarning, can influence adaptation following bereavement. The experience of spousal death varies between those who had some forewarning and those whose spouse died suddenly (Carr et al. 2006). Care work is emotionally and physically challenging, and older adults providing care for a spouse may also experience isolation. Yet, longer terminal illnesses may allow the surviving spouse to discuss and prepare for the death with their spouse and anticipatory grieving may take place. In sudden death situations, on the other hand, there is usually no opportunity to discuss impending death with the spouse, which may cause poorer health. Research demonstrates that unexpected deaths, violent deaths and suicide are more often associated with psychological distress compared to other types of deaths, especially those which occurred in natural circumstances. Other circumstances of death, such as the relationship between the deceased and the surviving spouse, influence the adjustment to widowhood. A higher level of dependence on a spouse during marriage is associated with a higher level of yearning and anxiety in widowhood. In contrast, marriages which were high in conflict

predict better outcomes following the death of a spouse (Carr et al. 2006). For those who were heavily dependent on their spouse, adjustment in widowhood may be more challenging.

**Gender** While spousal bereavement is less common among men, the central experiences of widowhood do not differ by gender. Both men and women miss their spouses and find life without their spouses challenging. Yet, the majority cope well enough. Research suggests that there are gender differences in the shorter-term psychological impact of spousal death. In general, older women are more likely to report higher levels of depression than men. However, in widowhood, these gender effects are generally reversed. Both men and women have lower levels of psychological health compared to their married counterparts but, compared to widows, widowers are more vulnerable to depression and are more likely to die (Stroebe et al. 2007). Gender also influences access to support in widowhood. Older widows are more likely to be involved in kin and friend networks, whereas older widowers report less access to support and may be disadvantaged by the absence of a peer group (Stroebe et al. 2001). One common assumption is that men are more likely to remarry to address this lack of support. The rate of remarriage or consideration of remarriage is higher amongst widowers than widows, and widowers are quicker to do so than widows (Bennett et al. 2013). However, actually only a small proportion of widowers remarry. In the UK, 6.1/1000 widowers aged 55 years and over remarry, compared to 1.1/1000 of widows (Office for National Statistics 2005). Interestingly, men and women talk about the events that led up to the death of their husband or wife in different ways (Hoonaard and Bennett 2013). Women's death narratives focus on goodbyes, on the emotional impact of the death and on the (un)expectedness, and place, of death, while men talk about the deaths in a way that enables them to show themselves as men. They are more factual about the events and use masculine speech, describing how they protected their wives.

**Age** Widowhood is a more expected event in later life. Compared to spousal death in midlife, older widowed adults may be more prepared

emotionally and practically and are more likely to have a widowed peer group (Soulsby and Bennett 2012). In a study comparing the experiences of widows over three age groups, young widows were found to be more symptomatic and, moreover, the symptom severity was more pronounced for those widows who had lost their husband at an earlier age (Ball 1977). There appears to be a curvilinear relationship between age and mortality/morbidity. Evidence suggests that those widowed in midlife are at greater risk compared to both younger and older widows. However, there are specific challenges faced by those widowed at an older age (Stroebe et al. 2001). Vulnerability to the short-term strains of widowhood increases with age. Most likely, this is in part attributable to the fact that it aggravates existing health problems, which are more prevalent in older adults. Older widowed adults may be faced with other losses, including reduced finances and the death of older family and friends. Older adults may feel that they should suppress their emotions. There are also differences in access to support: younger (aged 50–75 years) widows and widowers have a more stable social network compared to older (aged over 75 years), who typically experience a reduced sense of closeness to members of their social network (Lund et al. 1990). Thus, those widowed in later life may be at greater risk of experiencing social isolation or loneliness (Carr et al. 2006).

### Coping in Late Life Widowhood

Research demonstrates that, while widowhood is no doubt one of life's most stressful events, the negative impacts of spousal bereavement recover over time and most people are able to adapt to their changed circumstances. What facilitates adaptation? Traditional approaches to bereavement held that the bereaved must engage in grief work: working through thoughts and feelings in response to the death as a means of moving forward. More contemporary views argue that grief work is not a necessary part of adaptation in widowhood. Many older widowed adults cope reasonably well with the death of their spouse

without professional help. They instead draw on their own resources.

The Dual Process Model of bereavement (Stroebe and Schut 1999), described earlier in this entry, offers an insight into the types of coping processes that are associated with successful adjustment: accessing support when needed, making meaning, developing new relationships and reconstructing a new identity help to foster adaptation. As has been discussed earlier in this entry, access to support following the death of a spouse is a predictor of health outcomes and those who are embedded in supportive networks generally fare better. Friendships are particularly important for emotional and social well-being in widowhood and research has demonstrated that opportunities for reciprocal emotional and instrumental support are associated with lower levels of depression, greater satisfaction with life, and better coping.

Research using data from the CLOC study has revealed different adjustment trajectories in widowhood: time-limited disruptions, or “common grief”; chronic disruptions, lasting several years or longer; improved well-being; and the relative absence of depression (Bonanno et al. 2004). Among those who exhibit chronically elevated levels of depression, researchers have highlighted the importance of prebereavement functioning, distinguishing between those experiencing *chronic grief*, characterized by marked, longer-term increases in depression in response to the challenges of the death of a spouse, and those experiencing *chronic depression*, who report elevated levels of depression prebereavement, which then persist in widowhood. Another group, labeled the “depressed-improved” group, show a pattern of high levels of depression prebereavement, which is significantly reduced after spousal death. The pattern of adjustment in this group suggests that spousal bereavement represented the experience of the end of a chronic stressor such as an unsatisfying marriage and/or care work prior to the death. Finally, research shows that between approximately 30–50% of widowed men and women are resilient and do not show significant increases in depression, or other grief responses including searching for

meaning, thinking and talking about the loss, and distraction, following bereavement.

Resilience may be broadly understood as an ability to “bounce back.” A person could be classified as resilient if they viewed their current life positively, they were currently actively participating in life, and felt that their life had meaning and satisfaction (Moore and Stratton 2003). Thus, although most older adults are able to adjust in widowhood, not all who adjust appear to be resilient. Resilience may develop gradually, such as through the exercise of practical skills and the maintenance of emotional ties, or following a turning point, such as the receipt of support (Bennett 2010b). Contrary to the clinical view that the absence of grief symptoms is indicative of unresolved grief or denial, there is no evidence that resilient individuals are maladjusted or have a lesser emotional bond with their spouse.

## Summary

Research demonstrates that the death of a spouse in later life has a profound psychological, physical, and social impact. Spousal bereavement poses challenges for health, personal relationships, financial stability, and identity and widowed older adults must adjust to a new life as a widow or widower. Despite this, most older widowed adults demonstrate a capacity to adapt to the challenges associated with the death of a spouse, and many are resilient. Yet, there is still much to learn about the experiences which follow the death of a spouse. For example, we have not discussed the cross-cultural variations which may exist in the meaning and impact of spousal bereavement and subsequent widowhood. There may be generational differences in coping strategies, and this will influence the experience of widowhood for future cohorts of older adults. Limited research has considered the loss of a partner in same-sex unions and this needs more attention. It is hoped that future research will shed more light on the short- and longer-term experiences of both heterosexual and LGBT spousal loss.

## Cross-References

- ▶ [Aging and Psychological Well-Being](#)
- ▶ [Grief and Bereavement: Theoretical Perspectives](#)
- ▶ [Late Life Transitions](#)
- ▶ [Life Span Developmental Psychology](#)
- ▶ [Psychological Theories on Health and Aging](#)
- ▶ [Resilience and Aging](#)
- ▶ [Social Support and Aging, Theories of](#)

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## Women and Retirement

Sarah Wright and Anne K. Soutter  
 Department of Management Marketing and  
 Entrepreneurship College of Business and Law,  
 University of Canterbury, Christchurch,  
 New Zealand

### Synonyms

Aging; Gender; Retirement; Work transitions

### Definition

A woman's retirement is a subjective experience that includes personal (lifestyle) as well as objective indicators (ceasing work). A women's retirement age is defined as the age when a woman

describes herself as permanently not working or looking for work.

## Introduction

Acknowledgment of the gender differences for working women has intensified awareness of the issues surrounding women in retirement. Prior to the 1980s, retirement research included women specifically only as a proviso to examine married women's perceptions of their husband's retirement or to analyze the effect retirement had on marital behavior. This trend reflected societal norms which tended to perceive women as dependent wives of male earners, who had minimal income independence or financial security in their own right. However, women's participation in the labor force has significantly increased over the last four decades, predominantly due to improved access to postsecondary education, legislative changes regarding pay parity for female workers, and a greater demand for workers in the service industry. With the increase in women participating in the workforce and as they continue to live longer than men, women will continue to make up a larger proportion of the retired population. The focus of this discussion is to illustrate that women's retirement experiences, like their working experiences, are different from men's experiences and therefore require specific attention in research and theory development.

## Women's Retirement: Research Approaches

Calasanti (1996) has argued that a historically "androgynous" view of retirement fails to acknowledge the ways in which women's experiences are distinct and/or unique from men's. While similarities between men and women's experiences in work life, such as seeking feelings of competence or aiming to make a productive and necessary contribution (Perkins 1992), may have provided support for this approach, substantial differences exist between the working lives of

men and women. Women tend to be employed at lower organizational levels and are more likely to be employed in clerical, sales, and service roles. Conversely, jobs involving supervisory or managerial capacities are more likely to be held by men. In addition, women's employment pathways tend to be more circuitous and intervallic than men's, largely due to commitments to care for family members. Such pathways have a significant impact on a woman's opportunity to develop a continuous set of skills or to improve their occupational status (Quick and Moen 1998). They also tend to have had job assignments with lower remuneration, limited benefits, and fewer opportunities for career progression or promotion (Jefferson and Preston 2005). Compared to men, women are also more likely to occupy jobs that do not offer highly remunerative superannuation schemes.

Differences in men's and women's work life play an important role in differentiating the retirement experience of women from men, beginning fundamentally with the way in which retirement is defined. Common conceptions of retirement involve the transition from work as a distinct point in the life cycle when a working adult (usually an older male) leaves the workforce and never reenters it. For the growing number of retired women who continue to carry on with the domestic tasks and the activities they had always done while working, the notion of a "crisp" or one-time break from working life does not closely align with their experiences. Moreover, given demographic changes in the workforce and a concurrent move away from traditional gender roles and conventional family structures, it is neither appropriate nor accurate to assume that a woman's transition to retirement or her post-employment experience will follow the same pattern of previous generations of women or of men. New models for research on women and retirement are needed that consider the changing nature of the work environment and the unique experiences of women in and beyond the workforce. Two research approaches that work toward these ends include gender comparison studies and within

gender studies that more specifically focus on the female experience.

## **Gender Comparison Research**

Gender comparison research has been influential in identifying the ways in which the differences in men's and women's working lives influence their retirement experience. Four areas of research in this field include examination of the differences between men and women in remuneration and benefits, retirement planning and decisions, retirement goals, and levels of satisfaction upon retirement.

## **Gender Differences in Remuneration and Benefits**

Pay differential between working men and women is one variable that gender comparison research has explored for its effects upon retirement adjustment and well-being. According to aggregate statistics from 15 Organisation for Economic Co-operation and Development (OECD) countries in 2005, women on average have 29.2 years in employment, whereas men have 36.1 years (OECD 2009). Moreover, in the United States, women's full-time earnings were on average 81% of their male counterparts' earnings in 2005 (US Department of Labor 2006). The pay differential in the United Kingdom currently stands at 86% (Women and Equality Unit 2005) and ranges from 53% to 79% in European countries (OECD 2002).

These figures show that in general the extent of inequality has narrowed slightly since 1950 when a woman, on average, earned 60 cents for every dollar earned by a man (Blau and Kahn 2000). Nevertheless, for many families, the woman's income is a secondary source of earnings and is typically used for current consumption, presumably because this income has been considered temporary due to her discontinuous work history (Butrica and Iams 2000). If however the marriage fails, the inequality of this financial situation comes to the forefront, and

the financial disadvantage falls heavily on the woman (Orel et al. 2004). She consequently has more limited earning power or job opportunities, is without sufficient pension, and has not accumulated an asset base for her future security (Butrica and Iams 2000).

Differences in employment tenure and disparities of income during employment continue to impede women's abilities to qualify for pension schemes or accumulate savings; thus, the average income of women during retirement is disparate from that of men (Jefferson 2009). Women, on average, earn 79% of a man's retirement income (Social Security 2014), and in some high-income nations, more than 75% of the elderly poor aged 65 and older are women (Smeeding and Sandström 2005). With life expectancies surpassing that of men in industrialized nations, women are more likely to spend additional time in retirement, relying on accumulated lifetime savings for extended periods of time and thus contributing to their quality of life in retirement.

### Retirement Planning and Decisions

In general, women spend less time planning and preparing themselves for retirement compared with men (Jacobs-Lawson et al. 2004), a finding that has been attributed both to financial (lower disposable income leading to less planning) and socialization factors. In many cultures, women are socialized to believe that retirement is an exclusive life event for men, even if both husband and wife have been working throughout their adult lives. For example, Barnes-Farrell's (2003) research has shown that in dual career couples, the husband's anticipated retirement is quite often the most important factor in a woman's own retirement decision. In an earlier study, Whiting et al. (1998) found that retirement preparation was either exclusively focused on the husband's planned lifestyle, or what the couple would do together, leaving many women in the study unprepared for retirement in terms of financial preparation or recreational planning. Further, older women have often exercised less economic influence within the family and therefore have had

little experience in financial planning. In many cases, women have been insulated from understanding or knowing about their husband's financial situation, which can leave them vulnerable if widowhood occurs (Society for Research on Women in New Zealand 1999).

### Retirement Goals and Roles

When women do actively engage in planning for retirement, research suggests that their goals and aspirations tend to be more ambiguous than those reported by men. For example, Jacobs-Lawson, Hershey and Neukam (2004) found that women had more abstract goals, whereas men had more concrete goals. Women's goals were typically "other" focused compared to men (e.g., spending time with family, going out with friends). This corresponds with conventional beliefs that females are more apt at establishing and maintaining interpersonal bonds. The men in the sample rated leisure goals much more highly than women (e.g., golf, walking). Both men and women had a comparative number of goals regarding financial stability, exploration (e.g., holidays), contribution to others (e.g., volunteering), and spiritual (e.g., church, ministry work). However, men tended to generate task-specific goals, whereas women generated abstract goals, and were typically more concerned with general states of well-being than the realization of retirement goals (ibid.).

Particularly for older men and women, gender roles may also have an influence upon retirement decisions. One area in which the influence of gender roles manifest was the number of dependents in a working women's household; the greater the number of dependents, the greater the likelihood of women being retired (Talaga and Beehr 1995). Women in Talaga and Beehr's (1995) study were more likely to be retired if their husband was in poor health, enabling them to stay home to provide care. In addition to highlighting the extent to which external or uncontrollable factors in the women's environment were significant predictors of women's decisions to retire, Talaga and Beehr's (1995) research

further showed that many women continue to fulfill traditional roles as homemakers and caregivers in retirement, potentially affecting their retirement experiences and levels of retirement satisfaction.

In addition to retirement decisions, gender roles may also influence how retirement affects one's identity in retirement. Research by Hanson and Wapner (1994) suggests that many women experience retirement as a continuation of life rather than a defining change of role. Because women in Hanson and Wapner's (1994) study were more likely to derive their identity from informal roles and relationships, as opposed to structured roles in occupational settings, many found the transition to retirement less taxing than men. These findings led the researchers to suggest that women's working lives, often full of discontinuity, contributed to their ability to find role continuity as they transitioned into retirement (Hanson and Wapner 1994).

### Retirement Satisfaction

Studies that compare retirement adjustment through the lens of gender have produced some interesting, although at times contradictory, findings. For example, Quick and Moen (1998) reported that men are more likely than women to report satisfaction in their retirement compared to the last 5 years of employment. A more recent study explored the level of satisfaction of married retirees with their own retirement experience compared with their spouses, finding that husbands of retired wives are more satisfied than the wives of retired husbands (Smith and Moen 2004). Richardson and Kilty (1991) point to extended periods of unemployment in a female's work history and their propensity to spend more time in part-time employment as adversely affecting their retirement quality. However, Quick and Moen's (1998) research suggests that employment disruptions do not necessarily directly trigger retirement dissatisfaction. Their research found that women were more likely to report satisfaction with their retirement if they had experienced several yearlong gaps in their employment history. According to the researchers, the

transition to retirement perhaps is not as stressful for these women because they have experienced reasonable amounts of time away from the workforce, compared to those women who have been working continuously. Yearlong breaks may also be part of a planned employment strategy, which may not affect job reentry and occupational stability, or dramatically alter pension plans or lifetime savings. In addition, the ability to take multiple yearlong breaks probably also signals a socioeconomic and social support/marital status that enables this choice. The continuing availability of these greater resources may be a factor that contributes to the greater retirement satisfaction reported by women who appeared to have a planned strategy in their broken employment history.

Other studies have identified no significant differences between men and women with regard to retirement satisfaction (Kim and Feldman 2000). For example, Seccombe and Lee (1986) found that the antecedents of retirement satisfaction were similar for both genders; retirees in better health and those with higher incomes were more likely to report greater retirement satisfaction, regardless of gender. However, it should be noted that while moderating effects were not apparent in Seccombe and Lee's (1986) study, a number of individual differences associated with retirement satisfaction differed across gender, including length of time in the workforce, employment opportunities, and lifetime income. As such, the status of women on these variables can mean that at retirement, they are positioned in less favorable circumstances. Thus, individual differences in life circumstances may have more of an effect upon retirement satisfaction than gender per se. For Dailey (1998), key factors contributing toward a comfortable retirement for women include being married, having a high education, having an uninterrupted work history (or planned breaks maintaining occupational status), and owning a home. Circumstances such as divorce, downsizing, and disability reduce women's prospects during retirement and increase the risk of poverty in old age, a pattern that does not hold for both genders (Dailey 1998).

## Within Gender Research

Both male-oriented theoretical models and gender comparison research have contributed to a greater understanding of women's unique experiences in retirement. However, today's female retirees' experiences differ in important ways from both their foremothers and from their male counterparts, making women's retirement an important area for research and theory development. A discussion about women's experiences with retirement must consider the unique circumstances such as employment history and the nature of work commitments and family responsibilities that have shaped their lives within and outside of the context of their work. Three key areas are discussed below which consider the ways in which women's experiences are distinct from men's: women's roles and role identities, caregiver responsibilities, employment pathways, and remuneration opportunities.

### Women's Identity in Retirement

For many people, regardless of gender, one's position in the workforce is a principal source of personal identity. Research by Barnes and Parry (2003) found that women with strong work identities viewed retirement as a negative life event in ways that differed from men; women described retirement as a loss of a source of sociability while men described retirement as a time of potential loss of status. Price (2000) found that women retired from a professional career were more inclined to miss the challenge that work provided, as well as opportunities to tackle issues of problem solving, or to face novel experiences or other complex dilemmas on a daily basis. Many of the interviewees in Price's (2000) study had to confront stereotypes regarding retired women, particularly the perception that retired women are incompetent. As a result, many felt that they experienced discrimination because of their retired status. Despite the loss of the sense of achievement that came from their daily work, the majority of women retirees Price (2000) interviewed maintained that their sense of identity had not been severely threatened following their retirement.

Adjustment to retirement has also been shown to be affected by the type of jobs women held in their working life. For example, Price (2002) interviewed 29 retired women about their working and retirement experiences, half of whom had held professional jobs (e.g., medical doctor), while the remaining half had held nonprofessional jobs (e.g., clerical worker). In terms of the women's attachment to work, professional women in the study viewed retirement as an ending to a significant chapter in their lives. These women indicated that they felt a loss of social status after retirement, and over half of these women reported missing the social interaction that their work had provided. For professional women in particular, the incorporation of structure into their daily lives facilitated the adjustment process. In contrast, nonprofessional women expressed little difficulty in leaving their work roles, indicating that they felt relieved from the workforce. Nonprofessional retirees also indicated that they did not miss the interaction with former coworkers and reported being more involved with community and social activities. Nonprofessional women were inclined to view their family as their primary job, even during their working years. Finally, due to their more transitory employment histories, nonprofessional women were more likely to have greater familiarity with the adjustment process necessary to successfully adapt to moving out of the workforce (Price 2002).

In some aspects supporting and in some contrasting these findings, Richardson and Kilty (1991) found that women who had worked in jobs with low occupational status and experienced a large drop in income were most vulnerable to retirement adjustment problems. The authors suggested that retirees who had worked in professional or prestigious jobs are more likely to retain professional contacts, be involved in professional groups, and take on part-time professional employment, therefore maintaining their connections to, and status and integrity within, the community. Moreover, because of the nature of their occupations, many professional women are able to continue to practice their skills and abilities in

new roles that provided them with a sense of accomplishment and self-esteem. In contrast, retirees who had worked in low-status occupations were less likely to be able to utilize their skills in a way that generated postretirement income or facilitated social contact during retirement (Richardson and Kilty 1991).

### **Family Responsibilities and Women's Retirement**

For many working women with comparable levels of education and income to men, family commitments and responsibilities have had an effect on their ability to actively participate in the labor force. Thus, a large majority of today's female retirees have faced child-rearing responsibilities and are also likely to have had an, at least somewhat, intermittent employment record. This generation of retirees is also the first cohort of women whose participation in paid work has extended most of their adult lives. In contemporary research on women and retirement, women's work history and pathways are considered important factors in how and when retirement is experienced by women.

At varying stages of their lives, many working women find they must negotiate the demands of family and work obligations simultaneously. For example, childcare responsibilities often compete with work demands during a parent's early life, and eldercare needs may create significant strains during a woman's midlife. For many women, family care responsibilities take precedence over participation in the paid workforce. This results in a substantial proportion of women taking time out of paid employment in order to meet family needs, with particular impact on women whose country's pension scheme is based on participation in paid work (Jefferson 2009) or work for companies with employee-sponsored plans (Even and McPherson 2004; Thompson 2006). For many women, meeting these family responsibilities can dramatically affect the economic security and timing of their retirement. Through these effects, family responsibilities have the potential to significantly influence the psychological well-being of women during their elder years (Jefferson 2009).

During their working lives, a high proportion of women take on either full-time or part-time childcare responsibilities. Over the time, these occupational interruptions can have negative consequences for career continuity, upward mobility, and income potential. A causal link has been made by some researchers between access to affordable childcare and women's capacity to engage in employment and thus accumulate adequate pension entitlements (Frericks et al. 2006). Women who leave the employment setting for childcare responsibilities face losing potential seniority and job training opportunities and may experience skill depreciation or skill obsolescence (Dailey 1998). Further, because many retirement pensions and benefits are directly related to lifetime earnings, many women will receive significantly less than men in retirement income. Effectively, the operation of these factors can introduce a "wage penalty" for women who bear children (Hewlett 2002, p. 124). Although the entitlements for parental leave differ across countries, the effect of reduced overall earnings is not only economically disadvantaging for women during their working years, but also during their retirement. As noted previously, however, those women who experience several yearlong gaps in their employment history are more likely to report greater satisfaction with their retirement (Quick and Moen 1998). Such research indicates that planned career breaks need not be detrimental to a women's retirement well-being.

In addition to childcare responsibilities, women continue to cope with family obligations later in life when they face caring for their spouse or aged parents. The price of eldercare can be extensive in terms of time away from work and in the resources required to care for the family member. For instance, elderly parents must be taken to and from medical appointments, meals must be prepared and provided, housework must be completed, and personal hygiene must be attended to. Thus, in addition to the financial demands, eldercare almost inevitably requires an expenditure of time away from the employment setting (Hatch and Thompson 1992). The extent of these time requirements sometimes initiates the early retirement of women.

In addition to the need to care for elderly parents, ill health or disability in one's spouse has consistently emerged as an important predictor of the retirement decisions of married woman (Talaga and Beehr 1995; Hatch and Thompson 1992). In Talaga and Beehr's (1995) research, women who believed that their husband was in poor health were more likely to retire from the workforce to care for their spouse than were men with an unwell spouse or family member. In contrast, the men were more likely to continue to participate in paid employment to provide financially for their dependent family member. Further supporting this pattern, research by Matthews and Brown (1988) showed that female retirees, more so than male retirees, were more likely to retire for reasons that had to do with others, typically the health of their spouse or other family members.

Retirement from paid employment often implies a period of newly found freedom, a time when recreational pursuits can be engaged in with increased vigor, intensity, and commitment. However, for women who prematurely leave paid employment to assume a caregiving role, retirement is not generally viewed as an opportunity to pursue leisure activities but is considered another form of work in itself. Thus, the extent to which retirees have a sense of control over when they leave the workforce and deciding how to spend their time once leaving work seems to significantly affect retirement satisfaction and adjustment (Costa 1998).

## Conclusion

One of the most consistent research findings in the retirement literature is that the cessation of paid employment is financially challenging for women, and a number of factors have been identified as contributing to this situation. Two of the most significant factors are gender-associated income differences during employment and the fact that women tend to experience greater temporal discontinuity in employment due to family responsibilities (US Congress Joint Economic Committee 2011).

Gender serves to shape the nature of one's occupation as well as the timing of retirement

and welfare during old age. The conflicting nature of a women's role in the home and in the workplace continues to result in economic disadvantages for a great number of women, inevitably creating a dependency on a wage-earning partner. Many women do not have access to their own pension schemes through their workplace and are unable to independently accumulate sufficient personal savings to retire in comfort.

Women are making significant inroads toward occupational advancement and in the past few decades have experienced work patterns typically found in male-oriented roles. As such, women currently forming expectations about their retirement will not generally replicate the retirement experiences of their mothers or grandmothers nor will their retirement experiences look like men's retirement. Overall, compared to their mother's generation, women will have spent more time in the workforce, will have enjoyed higher incomes, and will have accumulated more pension privileges (US Congress Joint Economic Committee 2011). However, even though women who are currently in the workforce place a greater emphasis on their own opportunities in considering retirement, they, like previous generations of women, still have a high dependence on their husband's retirement income (Jefferson 2009). The reality remains true that a woman's marital status, her discontinuous participation in the workforce, her occupational and wage discrimination, and her extended life expectancy all significantly impact upon her retirement well-being.

It is therefore important that future cohorts of female retirees have sufficient knowledge about retirement which is based on their life experiences, not that of males (Price 2000). Because the number of retired employees will double in most industrialized countries over the next three decades, the need to determine the diverse experiences of women in retirement is necessary and timely (Everingham et al. 2007). Retirement models and macro-level policies need to recognize that retirement involves the intersection of social and economic factors as well as important life events such as childbearing and changes in marital status (Wong and Earl 2009; Dailey 1998).

## Cross-References

- ▶ Retirement and Continuity Theory
- ▶ Retirement and Social Policy
- ▶ Retirement Planning and Adjustment

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## Work Context and Personality Development Across Adulthood

Catherine E. Bowen<sup>1</sup> and Anna E. Kornadt<sup>2</sup>

<sup>1</sup>Wittgenstein Centre for Demography and Global Human Capital (IIASA, VID/ÖAW, WU), Vienna Institute of Demography/Austrian Academy of Sciences, Vienna, Austria

<sup>2</sup>Department of Psychology, Bielefeld University, Bielefeld, Germany

### Synonyms

Aging workforce; Big Five; Organizational behavior; Personality change; Personality plasticity; Social investment; Socialization; Work outcomes

### Definition

*Personality* refers to how a person typically thinks, feels, and behaves. *Personality development* refers to how personality changes over time and with increasing age.

## The Work Context and Personality Development Across Adulthood

*Personality* refers to individual differences in characteristic patterns of thinking, feeling, and behaving. Contrary to the hypothesis that personality is more or less stable after young adulthood, studies have robustly demonstrated that the Big Five personality traits continue to develop across the life span (Big Five Personality Structure and Aging). Due to the centrality of the (paid) work context for adult life, developmental researchers have been interested in how aspects of working life may be related to personality development, while organizational researchers have long been interested in how personality traits are related to work outcomes such as job performance and job attitudes. Given demographic changes including longer working lives and a higher share of older workers in the workforce taking place at the time of writing, there has been increasing interest over the last decade in understanding not only how personality and work outcomes are cross-sectionally related but also how normative patterns of personality *development* may affect the work context and work outcomes. In addition, the retirement transition as one of the major developmental tasks in later adulthood has been related to personality development at the end of (paid) worklife.

In the following we review the current state of scholarly literature on the relationship between the work context and adult personality development across the adult life span as described by the “Big Five” personality traits. With varying labels, the Big Five model refers to five personality dimensions: openness to experience (O; the breadth, depth, originality, and complexity of an individual's mental and experiential life), conscientiousness (C; socially prescribed impulse control that facilitates task- and goal-directed behavior, such as thinking before acting, following norms and rules), agreeableness (A; prosocial and communal orientation toward others, altruism, trust, modesty), neuroticism (N; negative emotionality, sensitivity to negative stimuli, tendency to feel anxious, nervous; the reverse of emotional stability), and extraversion

(E; energetic approach to the social and material world; sociability, activity, assertiveness, positive emotionality) (e.g., McCrae and Costa 2008). The Big Five model is the most widely studied model of personality within the work and personality literature and hence the focus of the current entry. There are, however, other personality characteristics and processes that are not subsumed by the Big Five model but which are relevant for discussion of personality development and the work context. Two examples are emotion and motivational processes. The relationships between work and developmental changes in emotional functioning (► [Affect and Emotion Regulation in Aging Workers](#)) and motivational orientation (► [Work Motivation and Aging](#)) are treated elsewhere in this volume.

### Implications of the Paid Work Context for Adult Personality Development

Contemporary theories of personality development, most notably the neo-socioanalytical model of personality trait development (e.g., Roberts and Wood 2006), have challenged traditional assumptions that normative patterns of personality development are predominantly driven by biologically induced “intrinsic maturation” processes (e.g., McCrae and Costa 2008). Instead, normative changes in adult personality are thought to be driven at least in part by investment in more or less universal, age-graded social roles or “developmental tasks” such as working and establishing a partnership and/or family. Fulfilling social roles and developmental tasks requires certain behaviors. For instance, the work role requires that a person shows up on time, completes tasks satisfactorily, and gets along with colleagues. Meeting the demands of the work role is rewarded (e.g., through positive feedback, status, income), while failure to meet demands is punished (e.g., through negative feedback, lower status, lower income). People are therefore encouraged to develop in ways that lead to successful fulfillment of the demands of the particular social role (Roberts and Wood 2006). Over time the behaviors and characteristics that a person adopts in order to

meet the demands of a social role become automatic and can subsequently “spill over” into other life domains. The extent to which fulfilling the social role affects personality development depends on the extent to which a person psychologically invests in the social role (for the work context, e.g., Hudson et al. 2012).

In addition to a socialization effect, people also tend to select themselves into social (work) roles that correspond with their personalities. For example, people with a higher level of O to start with tend to seek out and stay in work contexts in which they are continuously exposed to new situations and leave work contexts that are characterized by monotonous routines. In turn, the very characteristics that attract a person to a certain work context are the same characteristics likely to be reinforced by the demands and rewards of the work role over time (*corresponsive principle*, e.g., Roberts et al. 2003).

Empirical evidence of the influence of the work role and specific workplace characteristics on personality development in line with the neo-socioanalytical model of personality trait development has accumulated (for an overview, see Woods et al. 2013). First longitudinal studies in the field of personality development and work demonstrated that increases in work satisfaction were associated with increases in measures of emotional stability in young adulthood (e.g., Roberts et al. 2003; Scollon and Diener 2006). Job satisfaction, social status, and financial rewards as well as the degree to which individuals in New Zealand reported investing in their jobs moderated the degree to which typical developmental patterns took place between ages 18 and 26. For example, young adults in jobs that provided higher status, more satisfaction, and more financial security decreased faster in N and increased faster in communal positive emotionality (related to A) relative to their peers in less rewarding jobs (Roberts et al. 2003). In a more recent study, workplace characteristics such as income, autonomy, and benefits at work were predictive of increases in positive emotionality (related to E) and decreases in negative emotionality (i.e., N) among a sample of US adults followed between adolescence and young adulthood (Le et al. 2014).

Furthermore, and in line with the corresponsive principle, participants tended to have jobs in young adulthood that (a) were associated with their personality traits in adolescence (selection) and which (b) led to further accentuation of the same traits associated with the selection processes. For instance, assertive and ambitious adolescents were more likely to later work in positions with higher security and stability. In turn, higher security and stability were associated with increases in ambition and assertiveness. Recent evidence based on representative data from Germany also supports the corresponsive principle. Young adults were found to select job contexts that matched their personality traits (e.g., participants high in E tended to select jobs that had high E demands). Moreover, their personality traits changed in the direction of their current job demands if they stayed in the same job over the course of the 4-year study period (Denissen et al. 2014).

Interestingly, the timing of entry into the workforce is associated with changes in personality. Based on representative German data, people who started their first job increased more in C than those who had not (yet) begun their first job (Specht et al. 2011). Furthermore, cross-country differences in the timing of transition to the work role were found to explain variation in age patterns of personality across 62 countries. Namely, accelerated increases in A and C and decreases in N were observed in countries with earlier normative timing of job-role transitions (Bleidorn et al. 2013).

Taken together, the body of evidence reviewed above suggests that social investment in the work role appears to be a major driver of normative developmental increases in functional or social maturity, that is, the qualities that serve to facilitate functioning in society (Roberts and Wood 2006). Namely, social investment in the work role is associated with increases in the Big Five traits A and C along with decreases in N, particularly when people invest in their work role and when their work role is rewarding. Results have been consistent across samples from multiple countries (e.g., the USA, Germany, New Zealand). In contrast, *not* investing in the work

role or having particularly unrewarding work experiences seems to be related to atypical patterns of personality development, such as increases in N and decreases in A and C. For instance, young adults who invested less in their work role tended to *increase* in N and maintain initial levels of constraint (related to C) (Roberts et al. 2006). Unemployment has further been linked to decreases in C, A, and O and increases in N (German data; Boyce et al. 2015), while being fired (versus being promoted) has been associated with larger increases in N and decreases in C across 9 years (US data; Costa et al. 2000).

In contrast to the more or less consistent evidence with regard to the relationship between social investment in work and the Big Five traits associated with social maturity (N, A, C), social investment in work does not seem to be consistently related to development in the Big Five traits O or E. Potentially, the absence of a relationship between social investment in work and either O or E may be because employees in most occupational settings are rarely faced with “openness demands” (e.g., the need to master novel and challenging experiences) or with “extraversion demands” (e.g., the need to be socially outgoing), at least after an initial acclimation period. There is, however, evidence that people who work in specific occupations with high role demands for E (e.g., performer) and high O (e.g., poet) likewise increase in E and O (Denissen et al. 2014). In addition, the seminal work of Schooler and colleagues found that self-directed, complex work was related to more positive trajectories of intellectual flexibility and cognition, both related to O (Schooler et al. 2004).

Most of the evidence regarding the relationship between social investment in work and personality development stems from young adult samples. Social investment in the work role is thought to be a driver of normative personality development particularly as people enter worklife (typically in young adulthood) and also to support the stabilization of personality characteristics as long as the social role is maintained (cf. Denissen et al. 2014). There is less empirical evidence regarding the role of social investment in work and specific work

experiences and personality development later in life. Individual differences in job characteristics contributed little to personality development in a middle-aged US sample followed across 10 years (Sutin and Costa 2010). In another study based on US data, however, the strength of the correlation between change in psychological investment in the work role and change in personality development across average of two and a half years was similar for young and middle-aged adults (40+), suggesting that the influence of investment in work roles on personality trait change is a phenomenon that is not restricted to young adulthood (Hudson et al. 2012). Evidence based on representative German data suggests that middle-aged and older individuals have a higher level of “heterotypic stability” with regard to the demands of their work role relative to younger individuals. That is, older adults tend to find themselves in work contexts with similar personality trait demands, even when they change jobs (Denissen et al. 2014). Taken together, while there is some evidence that the *potential* for social investment driven personality change continues beyond young adulthood (Hudson et al. 2012), middle-aged adults may nevertheless maintain personality stability by exposing themselves to work environments that support personality continuity. More studies are needed before conclusions on the potential moderating effect of age on the relationship between social investment and personality development can be drawn.

### **Implications of Adult Personality Development for Work Outcomes**

While developmental researchers have been interested in how social investment in work and specific work experiences affect personality development, organizational researchers have long been interested in the relationship between personality and work outcomes such as performance, career success, and job attitudes, particularly as a means for optimizing employee selection processes. Historically, researchers have overwhelmingly tended to analyze the

relationship(s) between personality and work outcomes at a single point in time. The results of decades of cross-sectional studies have by now firmly established that personality is robustly related to a number of work outcomes. For example, the results of meta-analyses have demonstrated that E (+) and N (–) are related to job satisfaction while C is positively related to task performance across a wide range of jobs (see Judge et al. 2008 for an overview of the cross-sectional relationships between the Big Five traits and work outcomes).

Changes in the structure of the workforce taking place at the time of writing, including extensions of the years spent working and increasing proportions of older adults in the workforce, alongside increasing evidence of normative personality development, have stimulated a number of organizational scholars to question how adult personality development may be related to work outcomes at a single point in time and/or trajectories of work outcomes. Woods and colleagues (Woods et al. 2013) have suggested that *trait activation theory* (TAT; Tett and Burnett 2003) provides a theoretical framework for understanding why adult personality development might affect (trajectories of) work outcomes. According to TAT, organizational behavior results from an interaction between the person and the work situation. The demands and resources of the work context are in a state of flux, as, for example, learning demands and relationships with colleagues change or people gain autonomy with increased tenure. Hence, fulfilling the demands of the work role at different time points during one’s career might render different personality traits important (e.g., high A may be more important for an entry-level employee than for a tenured employee or supervisor).

Indeed, longitudinal studies have demonstrated that personality traits are differentially related to work outcomes at different time points. Using Australian data, Minbashian and colleagues (Minbashian et al. 2013) examined performance trajectories of 129 newly employed professionals across 4 years. On average, supervisor-rated performance peaked after about 3 years and then

started to decline. Participants high in O at baseline did not initially perform better than their peers. However, high O participants had more positive performance trajectories: in comparison with low O participants, they plateaued later and decreased less. In another study based on US data, the Big Five traits were used to predict sales performance of a sample of employees at two different career phases across a year (Thoresen et al. 2004). The results demonstrated that different personality traits predicted performance and performance growth among employees in a “maintenance” versus “transitional” (i.e., employees faced with new tasks) career phase. Among employees in the maintenance career phase, C and E were both associated with mean performance, and C predicted performance growth over time. In comparison, among employees in a transitional phase, O and A were associated with higher mean performance and with performance growth. As in the study by Minbashian et al. (Minbashian et al. 2013), employees in a transitional career phase who were high in O were less likely to experience performance plateaus. In light of the results of the two studies, it appears that especially C predicts performance and performance growth when employees need to sustain performance on the same tasks, whereas O seems to predict adaptation and may hence be especially important in transitional contexts in which employees must respond to changing job demands (Woods et al. 2013).

As of 2015, there were few empirical investigations of how personality *change* may affect how work outcomes change over time. The normative increases in C and A observed between young adulthood and late midlife are thought to have positive implications for different aspects of job performance (Ng and Feldman 2013). In particular, normative increases in C and A are thought to explain why older age is associated with more *organizational citizenship behaviors*, that is, in behaviors that are not part of the job description but that nevertheless benefit the organization (e.g., helping colleagues). Change in C was positively correlated with changes in work investment and

organizational citizenship behaviors and negatively correlated with changes in counterproductive work behaviors in a sample of US adults (Hudson et al. 2012), lending some empirical support to the hypothesis that normative increases in C might lead to more prosocial behavior at the workplace. In another study, changes in E and N were correlated with changes in work role satisfaction: decreases in N and increases in E were associated with increases in work satisfaction (Scollon and Diener 2006). Thus, there is some limited evidence that normative decreases in N across the adult life span may underlie normative age-related increases in positive work attitudes. Noting the importance of C for job performance during the maintenance career stage (see above), normative increases in C across the working life span are also thought to be one factor that help aging workers to maintain task performance over long periods of time (Ng and Feldman 2013), though this hypothesis has yet to be tested empirically.

Not only do people seem to change as a result of their work contexts, there is also some evidence that people’s personality is related to how the nature of their work changes over time. Baseline personality characteristics significantly predicted changes in job characteristics across 10 years in a sample of US adults (Sutin and Costa 2010). Participants high in N at baseline decreased in decision-making latitude, whereas participants high in E, O, and C reported more decision-making latitude 10 years later. A at baseline was unrelated to change in decision latitude. Baseline E predicted a decrease in hazardous work, and baseline A predicted a decrease in physical demands. Because job characteristics were based on self-reports, it is difficult to decipher the extent to which work contexts *objectively* changed versus the extent to which *perceptions* of the work context changed over time. It remains to be investigated whether normative and individual patterns of personality development lead to transformation of the work context over time as the proportion of older workers increases (e.g., whether normative increases in A result in more agreeable workplaces).

## Personality Development, Retirement, and Post-retirement Volunteering

Given evidence that particularly entering the work context is one driver of personality change, it logically follows that *exit* from the work force may also be reciprocally related to personality development. Like workforce entry, exit from the work force also has a substantial impact on people's lives, changing, for example, the structuring of time, social networks, sources of self-esteem, and financial means. Curiously, however, the notion that retirement might be reciprocally related to personality development has yet to find much resonance in the literature, perhaps because the very notion of personality changes in late middle adulthood/young old age is a relatively new idea. At the time of writing, two studies had investigated the relationship between retirement and personality development. Compared with participants who remained employed, in one study based on longitudinal US data, retirees increased in A and decreased in activity, a facet of E - (Löckenhoff et al. 2009). Personality changes in response to retirement did not differ depending on the voluntariness of retirement or post-retirement involvement in part-time work. In another study based on a representative German sample, retirement was associated with a decrease in C (Specht et al. 2011), suggesting that retirement may be one factor underlying the mean-level decrease in C observed in young old age (Big Five Personality Structure and Aging).

Despite the potential usefulness of identifying predictors of retirement timing and adjustment, to date there have likewise been few empirical studies on the relationship between personality and the timing of the retirement transition. In the longitudinal study based on US data cited above, personality at baseline was not related to future retirement (Löckenhoff et al. 2009). The lack of a significant relationship between personality and future retirement may indicate that the timing of retirement is highly context dependent, being related to, for instance, an individual's work, financial, and greater life context. In another longitudinal study based on Norwegian register data, the Big Five traits predicted disability retirement

but not non-disability retirement (Blekesaune and Skirbekk 2012). Different patterns were found for women and men. For women, higher N predicted disability retirement and the effect appeared to be mediated by worse health. For men, O was positively and A and E were negatively related to disability retirement. The study did not, however, provide clues regarding the mechanisms underlying the relationships between personality characteristics and disability retirement among men. Cross-sectionally, lower N and higher E have been related to higher retirement satisfaction in a sample of US adults (Löckenhoff et al. 2009). We are unaware of any studies that have analyzed the longitudinal relationship between the Big Five personality traits and adaptation to retirement (e.g., recovery, maintenance, and/or higher levels of well-being post-retirement when compared to pre-retirement levels), which leaves a gap to be filled by future research.

After retirement, volunteering has become an important activity for many adults in later life (► [Volunteering in Older Adults in Retirement](#)). Like paid work, volunteering contexts are also characterized by different resources and demands that may potentially stimulate particular patterns of personality development. Furthermore, in light of interest in encouraging post-retirement volunteering in many industrialized countries, it would be helpful to identify personality predictors of volunteering in late life. Empirical research on personality (development) and volunteering is also scarce, though the few existing studies point to interesting relationships. Based on cross-sectional and longitudinal analyses of data from the Health and Retirement Study in the USA, conscientious, retired individuals were more likely to volunteer than conscientious, working individuals (Mike et al. 2014). The authors suggested that retired high C individuals may volunteer as an outlet for their goal-striving tendencies. A and E were also related to a greater likelihood of volunteering, independent of working status. In addition there is some alluring evidence that volunteering in late life can under certain circumstances stimulate personality change. In a quasi-experimental study in Germany, older volunteers (60+) that received

competence training increased in O relative to a waiting-list control group of active volunteers that did not receive training. This was, however, only the case for trained volunteers that also had high internal control beliefs (Mühlig-Versen et al. 2012). The results of this study suggest that volunteering, in combination with certain internal (internal control) and external (training) resources, can reverse the typical adulthood pattern of decreasing O in late life.

## Conclusions and Future Research Directions

Evidence has accumulated that personality continues to develop across adulthood and into old age. A number of studies have identified work experiences and features of the work context as drivers of adult personality development. In particular, entry into the workforce appears to lie behind normative increases in A and C and normative decreases in N in young adulthood. First empirical studies also suggest that personality is related to work outcomes not only at a single moment in time but also to *trajectories* of work outcomes over time. Finally, the results of a handful of studies have suggested that retirement and post-retirement volunteer work are related to personality (development) in young old age.

Theoretical and empirical examinations of the relationship between work and personality development have contributed greatly to the fields of adult developmental and organizational science. Studies that have identified work experiences as drivers of personality change have provided direct evidence for both the contextualism and lifelong plasticity of adult development (Baltes et al. 1980). Increasing evidence of adult personality development in light of the links between personality and work outcomes has encouraged a number of organizational researchers to take more dynamic theoretical and empirical approaches that acknowledge that both people and work contexts – and their interaction – may change over time. Scholarly achievements in the study of work and personality development across the life span have therefore helped to further

knowledge about the contextual and individual conditions under which the potential for positive personality development and satisfying, productive work lives across the life span may be reached.

The current review of the literature on the relationship between work and personality development points to a number of directions for future research. While the relationship between work and personality is assumed to be reciprocal, most empirical work to date has focused *either* on how personality (development) influences work (development) *or* how work influences personality. More studies that investigate bidirectional effects of level and change in personality and work outcomes/characteristics are needed. There is a particular need for longitudinal studies with multiple measurement points that investigate how personality change affects changes in work outcomes. More studies including samples of middle-aged and older adults would be helpful in order to better understand how the relationship between the work context and personality development may depend (or not) on age, life phase, and career phase. Intervention studies that pinpoint modifiable aspects of the work context that can foster and support positive personality development across adulthood would be most helpful for organizations interested in maximizing employee productivity and well-being over the full working life span. Importantly, there is enormous variation between individuals with regard to their personalities and with regard to how they change with age. In addition, work contexts are characterized by different demands and resources/rewards depending on, for instance, occupation, company policy, supervisor, and colleagues. Investigations that are sensitive to differences between individuals and to differences between work contexts are likely to be the most helpful for identifying specific kinds of work context that best support positive trajectories of personality development and work outcomes for specific groups of individuals. Finally, at the time of writing there were few empirical studies on the (reciprocal) relationship between personality and the timing and/or experience of the retirement transition. Future research on the retirement transition, post-retirement

activity (e.g., volunteering), and personality development would be useful for identifying individuals who may need additional support in managing the retirement transition, factors that may help more people optimize the potential for positive personality development across the life span, and for helping organizations and policy makers to create contexts that support longer working lives and volunteering post-retirement.

## Cross-References

- ▶ [Affect and Emotion Regulation in Aging Workers](#)
- ▶ [Volunteering in Older Adults in Retirement](#)
- ▶ [Work Motivation and Aging](#)

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## Work Design and Aging

Donald M. Truxillo<sup>1</sup> and Sara Zaniboni<sup>2</sup>

<sup>1</sup>Department of Psychology, Portland State College of Liberal Arts and Sciences, Portland State University, Portland, OR, USA

<sup>2</sup>Department of Psychology and Cognitive Science, Università degli studi di Trento, Rovereto, TN, Italy

### Synonyms

Job design and aging; Job redesign and aging; Work redesign and aging

### Definition

There are two approaches to work design research relevant to older workers. First, some work design research focuses on physical aspects of the workplace and ways to accommodate workers as they

age. This research line takes a more ergonomic approach. In contrast, psychological work design addresses ways to address psychological changes (e.g., cognitive ability, personality) that take place over the work lifespan.

### Introduction

The workforce is expected to age in the coming decades in most industrialized countries (Eurostat 2013; Toossi 2012); this is a result of decreased birthrates, later retirements due to financial need, and raising of the retirement age in many countries because of longer lifespans (Vaupel 2010). As a result of these changes, people are working later in life, often well into their 60s and even 70s.

In this entry, the extant literature on job design for workers over the work lifespan is described. Specifically, two types of job design research are differentiated: research on physical aspects of the workplace to accommodate people as they age (a more ergonomic approach) versus job redesign that addresses psychological changes (e.g., cognitive ability, personality) that take place over the work lifespan. The focus in this entry is primarily on psychological job design, integrating lifespan development theories, age-related models of work motivation, and models of job design to describe how characteristics of the workplace can interact with worker age to affect job attitudes and behaviors. The few empirical studies that have examined psychological job design and age are cited. This entry concludes with a discussion of the several additional moderators that may further affect the interplay of age and job characteristics and concludes with a discussion of the practical challenges involved in implementing job redesign for workers of different ages in actual work settings.

### Physical Job Design and the Older Worker

It is well documented that a number of physical declines and disabilities are associated with age and that these may affect a person's ability to carry

out his or her work tasks. For example, age is associated with declines in aerobic capacity, muscle strength and flexibility, and basic sensory capacities such as hearing and vision (Maertens et al. 2012). There are also changes in ability to adapt to workplace changes in sleep patterns as required by shift work (Blok and de Looze 2011). However, although there is evidence for a decline in the health of older people, meta-analytic evidence shows little relationship between age and self-reported health issues (Ng and Feldman 2013). Further, despite physical declines, older workers also appear to have fewer actual workplace injuries (Ng and Feldman 2008), although older workers may take longer to recover from injuries (Sterns et al. 1985).

It is worth noting that the relationship between age and job performance is generally weak, with slightly positive associations between age and certain types of performance measures (e.g., organizational citizenship behaviors) (Ng and Feldman 2008). This null relation between age and work performance may be the result of a decline in physically demanding jobs in many industrialized workforces (Johnson et al. 2011). In other words, as physical aspects of jobs in industrialized countries appear to be on the decline, age-related physical declines may have less of a relationship with job performance.

### **Psychological (Cognitive and Personality) Changes That May Affect Older Workers**

In addition, a number of psychological changes can take place through adulthood, and these changes are relevant to the psychological design of jobs. First, cognitive changes include a gradual decrease in fluid intelligence (e.g., processing speed) starting at age 20. However, there are increases in crystallized intelligence (e.g., accumulated knowledge) up through a person's 50s and 60s (Schaie 1994). Second, some personality dimensions change throughout adulthood, with increases in conscientiousness and agreeableness and decreases in neuroticism (Roberts et al. 2006; Salthouse 2012). However, it is also important to

note that there is considerable variability in how people age (e.g., (Hansson et al. 1997), with some people aging more quickly than others and in different ways. This variability between people increases in the later decades of life, such that the job design needs of older workers may vary. In addition, some people appear to be more "successful" at aging (Hansson et al. 1997), that is, they may have less disease or illness, greater longevity, lack of disability, and increased life satisfaction (Bowling 2007). An important factor is an individual's ability to adapt to age-related changes within themselves, an issue that is central to lifespan development theories, described below.

### **Lifespan Development Theories and Psychological Job Design Models**

In this section, lifespan development theories that take into account these physical and psychological changes are described. This is followed by a discussion of the most influential job design models and how theories of lifespan development might be used to explain how worker age and job characteristics interact to affect attitudes, performance, and well-being.

**Lifespan development theories and motivation.** Lifespan perspectives, such as selective optimization with compensation theory (SOCT; Baltes and Baltes 1990) and socioemotional selectivity theory (SST; Carstensen 1991), describe aging as an essentially adaptive process and are useful for examining the interplay between age and work characteristics. These theories include a focus on the physical and psychological changes (e.g., cognitive skills, personality) that take place as people age and how people adapt to these changes. SOCT (Baltes and Baltes 1990) proposes that people use three strategies to successfully adapt to the aging process. *Selection strategies* refer to selecting specific goals that match personal resources which will likely change as people age due to physical and psychological changes. *Optimization strategies* refer to allocating time, efforts, and existing resources to achieve the desired results. *Compensation*

*strategies* refer to coping with losses to maintain positive functioning, that is, offsetting declines in certain areas by choosing to focus resources on other things. In the work context, older workers might use these strategies to fit their personal resources and job demands. For example, to compensate for declines (e.g., physical disabilities), an older worker might select to focus on job characteristics that give them the opportunity to use their accumulated experience (crystallized intelligence), allowing them to optimize their resources to achieve the desired results.

SST (Carstensen 1991) suggests that older adults perceive that time is limited, and they thus tend to prioritize present-oriented goals to pursue emotionally and socially gratifying experiences. At work, these might translate into focusing on satisfying work and relationships. In contrast, young adults are more likely to perceive time as open-ended and thus tend to prioritize future-oriented goals; in the workplace, this might include a focus on knowledge-acquisition goals that could advance their careers. According to socioemotional selectivity theory, older and younger workers are likely to be interested in different psychological job design features. While younger adults should benefit from a job that increases work-related knowledge important for future career development, older workers should benefit from a job that gives them the opportunity to maximize socially gratifying working experiences in the present (Truxillo et al. 2012b). SST has been used to explain the generally positive job attitudes observed among older workers (e.g., Ng and Feldman 2010). Note that many of the predictions from SOCT and SST do not necessarily differ.

Consistent with SOCT, SST, and psychological and personality changes that take place in individuals, Kanfer and Ackerman's (Kanfer and Ackerman 2004) age-focused model of work motivation describes how work motivation may change across the lifespan. This might include a shift from extrinsic to intrinsic motivation (a process generally supported meta-analytically (Kooij et al. 2014)) and the development of generativity motives (focused on supporting future generations) in middle age.

**Job design models.** A number of major job design models in the organizational psychology literature focus on psychological aspects of the job. Historically one of the first is Hackman and Oldham's Job Characteristics Model (Hackman and Oldham 1976) focused on five intrinsic job characteristics: autonomy, skill variety, task identity, task significance, and feedback from the job. *Autonomy* is the extent to which the job provides discretion and freedom to plan, schedule, and perform the work; *skill variety* is the extent to which the job involves the use of a wide range of skills and capabilities; *task identity* is the extent to which the job allows people to complete a whole piece of work from start to finish; *task significance* is the extent to which the job provides opportunities to have a meaningful impact on other people; and *feedback* is the extent to which the job provides employees with information about their performance. These five characteristics lead to critical psychological states (meaningfulness, responsibility, and knowledge of results), which in turn lead to positive work outcomes such as motivation, satisfaction, and performance. A number of studies have been conducted on the Job Characteristics Model over the last 40 years, and meta-analyses provide support for most of the hypothesized relations (Humphrey et al. 2007).

Karasek's job demands-control model (Karasek 1979) hypothesized that the combination of high job demands (e.g., work overload and time pressure) and low job control leads to high job strain. The author proposed that enhancing job control could buffer the detrimental effects of job demands on employee health. Subsequently, Karasek and Theorell (Karasek and Theorell 1990) included social support, expanding the model into the job demands-control-support model. The authors theorized that social support together with control helps to mitigate the effects of high demand on strain. Research has generally supported the effects of these models, as high job demands and low control and social support are associated with greater job strain (Häusser et al. 2010).

More recently, another related model is Demerouti, Bakker, Nachreiner, and Schaufeli's

job demands-resources model or JDR (Demerouti et al. 2001) model. This model suggests that while every occupation may have its own specific risk factors related to stress, these factors can be categorized into two general groups: job demands and job resources. Job demands consider physical, psychological, social, or organizational aspects of the job that require effort and are associated with certain individual costs. Job resources are defined as aspects that facilitate goal achievement, personal growth, and demand reduction and may be found at an organizational level (e.g., career opportunities), social and interpersonal level (e.g., supervisor and coworker support), and task level (e.g., skill variety, task identity, task significance, autonomy, performance feedback). Job demands are suggested to contribute to the emotional exhaustion aspect of burnout; in contrast, job resources are suggested to reduce disengagement. Empirical studies have provided evidence for the hypotheses of the job demands-resources model, showing the effects on important organizational outcomes (Schaufeli and Bakker 2004).

A recent perspective on job design, Morgeson and Humphrey's work design model, and related Work Design Questionnaire (Morgeson and Humphrey 2006), was developed to be a comprehensive model of job design, including a wider range of job characteristics compared to the previous models. The Work Design Questionnaire (WDQ) is the most comprehensive measure of job design available and utilizes 21 work characteristics, integrating the categories of motivational characteristics (i.e., task and knowledge characteristics), along with social and work context characteristics. Motivational work characteristics include both task characteristics (i.e., autonomy, task variety, task significance, task identity, and feedback from job) and knowledge characteristics (i.e., job complexity, information processing, problem solving, skill variety, and specialization). Social characteristics include elements such as social support, interdependence, interaction outside the organization, and feedback from others. And contextual characteristics include features such as ergonomics, physical demands, work conditions, and equipment use. Morgeson, Humphrey, and colleagues (Humphrey et al. 2007; Morgeson

and Humphrey 2006) found in their original study and later meta-analysis that the different features of job characteristics were differentially related to different work outcomes, such as work attitudes and behaviors, and that these relations can be mediated and/or moderated by psychological states.

**Integration of lifespan development and job design: conceptual development.** Recent theoretical contributions integrating age into job design suggest that different psychological job characteristics can differentially benefit workers of different ages, in terms of well-being, performance, satisfaction, and engagement (Truxillo et al. 2012a, b). However, although many researchers point to a need for research examining the role of individual differences such as age in job design (Grant et al. 2010; Morgeson and Humphrey 2006), only a few studies have examined how people of different ages may respond to different job characteristics (Shultz et al. 2010; Zacher and Frese 2009; Zaniboni et al. 2013, 2014).

Truxillo and colleagues (Truxillo et al. 2012a, b) used the lifespan development theories of SOCT and SEST (Baltes and Baltes 1990; Carstensen 1991) and the work design model of Morgeson and Humphrey (Morgeson and Humphrey 2006) as bases to propose that some job characteristics may be more beneficial for workers of different ages. For example, among task characteristics, the authors suggest that *autonomy* and *task significance* will lead to more positive working outcomes for older compared to younger workers. Older workers may prefer work autonomy, allowing them to craft their jobs (Grant et al. 2010) and choose roles that fit their strengths. Considering that generativity motives begin to develop in late career (Kanfer and Ackerman 2004), older workers may prefer to be more focused on meaning in their job (i.e., task significance). Among the knowledge characteristics, Truxillo and colleagues (Truxillo et al. 2012b) suggested that *job complexity*, *information processing*, and *problem solving*, to the extent that they require fluid intellectual abilities, can lead to more negative working outcomes for older workers compared to younger workers.

However, when older workers are able to successfully apply their accumulated knowledge and ability (e.g., selection, optimization, and compensation strategies), complex jobs can lead to positive work outcomes. For the same reason, older workers benefit from *skill variety* because it allows them to use their accumulated skills. The *specialization* requires in-depth knowledge and skills in a particular area, and older workers may prefer this characteristic since it can allow them to focus on a single specialty in which they have gained expertise. Among the social characteristics, giving *social support* and *interdependence* should lead to more positive working outcomes to older workers fulfilling the desire to be emotionally and socially integrated with other people.

**Integration of lifespan development with job design: empirical support.** Although to date there have been relatively few empirical studies that have actually demonstrated the importance of fitting job characteristics to the age of the worker, there has been some initial support. For example, research suggests that, in contrast to younger workers, older workers have more positive outcomes when they perceive increased autonomy (Hertel et al. 2013) and skill variety (Zaniboni et al. 2013) and decreased task variety (Zaniboni et al. 2014). Further, when older workers are able to successfully apply their accumulated knowledge and ability (e.g., selection, optimization, and compensation strategies), complex jobs can lead to positive work outcomes (Zacher and Frese 2009, 2011; Zacher et al. 2010). For the same reason, older workers appear to benefit from skill variety because it allows them to use their accumulated skills (Zaniboni et al. 2013). Despite this initial support for the importance of psychological job design to workers of different ages, the fit between a worker's age and job characteristics is probably a complex with additional moderators at play.

## Additional Moderators

Throughout this entry an assumption is that factors associated with a person's age will interact with their work environment to affect attitudinal

and performance outcomes. However, the situation is far from a simple age X job characteristics interaction, and a number of additional moderators need additional research attention. These moderators may qualify the ability to draw conclusions about the way that an individual worker of a given age may react to a job's characteristics. In other words, it is not as simple as considering matching a job's characteristics to a person's age, but rather, a number of additional factors should be considered as well (Truxillo et al. 2012b). In other words, there may be a great deal of variability in between individual workers of the same age, especially in later years.

Truxillo et al. (2012b) break down these additional moderators into three categories. *Individual difference* moderators include differences in work experience, health, and personality. They also include factors such as differential trajectories between individuals in terms of cognitive and personality changes. For example, similarly aged workers, one in good health and one in poor health, would likely seek and need different job characteristics to thrive. *Contextual factors* that may affect the way that similarly aged people react to job characteristics include the characteristics of the organization, team, profession, or national culture and norms. For example, there may be different norms for what is considered "old" within different professions, causing similarly aged workers in different professions to seek different types of job characteristics. Other contextual factors would be the job itself, with some jobs including tasks that are difficult for older workers to perform, whereas others might capitalize on an older worker's strengths. As an example, jobs with heavy physical demands may be difficult for older workers to carry out, whereas other jobs may incorporate the mental challenge that is needed to engage some older workers. Another contextual factor that may complicate the relationship between job characteristics and age includes generational status, in that similarly aged workers from different generations may have differential expectations for their jobs; in other words, the requirements of older workers today may be different from those of older workers 40 years from now. *Multiple job characteristic interactions*

denote the fact that the relationship between a particular job characteristic and age may be affected by an additional job characteristic. In particular, the job characteristic of autonomy may allow workers to craft their jobs to where it provides the greatest benefit for them.

## Challenges for Organizational Implementation

Despite increased research and interest on matching job characteristics to the worker, a number of challenges remain. Perhaps the most significant challenge is that almost no research has examined how interventions focused on objective changes in job characteristics affect older workers. Rather, the majority of the research has examined how workers' perceptions of their job characteristics affect their job attitudes and behaviors (Truxillo et al. [in press](#)). Relatedly, relatively little empirical work has been done on how actual changes to organizational human resource (HR) systems (e.g., training, performance management, teams) can affect older worker attitudes and behavior (Truxillo et al. [2014](#)). However, the extant literature on how older workers' perceptions of their job characteristics and outcomes should provide a path forward for empirical research on this issue (e.g., Hertel et al. [2013](#); Zaniboni et al. [2013, 2014](#)).

A second challenge for implementing age-sensitive job design is the significant differences among similarly aged people. As noted earlier, the differences among employees in the same age group may be greater than the differences between age groups, and within-age group variability appears to increase in later decades. For that reason, job design should incorporate not only differences between employees of different ages but also take into account how an individual employee is aging throughout their career. This approach would consider age-related job design from the standpoint of what is needed at different time points in an individual employee's career.

Another challenge is the issue of developing age-differentiated HR systems and jobs (e.g.,

Kooij et al. [2014](#)) while at the same time balancing issues of fairness and staying within legal constraints (Truxillo et al. [in press](#)). For example, SOCT strategies might suggest that older workers be allowed to off-load certain tasks that they are no longer able to carry out effectively. At the same time, this might affect their team members, such that younger employees would need to "take up the slack." This issue further illustrates that by definition work redesign cannot be done for any one individual employee without having cascading effects for the organization and for other workers.

Finally, it has been suggested that age-related interventions such as job design should use approaches that support workers of all ages and depending on their particular needs (Truxillo et al. [in press](#)). Such an approach is similar to the three-tiered intervention framework that is used in the health promotion/prevention literature. Using this approach, primary interventions would focus on the prevention of disease among workers starting from early in their careers, such as preventing exposure to stressful job designs. Secondary interventions would be focused on controlling negative outcomes for workers as they age, such as providing greater autonomy so workers could balance work and nonwork demands and be better able to continue working. Tertiary interventions would be focused on compensating for physical and psychological losses due to age and would generally focus on workers in late career.

## Summary

A number of physical and psychological changes occur over the work lifespan, with both positive and negative consequences for older workers. The issue of designing jobs for older workers takes on particular importance as the workforce in most industrialized countries continues to age. Lifespan development theories (Baltes and Baltes [1990](#); Carstensen [1991](#)) and research on work motivation for workers of different ages (Kanfer and Ackerman [2004](#); Kooij et al. [2011](#)) integrate this basic research on age-related changes to provide guidance for the design of jobs to fit the aging

workforce. Job design models (e.g., Morgeson and Humphrey 2006) from the organizational behavior literature identify key job characteristics that might be important for understanding how jobs are designed by taking worker age into account. Thus, the issue of age-differentiated job design is a complex one involving a number of variables, with a number of challenges its implementation in organizational settings. Additional research on the actual implementation of age-related job redesign in organizations is needed to help guide organizational practices.

## Cross-References

- ▶ [Age and Blended Working](#)
- ▶ [Age Diversity at Work](#)
- ▶ [Age Stereotypes in the Workplace](#)
- ▶ [Age Stereotyping and Discrimination](#)
- ▶ [Age-Related Changes in Abilities](#)
- ▶ [Motivational Theory of Lifespan Development](#)
- ▶ [Recruitment and Selection of Older Workers](#)
- ▶ [Socioemotional Selectivity Theory](#)
- ▶ [Training at Work and Aging](#)
- ▶ [Work Motivation and Aging](#)

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## Work Motivation and Aging

Christian Stamov-Roßnagel  
 Jacobs University, Bremen, Germany

## Synonyms

Employee motivation; Work motives; Work-related attitudes

## Definition

This entry summarizes the present understanding of the relationships between work motivation and worker age. The central propositions are that work motivation does not linearly decline with age and that a look at the interplay of global and specific levels of motivation is required to understand the particular situation of workers over 50 years old. The entry concludes with an outlook to emerging research.

Work motivation translates a worker's knowledge, skills, and abilities into actual work behavior and job performance. The former enable workers to carry out their jobs as required, while the level of motivation determines the amount of effort workers actually put into their jobs, i.e., it regulates the intensity, duration, and persistence of work behaviors (Pinder 1998).

In light of the impact of demographic change on the contemporary workplace, understanding the motivation of older workers – who are usually considered as “older” from the age of 50 – is of particular importance. In almost all industrialized countries, the average age of workers will be increasing markedly over the next two decades, as the numbers of young entries into the labor force will be decreasing. In response to this trend, retirement ages have been raised in several countries. Work lives will therefore become longer, making retention a key issue for many employers. Maintaining high levels of work motivation is an indispensable ingredient of successful retention.

Established theories of work motivation, however, are quite silent about the influence of age on motivation. While research into work motivation has had a long tradition since the 1950s, the interest in age-related changes in work motivation is a relatively recent phenomenon. Only in the past 10 years or so have the relationships between worker age and motivation begun to receive substantial research attention.

This entry summarizes the present understanding of the relationships between work motivation and worker age. To foreshadow, the most important research finding is that work motivation does

not inevitably and linearly decline as a function of biological aging. Like for younger workers, motivation is influenced by interactions of workers' goals and job demands. To understand what makes these interactions age-specific, current models incorporate constructs from lifespan psychology to describe the principles of motivational regulation. This regulation may be seen as multidirectional; it will be in the focus of the first section. Furthermore, contemporary models look at the interplay of global and specific levels of motivation to understand the particular situation of workers over 50 years old. That multilevel perspective will be the core of the second section. The entry concludes with an outlook to emerging research in the final section.

## The Multidirectional Perspective

The early view on age-related changes in work motivation was characterized by a notion of decline and seemed to justify the common stereotype (see Posthuma and Campion, 2009) that work motivation decreases as workers age. Warr (2001) listed a number of reasons why work motivation was likely to go down with age. First, the longer one has received certain bonuses and incentives, the higher a threshold these incentives must exceed to have equal value. As incentives cannot increase indefinitely, however, that *hedonic treadmill effect* will decrease motivation. Habits are a second source of motivation decline, because deviations from long-practiced work behaviors (e.g., when new technologies are introduced) might be perceived as aversive. A third source is workers' need for comparison of their performance to their colleagues' attainments. Across work life, the reference group may change as older workers compare their performance not only to that of their peers but also of their younger colleagues. Age-related norms and stereotypes could be a fourth source of age differences. For instance, older workers might show little interest in work-related training simply because others (supervisors, colleagues, friends, etc.) do not expect them to do so. Finally, older workers might have lower perceptions of the probability

of attaining positive work outcomes, which would also adversely affect work motivation.

Although that early view draws attention to the fact that rather heterogeneous factors might influence work motivation, motivation itself was depicted as a relatively passive and mostly negative “response” to personal (e.g., capability declines) and environmental (e.g., altered work demands) changes. However, job satisfaction research shows that job satisfaction is usually higher in older than in middle-aged workers. Furthermore, age has in several meta-analyses been demonstrated to be unrelated to core job performance. For some dimensions of job performance, even positive age effects have been shown such that the number of safety behaviors and avoidable absences rises and falls, respectively, with age.

This suggests that there may be more to older workers’ motivation than mere decline. Borrowing from lifespan psychology, more recent models of age effects on work motivation have adopted the notion that such age effects may be *multidirectional*, i.e., there may be decline in some aspects of work motivation, but stability, or even an increase in other facets. As a first version of the contemporary view, Kanfer and Ackerman (2004) proposed a theoretical framework centering on the notions that (a) the level of work motivation results from a worker’s beliefs about how likely he or she would be to attain certain work-related outcomes and how attractive these outcomes are to that worker and that (b) age moderates these beliefs in a systematic way. For instance, workers hold beliefs about how much effort they will have to invest to attain a particular performance level. As capabilities for the fast processing of complex information decline from middle to late adulthood, workers will expect they have to invest particularly high effort, which might lower their performance expectancies – and thus motivation – whenever such fast and complex processing is required. Performance expectancies might remain unaffected or even increase with age, however, if workers can use expertise, routines, or job experience, because such experience-based capabilities remain stable or even increase well into late adulthood (Baltes et al. 2006). At least in principle, this would leave older workers

with the option of focusing on roles and tasks in which they can use their expertise and routine in order to experience feelings of mastery and accomplishment.

Current conceptions capitalize exactly on that latter notion of *motivational selectivity* that features in general models of developmental regulation in lifespan psychology. In other words, contemporary models of age-related changes in work motivation are premised on the notion that people use a variety of strategies to match their resources to external demands. As a general strategy, people select subjectively important goals, optimize the ways they try to attain their goals, and thereby compensate for age-related losses (SOC strategy; see Baltes and Baltes 1990). More specifically, socio-emotional selectivity theory (SST; Carstensen 2006) predicts that the nature of subjectively important goals will change across the lifespan as people’s general sense of time shifts from “time since birth” to “time until death” around mid-life. As a consequence, goals which concern the acquisition of knowledge and goals concerning the regulation of positive emotional states shift importance. When time is perceived as open ended, prioritized goals rather relate to “investments,” focusing on gathering information, on experiencing novelty, and on expanding skills and knowledge. When time is perceived as constrained, goals related to “harvesting” become more salient that can be realized in the short term, such as emphasizing feeling states and regulating emotional states to optimize psychic well-being.

Consistent with these assumptions, the empirical evidence converges in the finding that work-related motives systematically differ in their relationship with age. Motives refer to a worker’s preference for particular job characteristics and classes of outcomes (e.g., high performance, good pay, friendly coworkers). Most broadly, growth-related, security-related, and social motives may be distinguished. The former include activities aimed at reaching higher levels of functioning, such as, for instance, participation in organizational training and development programs or taking on leadership roles. Social motives represent a preference for job

characteristics and work outcomes that pertain to affiliation and collaboration with others, whereas security motives involve a preference for job features and work outcomes that secure one's general welfare. From a socio-emotional selectivity viewpoint, security and social motives would be expected to be higher for older workers, as these convey positive emotional states. The strength of growth motives, on the other hand, would be expected to decline. Supporting the latter hypothesis, across studies, negative correlations of age with motives such as seeking advancement or promotion, as well as development and challenge, emerge. At the same time, older workers report stronger motive strength for job characteristics and outcomes related to accomplishment, job enjoyment, and utilizing their existing skills. In terms of security motives, older workers indicate a stronger preference for job security, while the correlation of age with the importance of compensation and benefits is generally negative. In a similar fashion, relative to their younger colleagues, older workers indicate a stronger preference for helping people or contributing to society through their jobs, but pay less attention to the recognition they gain from their job and to working with people. There are moderators of the age-motive relationship; for instance, the relationship between age and growth motives was positive among blue-collar workers, but negative among white-collar workers. In sum, therefore, research shows that work preferences from the same class (growth, security, social) may show differential relationships with age. This finding is consistent with the assumption that work motivation may change with age in a multidirectional way. Also, the finding that growth motives are positively related to age in some groups of workers, but not in others, supports the assumption that there is no normative, biological motivation decline with age.

In sum, the evidence available to date suggests that work motivation does not uniformly decline with age, but may increase for certain aspects of jobs and decrease for other aspects. Like for their younger colleagues, older workers' motivation is shaped by the interaction of person characteristics and job demands. Older workers are likely to have

a different perspective on their occupational future than their younger colleagues in that they perceive fewer remaining developmental opportunities in their work lives, but this future time perspective, rather than depend on age per se, is largely influenced by the complexity of one's job and the degree of control workers have over their jobs.

## The Multilevel Perspective

The research summarized above is primarily intended to account for the determinants and consequences of *motivation at work*, i.e., as workers perform their work roles on a daily basis. Motivation at work is largely determined by momentary and situational drivers and can be defined as the kind of motivation that one experiences at a specific time and toward a specific activity.

A profound understanding of age-related changes in work motivation requires, however, that other levels of motivation on top of motivation at work be taken into account. The central proposition of a recent model is that workers' motivation is determined by three levels of work-related goals and motives (Kanfer et al. 2013). One of those levels concerns the at-work goals discussed in the previous section. Together with those, to-work goals and to-retire goals need to be considered. *Motivation to work* is similar to earlier constructs such as *work centrality* or the *meaning of work* and refers to the general value and importance one attaches to one's work. More technically speaking, motivation to work denotes the motivation to enter into a formal or informal public work arrangement in which workers allocate personal resources (e.g., time, attendance, mental or physical effort) in exchange for a portfolio of expected material (e.g., pay, healthcare benefits) and immaterial (e.g., sense of competence, recognition) rewards. The motivation to retire simply refers to the intention and preparedness to exit from one's current work.

There are two main reasons why it is important to integrate into models of age differences in work motivation both the motivation to work and the motivation to retire. First, it is around the age of

50 that the latter types of motivation begin to change and to play a more influential role than in earlier phases of one's work life. For instance, around that age, most workers' careers have reached or are near their "peak" in terms of the highest possible position and salary level. Also, as most people's financial situation might relax (e.g., because mortgages have been paid off), benefits and compensation begin to be of lesser importance. At the same time, retirement might be on the horizon for the first time. Therefore, the constellation of motivational drivers might be quite different to that of younger and middle-aged workers, for whom the motivation to work might be a more uniform motivational driving force and for whom the motivation to retire might not play a significant role at all. These marked differences between younger and middle-aged workers on the one hand and older workers on the other hand need to be considered in research on work motivation and aging.

The second reason for the multilevel view on older workers' motivation is that a uniform, "hierarchical" relationship between the motivation to work and the motivation to retire on the one hand and motivation at work on the other hand is less than likely. Even if motivation to work decreased and motivation to retire increased beyond the age of 50, this would not necessarily imply that motivation at work also went down. As mentioned above, motives of accomplishment, job enjoyment, and utilizing one's existing skills are positively related to age; they convey a sense of mastery and competence and thus are beneficial to one's job-related well-being and presumably even to one's general well-being. Therefore, workers are likely to maintain relatively high levels of motivation at work even in light of decreasing motivation to work. In line with these assumptions, recent research on the transition from work to retirement in the age group of 55–70 years shows that sizeable percentages of workers who leave their jobs before the official retirement age – indexing relatively low motivation to work – engage in voluntary work after retirement. This trend is most pronounced in workers who report having enjoyed their last position before retirement. This fits with Kanfer et al.'s

(2013) proposition that the association between the motivations to work and at work is relatively weak, given that motivation to work is influenced by sociocultural and economic conditions, while at-work goals are most strongly influenced by local work conditions.

## Summary and Outlook

As the percentage of older workers continues to rise, age-related changes in work motivation receive growing research attention. Understanding the system underlying such changes is vital for developing work design and managerial practices that enable motivated work throughout one's work life. After a decade of research on age differences in work motivation, one of the most important insights is that those age differences may best be described as being of a qualitative, rather than a quantitative, nature. In terms of motivation at work, i.e., motivated work on a daily basis, older workers are not generally motivated more or less than their younger colleagues, but they might be motivated for different aspects of their jobs. These differences are not so much a result of biological aging, but of changes in goal priorities. Motivation to work might be lower in older workers relative to their younger counterparts, but this will not invariably incur decline in motivation at work.

As far as the "big picture" is concerned, research on work motivation and aging appears to be in good shape. Current models integrate the global level of motivation to work and the specific level of motivation at work; by looking at the interactions of these levels, such models take a more fine-grained look than many of the established "age-free" theories of motivation. Also, adopting the motivational selectivity principles from lifespan psychology builds a bridge toward a stronger incorporation of work-related affect into theories of work motivation. These have been criticized of overemphasizing cognitive processes at the price of neglecting affect. Research on work motivation and aging has begun to show, however, how affective processes might be central determinants of motivation and

that certain aspects of motivation cannot be reasonably studied isolated from affect. In the face of longer work lives, understanding the links between affect and motivation will be of growing importance to enable the designing of physically and psychically sustainable work.

That said, one of the goals for the next decade of research could be to work toward coherent, integrated models. For a couple of years now, there have been calls for metatheories of motivation. At present, in the field of general work motivation, there are several established theories that are used “in parallel,” but how they relate to one another remains largely unexplored. On top of this, research on work motivation and aging imports additional concepts (e.g., socio-emotional selectivity) into the field and proceeds in a theoretically eclectic fashion. This might further complicate the situation unless some of the future work is dedicated to “tidying up” the conceptual landscape.

On the methodological side, more longitudinal work will of course be needed to model age-related changes in work motivation. In addition to established multiple-wave survey designs, research might benefit from experience-sampling designs. For instance, to reveal age differences in at-work goals, which are most strongly influenced by local work conditions and which change in a multidirectional fashion, week-level studies could look at workers’ perception of their work conditions (e.g., supervisor support, job complexity, and intensity) in a given week and their levels of motivation in that same week. Also, job-related well-being could easily be included as an outcome measure. Conducted over a number of weeks and with workers from several age groups, such studies would show work motivation and its drivers and underlying age differences “in motion.”

## Cross-References

- ▶ [Affect and Emotion Regulation in Aging Workers](#)
- ▶ [Job Attitudes and Age](#)
- ▶ [Motivational Theory of Lifespan Development](#)
- ▶ [Socioemotional Selectivity Theory](#)

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## Work to Retirement

Donatienne Desmette<sup>1</sup> and Franco Fraccaroli<sup>2</sup>  
<sup>1</sup>Institute of Research in Psychological Sciences, Université catholique de Louvain, Louvain-la-Neuve, Belgium  
<sup>2</sup>Department of Psychology and Cognitive Science, University of Trento, Trento, Italy

## Synonyms

Attitudes toward retirement; Intentions to retire; Transition to retirement

## Definition

This entry aims at proposing theoretical and practical aspects related to the transition from work to retirement. The major psychosocial theoretical models that try to explain this transition are presented. Individual and contextual (organizational) factors that influence the nature and quality of the transition to retirement are then discussed. Finally, bridge employments are presented as a pragmatic way adopted by workers and organizations to have a progressive transition from full employment to full retirement.

## Introduction

In most of the Economic Co-operation and Development (OECD) countries, a strong demographic transition is ongoing, characterized by increasing life expectancy and a reduction of birth rate. This transition is accompanied by the retirement of the baby boom generation and budget restrictions of the national pension systems exacerbated by the financial crisis (Jeungkun 2009). Due to all these combined reasons, retirement has become a major concern for (a) governments that have to ensure the future sustainability of the social security system and equity between generations, (b) work organizations that have to develop age management policies to ensure a productive participation of older workers in the workplace, and (c) individuals who may feel more insecure about their future as retirees and have to plan a longer late career at work.

Today, in comparison to the past, retirement has become a new social object that is rethought by decision-makers and the overall society. For that reason, some researchers have started to use the terms “modern retirement” (Beehr 2014). While 70 years ago only a restricted number of people benefited from retirement, for a limited number of years (remember that in the 1950–1955, the general life expectancy in EU countries was around 65 years), nowadays, a larger number of people reach the eligible age for retirement pension and for a longer period of

life (the life expectancy at 65 years is currently in EU around 17 years for men and 20 years for women, OECD 2012). At the same time, most of people enter in the retirement age in a better health condition, in comparison to the past, and they are still able to be active in the social life. Also, the combination between different life stages is more mixed, with increased flexibility and gradual transition from work to retirement.

In other words, new retirement may be quite different from the traditional conception that retirement occurs among older workers who quit a long full-time paid work when they have reached the specified retirement age and subsequently receive private and/or public pension benefit that only retired people receive (Beehr 2014). Many countries no longer have compulsory retirement ages, and many are extending the age at which access to public pension schemes may be possible (Hesketh et al. 2011). In this framework, the subjective choice to postpone retirement age and to continue to work longer is an issue at the individual and organizational levels. As an example, employees in OECD countries tend to retire considerably earlier than the age of 65 years (i.e., before the country’s official retirement age or the age at which the individual is usually entitled to a full old-age pension, Jeungkun 2009), but at the same time, due to employment policies in different countries, in Europe (EU-28), the rate of people aged between 55 and 64 years old who are still active in the labor market has improved for the last 10 years from 39.9% (in 2003) to 50.1% (in 2013). Echoing the increased activity rate of older workers, bridge employment has received an increased consideration in retirement literature as the transition between workers retire from their main career but before their complete withdrawal from the workforce (Alcover et al. 2014; Wang et al. 2008).

This entry aims at proposing a selective but representative review on literature at the following levels. The first section puts some guidelines about the major theoretical perspectives that have framed studies in retirement and that are likely to substantively contribute to future research. The second section focuses on the individual and contextual (especially related to the organizational

situation) factors that contribute to the decision to retire. In a final section, the different ways to move from work to full retirement are analyzed with a particular attention to the so-called bridge employment, a transitional solution that is aimed to reduce engagement in the main career but continuing working with a lower level of obligations.

## Theoretical Perspectives on Retirement

In their comprehensive review, Wang and Shultz (2010) analyzed how different theories are applied to understanding the retirement process (for a deepened insight in theories, see Wang 2013). Building on an extended literature, they proposed an integrative theoretical framework that conceptualizes retirement as decision-making, retirement as an adjustment process, retirement as a career development stage, and retirement as a part of human resource management. From this, two key approaches emerge when analyzing retirement as a process that occurs over time: retirement as a decision-making process and retirement in the life span. Each of them highlights specific aspects of retirement as well as different theoretical approaches.

In the retirement as decision-making perspective, as the final exit from a process of older workers' gradual disengagement from work, retirement is conceptualized as an informed (rational) choice behavior. In other words, when workers decide to retire, they choose to decrease their psychological commitment to work and to behaviorally withdraw from work (Beehr 2014; Wang and Shultz 2010). Most theories about retirement decision-making process refer to a cost-benefit framework, assuming that older workers decide to retire once the benefits of retirement exceed those of working on the basis of information individuals have regarding their own characteristics and their work and nonwork environment. The particular factors (e.g., economic or noneconomic, individual, organizational, etc.) that are analyzed in this perspective depend on the discipline and the theoretical framework (Van Solinge and Henkens 2014). Feldman and Beehr (2011) proposed a three-phase model of

retirement decision-making where workers start to envision the possibility of their future life as retirees, then they assess the past experience at work to inform when to retire, and finally they put concrete plans for acting their retirement into action. The authors do not suggest that these three phases of retirement decision-making are completely distinct, but they assume that the salience of various retirement-related issues varies across the time period during which the retirement decision is made.

This model helps to clarify which theories will be the most relevant in explaining processes that contribute to each phase of the decision to retire. However, one major limitation of this perspective, as Wang and Schultz (2010) noticed, is that not all retirement decisions are voluntary as supposed in the informed-choice. Sometimes, retirement can be enforced on a person by the organization, for example, through downsizing, or by other constraints like mandatory retirement. Therefore, the voluntariness of the retirement decision could be viewed as a boundary condition for applying the informed decision-making approach in analyzing predictors of the retirement decision.

In the life span approach of retirement, the decision to retire is viewed as less important than the characteristics of retirement process embedded in the decision-making (Wang and Shultz 2010). In other words, because patterns of transition are variable regarding the timing of the decision, the previous preparation for the decision, the resources, and other aspects associated with the decision, the life span approach is more interested in apprehending the diversity of retirement patterns, that is, "how" people retire rather than strictly "when" they do decide to retire. The life span approach conceptualizes retirement as an adjustment process (Kim and Moen 2002) and in the perspective of adults' development (Löckenhoff 2012). In the adjustment perspective, retirement is seen as a process through which retirees achieve a new equilibrium into their new lives. In this respect, Kim and Moen (2002) considered the economic, personal, and social mechanisms that might facilitate the psychological well-being into retirement. Basically, people are seen as willing to maintain earlier lifestyle

patterns as well as fulfilling roles and identities even as they exit their primary career jobs in order to prevent psychological distress. This conceptualization of retirement as adjustment leads research on both the retirement transition (i.e., from employment to retirement) and postretirement trajectory (i.e., individual development in postretirement life) (Kim and Moen 2002; Wang and Shultz 2010).

Retirement as a career stage (Wang and Shultz 2010) offers some consideration about retirement in a developmental perspective. Bridge employment is especially into the focus as the way to fulfill older individuals' career needs. In a more extensive way, Löckenhoff (2012) proposed that life span developmental theories could contribute to conceptualize change over time in retirement studies, depending on how people maintain a sense of control, balance gains and losses, and perceive time horizons in retiring. In particular, socioemotional selectivity theory [SST] (Carstensen et al. 1999) might be of prime interest in lengthier transition contexts. SST proposes that as people age, their perspective of remaining lifetime changes from being expansive to limited. Awareness of remaining time influences people's choice of goals: the more time is perceived as limited, the more people will value emotional goals as well as meaningful social interactions and the less they will value knowledge-relevant goals. Applied to the career, analyzing the role of changing time orientation perspective has been recognized has a major issue for retirement studies. In particular, some findings indicate that older workers who had a greater subjective life expectancy were less inclined to retire early (see examples of studies in Hesketh et al. 2011; Löckenhoff 2012). Other researches reveal that the work environment can shape the developmental processes and their consequences on older workers' attitudes (see the review and conceptual paper by Truxillo et al. 2012). As a whole, recent research leads to conclude that life span developmental perspective would be especially well suited to analyze the role of contextual resources and their role in older workers' intention to retire.

## Why Do Older Workers Retire?

Recent years have seen increasing research on retirement (for an extensive review, see Wang 2013). Echoing the decision-making perspective on retirement, a vast portion of research is devoted to understand why people retire. In studies, retirement has been measured as individuals' behavior, that is, if people actually retire or not (Van Solinge and Henkens 2014) and how (e.g., with a retirement pension or disability retirement (Blekesaune and Solem 2005) or if they retire fully or partially (Zaniboni et al. 2010)). Based on the rational assumption that people do what they intend (Beehr 2014), other studies analyzed planned or preferred age to retire (Zappala et al. 2008) and (early) retirement intentions (Lagacé et al. 2010). Turnover intention has also been considered as retirement in studies including younger workers (Henry et al. 2015). Antecedents of retirement are usually analyzed at the macro-level (contextual and normative factors), the micro-level (i.e., individual factors), and the meso-level of the organization- and work-related factors (Schalk and Desmette 2015; Wang and Shultz 2010). From this, public policies, specific individual characteristics, a complex pattern of work characteristics, and age climate emerge as at particular interest.

### Public Policies as Contextual and Normative Frame

Older workers are assumed to retire when they are eligible for pension funds and when they can afford to do so financially. However, the decision to retire depends on other aspects than economics. In particular, public policies frame what routes for retiring are actually possible. Several national governments decided to remove mandatory age retirement (the USA, the UK, Finland) giving workers more flexibility in transitioning to retirement as well as the opportunity to decide how long to stay at work. The advantages of such policies could be related to a reduction of age discrimination (for instance, giving the same opportunities to women and men) and to recognizing the right for older people to use their

competences and to maintain a productive position in the society if they want (Baruch et al. 2014). Beyond the age limitations from mandatory or out of mandatory retirement, the type of social security system is of importance. Early retirement tends to be higher in countries with public policies that support early exit routes like in Belgium and France rather than employment like in Sweden and Japan. Similarly, a high unemployment rate is likely to force older workers who want to keep working to withdraw from the labor force (Jeungkun 2009). Moreover, public and private pension schemes contribute to define social norms as well as expectations that organizations share about the “right time” to retire. Also, in the frame of SST, such public policies and their organizational effects might contribute to older workers’ time orientation in the career.

### **The Sociodemographics and Health Conditions**

Age, wealth, and health emerge among the most decisive individual characteristics (see the reviews by Schalk and Desmette 2015; Wang 2012): Workers who start considering retirement are likely to be older, they perceive a better adequacy of their actual or future income, and/or they have a poorer mental and physical health. Health conditions are the ones of the strongest predictors of perceived work sustainability in older workers as well as of older individuals’ adjustment in retiring.

Other sociodemographics lead to a more mixed pattern. In general, less educated workers tend to retire earlier, among others through disability retirement due to more aversive working conditions (Blekesaune and Solem 2005). Regarding gender, findings are somewhat inconsistent. In fact, they highlight that retirement decision is not an individual but often a marital and/or family matter. In general, having a family and especially a spouse may contribute to the decision to retire. As Beehr (2014) noticed in his review, dual-career couples often tend to retire at about the same time. Moreover, early retirement has been shown more frequent among workers with a partner than in

older workers without a partner (Van Solinge and Henkens 2014) as well as when older workers perceive lower family-to-work conflict (Kubicek et al. 2010). Studies found effects of gender in combination with marital status: Married women retired earlier more often than married men (Blekesaune and Solem 2005) and women were more likely than men to willing partial retirement (Desmette and Vendramin 2014). The lower loss of status associated with retirement for wives than for husbands as well as their greater family-care roles would explain early retirement of women compared to men (Blekesaune and Solem 2005).

### **The Job Characteristics**

In their meta-analytic review, Topa et al. (2009) found that as a whole, negative working conditions would have somewhat limited effects on retirement intentions. In fact, findings regarding the organizational situation conclude to a heterogeneous pattern except for hard physical work conditions that are at risk for the health (e.g., jobs exposing to musculoskeletal disorders, biochemical and ambient risk, night and shift working hours, etc.). These hard physical jobs have consistently been shown make retirement more likely, through either early retirement scheme or disability retirement (Blekesaune and Solem 2005; Kubicek et al. 2010). In general, but with more mixed results, older workers will be more in favor to retirement when they perceive work-time pressure (i.e., high-speed work), when their task is repetitive, and/or when they have a job with low autonomy and control in the task (Blekesaune and Solem 2005; Schreurs et al. 2011). Similarly, older workers who feel they are plateauing in their career and/or that their job does not still offer higher levels of challenge will tend to consider early retirement (Zaniboni et al. 2010). Based on a Belgian older workers’ sample from the European Working Conditions Survey (EWCS2010), all these working conditions have been confirmed as adverse factors that make the job unsustainable until the retirement age (Desmette and Vendramin 2014).

As regards research on social relationships, findings tend to conclude that retirement is

postponed when older workers benefit from positive social relationships in their workplace, like social support from colleagues and/or supervisor (Schreurs et al. 2011; Van Solinge and Henkens 2014), maybe because workers could feel the risk of poorer social integration when retiring. As an example, Zaniboni et al. (2010) found that older workers who anticipated a loss of social integration in retirement were more willing to have part-time retirement rather than full retirement. However, in some cases, social cohesion can increase early retirement. Results of a study by Oakman and Wells (2013) indicated that older workers who perceived the most that they had opportunities for networking at work (i.e., the measure of social cohesion) were significantly more likely to retire within the next 5 years. In this study, older workers might have adjusted their retirement age on the average retirement age in their workgroup because of normative and affective processes. In other words, social relationships might play both a pro and con role in retirement depending on either they activate the norm of retirement or they fulfill meaningful social needs.

Studies have recently proposed conceptualizations of work characteristics in the frame of job demands and job resources in order to explain the role of health impairment and disengagement processes in retirement (Kubicek et al. 2010; Schreurs et al. 2011; Van Solinge and Henkens 2014). For example, a study by Schreurs et al. (2011) showed that job resources had an indirect effect on early retirement intentions through work enjoyment. The more older workers perceived control and social support from their colleagues and supervisor, the less they intended to retire early because they felt more pleasure in doing their work. Congruently to this perspective, studies on older workers' attitudes at work have given some support (however with some contradictory findings) to the hypothesis that voluntary retirement closes a process of disengagement process. In particular, lower involvement in the job and lower satisfaction at work contribute to increase early retirement (see the meta-analytic review by Topa et al. 2009) despite reviews concluding a weak relation between retirement and satisfaction (Beehr 2014).

### The Organizational Age Climate

As a whole, findings on work characteristics lead to conclude that organizations should apply human resource management strategies that could foster the postponement of retirement of older workers (age management). Echoing pressure to increase older workers' activity rate and longer retirement transitions, this field of research is currently growing. There are many retention strategies to support work for people in late career (see, e.g., the review by Paullin and Whetzel 2012):

#### (a) Tailoring human resource practices

Human resource (HR) practices that aim at specifically fulfilling the needs of older workers for reduced job demands should consider hard physical working conditions, flexibility in the work schedule, and age-related opportunities for skills development because these working conditions have been shown crucial in impairing older workers' health or in increasing their work disengagement. Studies tend to give some support to this assumption but with caution.

Positive effects of age tailoring have been shown extensively. For example, building on several previous studies that supported the usefulness of tailored HR practices in postponing retirement, Armstrong-Stassen and Schlosser (2010) found in a nurses' sample that flexible work options (flexible work schedules, reduced work week (part-time), job sharing, and unpaid leave options) reduced the likeliness of retirement because these older nurses perceived stronger procedural justice in their organization and higher support from their supervisor. Similarly, early retirement tended to be less likely when older workers benefited from organizational practices that were specifically tailored for improving the development of older workers' career aspects, like displaying special attention to maintaining the employability of elderly employees (Zappala et al. 2008), as well as from practices that sustained their development needs like providing job opportunities for learning new things (Zaniboni

et al. 2010). In terms of job enrichment, Zaniboni et al. (2013) showed that increased skills variety rather than task variety contributed to decreasing older workers' turnover intentions. Moreover, (career) development needs should not be the only aspect taken into account. Henry et al. (2015) highlighted that age-related social needs are of importance in older workers. They showed that when older workers perceived that their organization provided practices that nurtured their generativity needs (i.e., older adults' motives to care and guide younger generations), they were significantly less inclined to quit. Higher quality of contact with younger colleagues explained this indirect effect between higher opportunities of fulfilling generativity needs and lower retirement likelihood in older workers.

However, studies can fail to find a significant association between age-related HR practices (including among others work schedule, job design, training) and retirement consideration (Hennekam and Herrbach 2013; Van Solinge and Henkens 2014). Moreover, tailored HR could have detrimental effects. In particular, as preferential treatment toward a social category, age accommodations can contribute to increased stereotypes and discrimination toward older workers. Iweins et al. (2012) revealed that when younger workers perceived that their organization implemented age-tailored HR practices like specific work-time reductions for older workers, they were more prejudiced against older workers as a whole. In other words, age-related practices may be a double-edged sword because they can – or not – contribute to reduce retirement but also because they may contribute to the unintended effect of increasing ageism.

(b) Organizational ageism

The organizational culture regarding retirement signals older employees in multiple ways when they should move out of the workplace. For example, examining an organization's customs and practices regarding retirement timing, Van Solinge and Henkens

(2014) found that when older workers perceived that early exit was commonplace in the organization, that is, all their colleagues were retiring early, participants were much more inclined to retire early themselves as well. One explanation could be that mean age for retiring in the environment contributes to frame older workers' occupational time horizon. Another explanation might be that ageism pushed older workers outside the workforce. In countries where older workers' activity rate is relatively low like Belgium and Italy, older workers are perceived as willing to retire early and they are also more likely to be more discriminated because of their age (Desmette and Vendramin 2014). Some researchers assume that early retirement is a coping strategy that individuals may adopt to avoid the negative social identity associated with their membership to the stigmatized older workers group. For instance, it has been shown that the more individuals self-categorized as older workers (Gaillard and Desmette 2008) and the more they had negative feelings about this social identity (Zaniboni et al. 2010), the higher their intentions to retire early. Other studies emphasize the role of the context as the cause of retirement viewed as the avoidance from identity threat. Intentions to retire have been shown to be higher in older workers who perceived that their organization discriminated them because of their age (von Hippel et al. 2013) and when the context had made salient negative stereotypes rather than positive stereotypes about their age group (Gaillard and Desmette 2010). Finally, a study by Lagacé et al. (2010) depicted the process of early retirement as the final step of an identity disengagement from the work domain. In a study with older nurses, they found that an organizational ageist culture (including discriminating practices and denigrating language) induced a feeling of strong frustration in older workers that lead them to question the value of their professional environment and consequently to subjectively disengage from the occupational role. Retirement was the final issue of

this process. Of course, age-related discrimination is not limited to older workers but also affects younger workers but being old seems to be an aggravating factor of the effects of perceived discrimination (von Hippel et al. 2013).

## Bridge Employment

As already mentioned in the “Introduction,” in the recent years, the transition from work to retirement has been less linear and less characterized as a unique event. The passage from a full-time job to a full-time retired condition is more progressive, with variable durations, and different career paths can be followed to become “retiree” (Beehr 2014). In summary, the international labor market for people aged from 55 to 65–70 years has deeply changed in the last two decades (1995–2015). An increase has been registered in employment rates among people aged over 55 because public policies, particularly in Europe, have raised the pensionable age in order to balance the ratio between active and retired people. Work experiences have also substantially increased after retirement. Mainly because of economic necessity, some individuals at the retirement age try to continue working, even if in part-time or fixed-term jobs, although they are entitled to a pension. Even at an elderly age, workers are requested to manage their careers, to search for jobs well suited to their work abilities, and to begin new pathways and reactivate processes of skills acquisition and development.

As a result of these processes, many career pathways between the full work position and full retirement are today prevalent in the older workers experience (Alcover et al. 2014): “Phased retirement” refers to the alternative of working shorter hours for the same employer, “partial retirement” concerns a job change from a career job to a new full-time or part-time position, “bridge employment” involves a change in employer and sometimes a switch to self-employment, and “reentry” is a come back into the labor force after retiring.

Especially well-studied form of this progressive transitional experience from work to

retirement is “bridge employment” (Alcover et al. 2014). Bridge employment may be defined as jobs that follow full-time employment and precede complete labor force withdrawal or retirement from work. Different types of bridge employment can be identified. One of the main distinctions is between career-consistent bridge employment and noncareer bridge employment (Wang et al. 2008). The former type may occur in the same occupation, when older workers continue to work in previous job in the same organization or in a new one. The latter type (noncareer bridge employment) is related to the experience of people who choose to work in a different field, usually also with a lower status and a reshape salary. In many cases people are engaged in bridge job as self-employees such that they benefit from more autonomy and more flexibility in managing work hours and workload (Alcover et al. 2014).

A key issue in research on bridge employment is explaining retirement versus intentions to continue working. Indeed, intention to continue working would not be just the opposite of a low desire to retire (Schalk and Desmette 2015). On this respect, various antecedents of bridge employment have been examined by researchers. Alcover et al. (2014) and Wang et al. (2008) offer a quite complete list of these elements that could explain the access to this step of the work career. Some variables are related to individual psychological attributes such as career commitment and the entrepreneurial attitude. Some other variables are related to the lifestyle like living in a family with dependents and financial demands. Finally, some antecedents are connected to organizational conditions that could facilitate bridge employment experience. Retention strategies for preserving older workers’ skills and competences seem especially important in this respect. Examining which antecedents predict either full retirement or bridge employment, Wang et al. (2008) found that being younger, more educated, and healthier and having experienced less work stress in the previous job are favorable antecedents to bridge employment (either in the career or in another field) rather than full retirement.

Another key issue is concerned with outcomes of bridge employment for older people. The

positive outcomes of the bridge employment experience have been shown by a number of studies. Findings have been systemized in Alcover et al. (2014). In short, there are evidences for some psychosocial benefits for the individual workers in terms of work and life satisfaction, reduction of work stress and workload, engagement and motivation, and financial stability after retirement. From the organizational point of view, bridge employment could have the effect of reducing the negative stereotypes against older people in the workplace.

## Conclusion

In the context of new retirement where frontiers between work and retirement have been somewhat blurred for older individuals because of longer transitions, routes for future researches are numerous and challenging. Three perspectives may be into the focus to conclude.

First, from a theoretical point of view, life span developmental approaches offer quite promising frameworks to go further in analyzing retirement motives over time. In particular, the increasing diversity of retirement routes (Alcover et al. 2014) calls for better understanding the role of time perceptions in retirement decision, its antecedents and consequences, into and outside the workplace. Social and organizational norms in the context of new retirement as well as their role in individuals' perceptions and attitudes at work should be better understood. Also, research should improve the understanding of the consequences of retirement patterns and lengthier transitions not just for the older workers but also the family and the society as a whole.

Second, organizations should develop HR practices devoted to care older workers' health and to support motivation in the job. Above all, working conditions have to be sustainable in the aim to preserve the health of the older workers until full retirement. In this objective, tailored HR practices for reducing aversive job demands, especially those at risk for the health, are needed. Moreover, organizations should provide resources

in order to support older workers' work enjoyment and motivation. Bridge employment might be a relevant route to keep them at work for longer. However, bridge employment has been shown to be more desirable when the quality of previous job was higher. Therefore, active aging (i.e., working longer) requires that organizations take care of their employees all along the career.

Finally, social relationships might be better into the scope of researchers and organizations. Indeed, congruently with SST assumptions, studies lead to conclude that social relationships can play a significant role in retirement decision. In this respect, intergenerational relationships seem a crucial issue. Conditions for qualitative contact between younger and older workers, because they contribute to postpone retirement, should be implemented. In particular, organizations should pay attention to fulfill older workers' needs but avoiding feelings of intergenerational inequity and ageism that can be related to age-tailored HR practices. In other words, age diversity management is a part of a sustainable work environment for older workers.

## Cross-References

- ▶ [Age Discrimination](#)
- ▶ [Age Stereotypes in the Workplace](#)
- ▶ [Age, Self, and Identity: Structure, Stability, and Adaptive Function](#)
- ▶ [Intergenerational Relationships](#)
- ▶ [Life Span Developmental Psychology](#)
- ▶ [Motivation to Continue Work after Retirement](#)
- ▶ [Organizational Strategies for Attracting, Utilizing, and Retaining Older Workers](#)
- ▶ [Postretirement Career Planning](#)
- ▶ [Retirement and Continuity Theory](#)
- ▶ [Retirement and Social Policy](#)
- ▶ [Retirement Planning and Adjustment](#)
- ▶ [Selection, Optimization, and Compensation at Work in Relation to Age](#)
- ▶ [Socioemotional Selectivity Theory](#)
- ▶ [Stress and Well-being: Its Relationship to Work and Retirement for Older Workers](#)
- ▶ [Timing of Retirement](#)

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## Working Memory in Older Age

Vanessa M. Loaiza<sup>1</sup> and Klaus Oberauer<sup>2</sup>

<sup>1</sup>University of Essex, Colchester, United Kingdom

<sup>2</sup>University of Zurich, Zurich, Switzerland

### Synonyms

Working memory capacity; Short-term memory; Working memory updating; Updating and monitoring

### Definition

Working memory (WM) refers to the immediate and limited memory system that is responsible for maintaining, processing, and updating information flexibly and for brief periods of time. WM is sometimes used interchangeably with short-term memory in the literature, although WM is often considered more active and dynamic than the more passive short-term memory. The construct has been fundamental to researchers' understanding of age-related changes in a broader range of other cognitive abilities, such as fluid intelligence

(i.e., abstract reasoning) and long-term episodic memory (i.e., retrieval of information that is no longer held in working memory). This chapter reviews several important life-span models of WM from the literature and their supporting evidence, while also considering other aspects of WM, such as methodologies for testing WM capacity in older adults, the neural signatures of WM in the aging brain, and whether it is possible to train WM in order to yield improvements to other areas of cognition across the life-span.

## Introduction

In daily life, we are regularly required to briefly hold some information in an accessible state for an ongoing task. While planning a trip, for example, it is often the case that we must consider the prices of several hotels to make comparisons between them, perhaps while also considering their relative distances to a desirable location in the city. The immediate memory system thought to underlie such tasks is called *working memory (WM)*, a concept that has been fundamental to many theories regarding age-related changes in cognition due to its hallmark responsibility of maintaining information available for processing.

*Working memory capacity* refers to the maximum amount of information that a person can maintain efficiently in WM. It is well known that WM capacity is limited: The system can become quickly overloaded (e.g., considering the prices of a large number of hotels), resulting in considerably impaired performance. Moreover, WM capacity only becomes more constrained with increased age: Older adults show worse performance on WM tests compared to younger adults (Bopp and Verhaeghen 2005; McCabe et al. 2010; Park et al. 1996). This fact is particularly important because the functioning of WM has a large impact on many other forms of complex cognition. Individual differences in WM capacity correlate highly with success on other cognitive tasks, such as tests of long-term episodic memory and of reasoning ability. Moreover, individual variation in WM capacity accounts for a large proportion of age-related variance in cognitive

abilities such as episodic memory (McCabe et al. 2010; Park et al. 1996). In other words, how much individuals of different ages vary in their episodic memory performance can largely be ascribed to their variation in performance on the WM measure. For that reason, WM has been a core construct at the center of research on age-related decline in higher-order cognition.

The explanation that many researchers offer for such findings is that the mechanisms underlying WM are similarly required during tasks measuring other forms of higher-order cognition. However, researchers have disagreed about what causes the limitations in WM and why WM capacity predicts other cognitive functions. In the aforementioned example of maintaining hotel prices and locations for a trip, it could be that younger adults excel at this task relative to older adults because: (1) they are just generally faster and therefore more efficient at the task (*processing-speed hypothesis*); (2) they are better able to disregard irrelevant information (e.g., checking emails, distracting music) during the task (*inhibitory-deficit hypothesis*); (3) they are better able to flexibly coordinate between the different subtasks involved (*coordination and task-switching hypotheses*); or (4) they are more effective at integrating the hotel price and location information into a cohesive unit (*binding-deficit hypothesis*). Accordingly, age differences in one of these predicted underlying functions in WM are thought to be similar in other tasks of higher-order cognition (e.g., episodic memory) that likewise rely on the same function.

The goal of this section is to review several frameworks and concepts that have been important to explaining age-related differences in WM and elucidating its role in higher-order cognition. Important findings from the neuroscientific literature concerning age-related changes in the brain that correspond to changes in WM performance are also reviewed. Furthermore, findings from the relatively recent field of WM training are also considered. Prior to these overviews, a summary of the typically used empirical methods in the field of cognitive aging and WM is presented.

## Empirical Methodologies and Working Memory Measures

There is a wide range of commonly used empirical methods in the study of WM across the lifespan. The use of any one of these particular methods depends on the research question of the researcher, and unfortunately, sometimes the convenience and cost of the study. Furthermore, the WM literature in general is rife with discussion on the best tasks to use to properly assess WM capacity. Much of the research attempts to balance the practical importance of utilizing well-established and reliable tasks with the aim to use theoretically informative tasks that could adjudicate between purported mechanisms of WM. A thorough consideration of these empirical and task-specific methodologies is essential for any study on WM in older adults.

**Empirical Methods.** As is the case in many areas concerning development, studies of WM generally fall under the umbrellas of either cross-sectional or longitudinal designs. Both types of designs either recruit participants for a continuous age sample (e.g., adults aged 18–80 with the ages more or less equivalently represented) or recruit participants to represent prearranged and discrete or extreme age groups (e.g., younger adults aged 18–30 vs. older adults aged 65–80). Cross-sectional studies compare adults of various ages or age groups at the same singular time point. Thus, cross-sectional studies assess interindividual variability, or how WM differs between these disparate age groups. Conversely, longitudinal studies examine adults representing one or several age groups across at least two time points. Thus, longitudinal studies are primarily concerned with intraindividual variability, or how WM differs within a person across different points in time. Whereas cross-sectional designs tend to show a steep linear decline from age 20 on in a host of cognitive functions including WM (McCabe et al. 2010; Park et al. 1996), longitudinal designs usually show much more modest rates of decline in WM (Hertzog et al. 2003). Within either cross-sectional or longitudinal designs, researchers typically implement

experimental or individual differences methods, or a combination of the two, depending on their research question. Experimental research questions concern the effect of manipulating one or several factors on subsequent performance. In cross-sectional designs, for example, researchers may examine whether increasing the amount of information (i.e., load) in WM yields different patterns of brain activity in the prefrontal cortex in younger and older adults (Daselaar and Cabeza 2014). Experimental studies very commonly test for age  $\times$  variable interactions, such that effect of manipulating a variable (such as WM load) is more pronounced for one age group than another.

As will be discussed more thoroughly in the overview of theories of WM age differences, such interactions can be informative for differentiating key aspects underlying age-related changes in WM. However, many age  $\times$  variable interactions are ordinal, and as such, are uninformative because they depend on the scale of measurement. Several methods have been developed to address this issue. First, a Brinley plot is a scatterplot wherein older adults' mean performance is plotted as a function of that of younger adults' for the same task condition. The regression line represents the relation between young and old adults' performance scores across a number of tasks and experimental conditions. A meaningful interaction between age and the variable of interest can be inferred if two separate regression lines are necessary to explain the young-old relation in two conditions (e.g., a baseline condition and a critical experimental condition). Two lines would suggest that there is a specific age-related deficit associated to the experimental condition over and above the age deficit observed in the baseline condition. Conversely, if only one regression line is necessary to explain the relationship between younger and older adults' performance on the different task conditions, then it can be inferred that the age-related deficit can be reduced to a single underlying variable that accounts for the age effects in all task conditions.

In a similar vein, state-trace plots also examine interactions between age and a variable of interest by plotting performance on one task (e.g., the

baseline condition) against performance on another task (e.g., the experimental condition) in order to ascertain if the relationship between these tasks differs between younger and older adults. Similar to Brinley plots, an age  $\times$  variable interaction can be inferred if two regression lines (one for either age group) are necessary to explain the performance relations between the tasks. However, if only one regression line is necessary, then it can be concluded that the relationship between the tasks can be reduced to a single variable that changes across the lifespan. Thus, Brinley plots and state-trace plots can be very informative to indicate whether an underlying process or mechanism is uniquely deficient in older age or not.

Individual-differences research asks to what extent differences between individuals on a particular task or set of tasks covary with differences on other measures. Because no single task is a pure measure of a construct, it is increasingly common to administer a number of tests that purportedly measure the same underlying construct, such as WM capacity. The construct is represented by the latent factor that reflects the common variance of all the WM tests. Researchers then use structural-equation modeling (SEM) to examine how these latent constructs correlate with other constructs, such as fluid intelligence. These methods are important for assessing the contribution of WM in explaining age-related variability in other complex cognition. For example, in a longitudinal design, one could examine how changes in WM performance from age 64 to 70 accounts for the changes shown in other variables like episodic memory (Hertzog et al. 2003). Analogous analyses in cross-sectional designs using path models examine how WM accounts for age-related variability in other measures (McCabe et al. 2010; Park et al. 1996). Individual differences methods like hierarchical linear regression and SEM can be useful for comparing alternative models to each other, but such methods applied to cross-sectional designs are inadequate to infer that age-related changes in one construct (such as WM) are causally responsible for age-related changes in other constructs (Lindenberger and Pötter 1998).

**Working Memory Measures.** Most researchers agree that WM is a system that briefly maintains, manipulates, and updates information. Given this characterization of WM as a construct, researchers have created a plethora of tasks that aim to assess these functions.

Complex span tasks have dominated the literature: They require participants to briefly maintain information (e.g., in verbal complex span tasks, digits, letters, or words) while concurrently engage in other processing activities (e.g., in operation span, arithmetic problems, such as “ $4 \times 6 = 24?$ ”). Typically, after 2–7 memoranda have been presented, participants are asked to recall them in their original order of presentation. Other WM tasks emphasize the updating function of WM, such that initially presented information (e.g., the digits 4 2 9 presented across three frames) is updated using new incoming information (e.g., successively presented operands such as +2, +1, and –3, to be applied to the first, second, and third digit, respectively). Other studies, especially neuroscientific studies using fMRI, commonly use *n*-back tasks. In the *n*-back paradigm, participants observe a long series of items and decide for each presented item (e.g., letters) whether it matches the item presented *n* steps back (e.g., in a 2-back with letters, the sequence L-R-L-Q would require “yes” to the second presentation of L but “no” to Q). Neuroscientific and behavioral studies have also commonly employed immediate short-term recognition or probed-recognition paradigms: A set of stimuli is presented, followed by a brief delay. WM is then tested by presenting a probe stimulus and requiring participants to decide whether it was included in the memory set, or whether it matches one particular stimulus in the memory set.

There are several methods of determining whether various measures of WM capacity are good indicators of the construct as well as informative about the nature of WM itself (Oberauer 2005b). These methods are not necessarily specific to WM research but have been immensely informative for the literature in general and for considering age-related changes in WM performance. As discussed previously, researchers often use factor analysis to the benefit of

understanding how these WM measures share common variability at the latent level. That is, if different kinds of measures of WM capacity load on the same factor, then it can be concluded that only one factor of common variability is necessary to explain performance on the tasks (i.e., construct validity). Furthermore, the different WM measures should correlate to the same extent with other criterion measures commonly associated to WM, such as fluid intelligence (i.e., convergent validity). Conversely, the measures should not predict performance on other tasks that are theoretically assumed to be unrelated with the construct, such as visual search (i.e., discriminant validity). Finally, the measures should be similarly affected by experimental manipulations and by age at both the behavioral and neural level, especially as predicted by the theoretical understanding of the construct. While it is greatly important to establish the reliability and validity of these different measures, the selection of any one of them thereafter depends on the research questions of the study. Specifically, the selection of one task over another is motivated by the task characteristics that allow one to test the underlying mechanisms of interest.

### Theoretical Accounts for Age-Related Decline in Working Memory

Given the many proposed models of WM (Miyake and Shah 1999), it is not surprising that there are a variety of corresponding theoretical accounts for age-related differences in WM. Some of these theoretical accounts have focused on interpreting age-related deficits in WM as deficits in more basic functions (i.e., processing speed, binding), whereas others have emphasized the importance of cognitive control in WM (i.e., inhibition of irrelevant information, coordinative ability).

**Processing Speed.** Among the earliest and arguably the most profoundly influential explanations for age-related decline in WM, and fluid cognition in general, was the *processing-speed hypothesis* (Salthouse 1996). It is regularly observed that older adults process and respond to information much more slowly than

younger adults. For example, on a typical processing speed measure (e.g., letter comparison), the speed with which one decides whether a string of consonants matches another string of consonants (e.g., LHQFPY – LHRFPY) tends to increase with increasing age. The processing speed hypothesis states that information in WM declines over time. Therefore, adults' slower speed of processing means that fewer cognitive operations on information in WM can be completed before that information is lost. Moreover, less information is simultaneously accessible in WM because encoding and rehearsal of information is also slowed, compared to younger adults. Thus, processing speed is argued to cause the age-related decline in performance in WM tasks. Evidence for the processing-speed hypothesis comes from the well-established finding that the negative correlation between age and measures of WM capacity is substantially attenuated when measures of processing speed are statistically controlled for, particularly in cross-sectional studies.

Despite consistent evidence that processing speed shares a large proportion of age-related variance with performance on tasks of higher order cognition, age differences in WM capacity cannot be reduced to mere speed of processing. A number of studies varying different dimensions of task complexity have shown that age differences in speed of processing depend on the demands of the task: As task complexity increases, the ratio of average response times between old and young adults increases from about 2:1 to about 4:1 (Oberauer 2005a). This suggests that the age difference in speed is not a cause but a consequence of the age difference in WM capacity: With reduced WM capacity all task-relevant representations – including task sets that implement the goals and instructions – are represented less robustly, resulting in slower processing, and that effect is exacerbated the more WM is loaded. Further evidence has indicated that older adults' comparatively slower processing speeds are largely due to different speed-accuracy trade-offs between younger and older adults: Older adults are more likely to prioritize accurate responses at the cost of response times, whereas younger adults tend to balance

speed and accuracy to achieve the most correct responses per unit of time (Starns and Ratcliff 2010). Therefore, much of the age-related slowing observed in response times does not reflect slowing of information processing.

From an individual differences perspective, WM and processing speed at the latent level are often strongly related but still distinguishable constructs. Moreover, structural-equation models including both WM and processing speed as separate predictors of higher-order cognition (e.g., episodic memory) have provided better fits of the data than models that only used speed as a predictor variable and WM as a measure of general memory ability (McCabe et al. 2010; Park et al. 1996). Thus, although processing speed is an important factor in age-related decline in cognitive abilities, research from experimental and individual differences perspectives alike show the unique predictive utility of a WM factor that cannot be entirely reduced to processing speed.

**Inhibition.** The *inhibitory-deficit hypothesis* attributes age-related changes in WM to a decreased ability to keep irrelevant information out of WM, and thereby prevent it from interfering with the task at hand (Hasher et al. 2007). According to this view, age differences in WM arise not because older adults are less capable than young adults of maintaining information in WM; rather, there is *too much* irrelevant information cluttering their WM that disrupts the maintenance and processing of relevant information and consequently yields worse performance.

The evidence for inhibition as a crucial factor in WM stems from a number of different paradigms that infer successful inhibition from the contrast of two experimental conditions. Inhibition can be inferred from slower response times to information assumed to be suppressed previously, less priming of suppressed information, or fewer intrusions of information that was deemed irrelevant to the task, compared to a baseline condition in which suppression is unnecessary (Hasher et al. 2007). Compared to younger adults, older adults have shown diminished inhibitory ability in each of these regards. The paradigms developed to test inhibitory functioning have included negative priming, directed forgetting, and resistance to

prepotent responses (e.g., antisaccade, Stroop), among many others. In many of these paradigms, the crucial measure is the relative difference in response times during the critical task that requires inhibition of irrelevant information compared to a baseline condition. For example, the negative priming task simultaneously presents two stimuli and requires a response to the predetermined relevant stimulus (e.g., name the red letters) while also ignoring the irrelevant distracter (e.g., a superimposed green letter). Negative priming effects are shown when response times are differentially slower when the irrelevant distracters are repeated as relevant stimuli on the following trial, compared to a baseline condition wherein none of the distracters are repeated. Thus, *smaller* negative-priming effects indicate failures to inhibit the irrelevant stimulus, whereas in other paradigms, which measure the influence of distraction or prepotent responses (e.g., antisaccade, Stroop), *larger* effects indicate failures to inhibit distracting or irrelevant stimuli compared to the neutral baseline. Accordingly, proponents of the inhibitory-deficit hypothesis have shown that older adults show less evidence of inhibiting the distracting or irrelevant stimuli in these paradigms compared to younger adults (Hasher et al. 2007).

A recent meta-analysis has cast doubt on inhibitory functioning as the main culprit of age differences in WM (Verhaeghen 2011). This is largely demonstrated by using Brinley plots that plot older adults' response times as a function of younger adults' response times for the aforementioned baseline and critical conditions. If increased age is associated with impaired inhibitory function, then the function relating older adults' response times to those of younger adults in the critical condition should have a higher intercept, or a steeper slope (or both), than the function for the baseline condition. However, as the meta-analysis showed, older adults' relatively slower response times in the baseline conditions were not further exacerbated in the critical conditions requiring inhibition. This result contradicts the assertion that older adults suffer from a specific deficit in inhibitory function. Furthermore, critics have questioned whether inhibition is really necessary to explain the results of the studies that purportedly support

deficient inhibition in older adults (Oberauer 2005a). As will be discussed in a later section, it is possible that intrusion errors or slower response times to irrelevant information may not reflect inhibitory failures per se, but rather poor discrimination of the proper source context of the information due to failures of binding (Oberauer 2005a).

**Coordination and Task Switching.** Another explanation of age differences in WM is the relatively diminished ability to coordinate or switch between different subcomponents of a task. Research on coordination between tasks in WM has utilized dual-task paradigms, wherein performance on a single-task condition (e.g., responding to visually presented stimuli) is compared to performance when that task is performed concurrently with an additional task (e.g., also responding to auditorily presented stimuli). A meta-analysis has indicated that the relative cost of performing the dual-task relative to the single-task is reliably larger in older adults than younger adults, although the effect is relatively small (i.e., an age difference of 36 ms) (Verhaeghen 2011).

Somewhat relatedly, the ability to switch between tasks has also been a considered source of age-related differences in WM. This ability can be tested with the task-switch paradigm, in which participants must perform one of two tasks on successively presented stimuli, with a task cue informing participants on each trial about the task to be carried out. As in the dual-task paradigm, these tasks are first performed alone (pure blocks; e.g., reporting the parity of a digit vs. reporting its magnitude relative to 5) and then together (mixed block; e.g., report the parity of the digit if the digit is red, report the magnitude if the digit is blue). Two measures of interest are assessed: the *local task-switching cost* associated with switching tasks within the mixed block (i.e., switch vs. nonswitch trials) and the *global task-switching cost* associated with the general requirement of switching (i.e., pure vs. mixed blocks). Global task-switching costs are larger for older than younger adults, whereas local task-switching costs are similar in both age groups (Verhaeghen 2011). Thus, age differences appear to be largest when participants must maintain two distinct task sets, as is required during dual-task and global task-switching paradigms.

Whereas this research demonstrates age-related differences in cognitive control as manifested by task coordination and global task-switching, correlations between measures of WM capacity and task-switching are typically low (Oberauer 2005a). If age differences in WM arise from differences in the ability to coordinate and switch between tasks, then these variables should be highly correlated, and account for similar variance in other measures of higher-order cognition. However, the aforementioned meta-analysis showed that a latent construct representing task-switching and coordination did not explain additional variance in complex cognition (representing reasoning, episodic memory, and spatial ability) over and beyond the influence of WM and processing speed (Verhaeghen 2011). Thus, age differences in these abilities likely do not reflect the differences shown in WM capacity.

**Binding.** Another potential source of age-related decline in WM concerns whether older adults are specifically impaired in their ability to establish temporary bindings between information and their contexts within a common cognitive coordinate system (Oberauer 2005a). Much of this research is guided by the premise that WM tasks require robust bindings between contents (e.g., information to remember, such as words) and their contexts (e.g., the relative positions of the words in the trial), as do other complex cognitive tasks with which WM is correlated (Oberauer 2005a). This conception of age differences in WM also corresponds to evidence from the episodic memory literature: Older adults exhibit a specific deficit in the retrieval of information on the basis of associations (Old and Naveh-Benjamin 2008) or recollection of specific details (Jacoby and Rhodes 2006), both of which presumably require some binding of that information during encoding.

Research testing the *binding-deficit hypothesis* has focused on the importance of constructing, maintaining, and dissolving temporary bindings among representations in WM and their temporal-spatial source contexts (Oberauer 2005a). The contribution of bindings in WM can be measured through short-term recognition paradigms that separate two contributions to the recognition

decision: (1) recollection, reflecting memory for which content was presented in which context, based on temporary bindings, and (2) familiarity, reflecting memory for which content was presented without memory for its context, which merely requires the activation of content representations but no bindings. The two contributions can be measured separately by recognition paradigms in which participants must decide whether the test probe has been presented in a particular context. For instance, in the local-recognition paradigm a set of words is presented across a row of boxes, and a recognition probe appears in one box, requiring a decision whether the probe matches the memory word in that box. In this paradigm there are two kinds of to-be-rejected probes: new probes, not included in the memory set, and intrusion probes, which were in the memory set but in a different box (i.e., a different context). Whereas new probes can be rejected based on their lack of familiarity alone, rejection of intrusion probes requires bindings between the words and their boxes. Older adults exhibit disproportionately larger costs for intrusion probes compared to new probes, as predicted by the assumption that their recollection is impaired by a binding deficit. In contrast, older adults were much less impaired in rejecting new probes, suggesting that their ability to use familiarity for recognition decisions is largely intact (Fandakova et al. 2014; Oberauer 2005a).

The disproportionate intrusion costs for older adults cannot be explained by an inhibitory deficit (Oberauer 2005a). Rather, the intrusion costs reflect an age-related deficit in binding information in WM. In addition to the aforementioned meta-analysis concluding that older adults do not exhibit deficient inhibitory control, these studies have further supported the notion that the source of intrusion costs commonly attributed to inhibitory failures may in fact be due to relatively deficient binding in WM. Furthermore, age-related deficiencies in building or maintaining bindings in WM connects the age differences exhibited in WM to the specific age-related impairment of retrieving associative information from episodic memory (Jacoby and Rhodes 2006; Old and Naveh-Benjamin 2008).

## Working Memory in the Aging Brain

The advent of neuroscientific techniques has also been considerably important to scientists' understanding of the underlying brain mechanisms that correspond to age-related change in WM performance. Neuroimaging techniques include positron emission tomography (PET), functional magnetic resonance imaging (fMRI), electroencephalography (EEG), and transcranial magnetic stimulation (TMS). Researchers have also been interested in the role of neurotransmitters, especially dopamine, associated with age-related changes in WM.

Much of the neuroscientific research has centered on the frontal lobe, especially the prefrontal cortex, and its interactions with other brain regions in supporting WM functioning. Among other regions, the frontal lobes are known to decline in structural integrity with increased age. Thus, researchers have been interested in whether these structural changes correspond to functional decline in WM capacity with older age (Daselaar and Cabeza 2014; Nagel and Lindenberger 2014; Nyberg et al. 2012; Reuter-Lorenz and Cappell 2008). Much of this research has been guided by examinations of how neural activity differs between younger and older adults on WM tasks, especially as the tasks increase in attentional demand or WM load. There are a number of studies indicating underactivation of task-relevant neural regions in the prefrontal cortex in older adults, whereas other studies have suggested overactivation relative to younger adults (Daselaar and Cabeza 2014; Nagel and Lindenberger 2014; Nyberg et al. 2012; Reuter-Lorenz and Cappell 2008). Underactivation occurs when older adults activate a brain region to a lesser extent than younger adults, whereas overactivation often manifests as bilateral activation of the prefrontal cortex, or activation of the mirror area in the opposite hemisphere in older adults that is unilaterally active in younger adults (i.e., Hemispheric Asymmetry Reduction in Older Adults, or HAROLD (Daselaar and Cabeza 2014)). Both patterns can occur in the same task, especially when WM load is varied: Whereas younger adults show increasing activity with increasing load, older adults show overactivation under low WM loads and underactivation at higher loads relative to younger

adults. Underactivation is typically interpreted as an age-related functional deficiency in the processes that rely on the particular neural substrate. The interpretation of overactivation in the HAROLD pattern, however, is less clear than underactivation, primarily due to conflicting results regarding the performance associated with this activity.

Some studies have shown that overactivity is correlated with higher performance in older adults, indicating that the recruitment of additional brain regions may serve a compensatory role in WM and other cognitive functions (Daselaar and Cabeza 2014; Reuter-Lorenz and Cappell 2008). These studies are commensurate with the compensation-related utilization of neural circuits (CRUNCH) hypothesis (Reuter-Lorenz and Cappell 2008). Specifically, in order to meet task demands, older adults recruit more neural circuits than younger adults to compensate for declining neural efficiency. However, older adults appear to reach their maximal capacity of compensatory function at low WM loads, and therefore show underactivation during high loads relative to younger adults. The pattern of overactivation has been linked to successful aging in that older adults who more strongly show overactivation are more likely to exhibit greater WM performance relative to those who do not (Daselaar and Cabeza 2014; Reuter-Lorenz and Cappell 2008). However, others have interpreted the HAROLD pattern as dysfunctional; that is, older adults with preserved WM should be more similar to younger adults in terms of patterns of brain activity (Nagel and Lindenberger 2014; Nyberg et al. 2012). Overactivation may rather be more indicative of increased effort, and those who are successfully aging would not need to recruit additional neural regions if their performance was comparable to that of younger adults. Accordingly, some studies have shown that the older adults with the highest WM capacities had more similar patterns of activation in the prefrontal cortex to younger adults than low performers (Nagel and Lindenberger 2014; Nyberg et al. 2012). Moreover, increasing prefrontal activity was related to increasing WM recall accuracy in younger and older adults when an index of responsivity was considered

(i.e., subtracting the signal change in the lowest from that of the highest load). Thus, the causative role of overactivity in regions of the prefrontal cortex in older adults' behavioral WM performance is presently to be determined.

Other research has indicated that WM age differences are not solely localized to the prefrontal cortex. In addition to its interaction with the parietal cortex, the circuitry between the prefrontal cortex and the medial temporal lobe has more recently received much attention. Activity in the medial temporal lobe is more traditionally linked to episodic memory. However, more recent research has suggested that the medial temporal lobe is additionally important during visual-spatial WM tasks, particularly when the tasks involve binding between spatial/pictorial elements of the memoranda (Daselaar and Cabeza 2014). These studies indicated greater age-related underactivation of the hippocampus when the WM tasks explicitly required binding (e.g., an object in its location) relative to maintenance of item-specific information (e.g., just the object or just its location) (Daselaar and Cabeza 2014). Such studies converge with the previously described behavioral studies showing that the age differences in WM may be attributable to older adults' relative inability to bind information in WM (Fandakova et al. 2014; Oberauer 2005a).

Finally, a number of studies have also investigated the functional role of dopamine (DA) activity in the age-related decline in WM. There is much evidence that both presynaptic (i.e., the DA transporter) and postsynaptic markers (i.e., D1 and D2 receptors) deteriorate with increasing age (Nyberg et al. 2012). Among other cognitive functions, age-related decline in D1 receptor binding potential in the caudate nucleus and the prefrontal cortex have been associated with underactivation of fronto-parietal regions and corresponding reduced performance in older adults during WM tasks (Nyberg et al. 2012). Specifically, statistically controlling for D1 binding in the caudate and prefrontal cortex fully mediated the age-related underactivation in the left prefrontal cortex and partially mediated the age-related underactivation in the right prefrontal and left parietal regions (Nyberg et al. 2012). Moreover,

simulating older adults' DA activity in young adults by allocating a D1 antagonist induced increased frontal bilateral connectivity in younger adults that significantly predicted WM performance (Nyberg et al. 2012), supporting a compensatory view of the previously described HAROLD pattern exhibited by older adults (Daselaar and Cabeza 2014; Reuter-Lorenz and Cappell 2008).

## Training Working Memory

An increasingly important topic in the cognitive aging literature is whether the effects of age-related cognitive decline can be circumvented by training older adults on these cognitive functions, especially WM. Given its aforementioned importance for a wide range of higher-order cognition, many researchers have focused on WM as an access point to generalizing the benefits of increased WM capacity. If WM accounts for substantial age-related variability in other factors (e.g., fluid intelligence), then perhaps training WM could improve older adults' performance in these other cognitive functions (i.e., *far transfer effects*). However, it may also be that the effects of training are only specific to the trained task (i.e., *trained task effects*) or, at best, other measures of WM capacity (i.e., *near transfer effects*). Finding that WM training does not improve broader cognitive functions would undermine the practical utility of training WM in older adults.

Although rising in popularity, the question of whether older adults' WM capacity can be improved and can show generalizable benefits to other forms of cognition is still not settled. Theoretically speaking, it is not clear which aspects of WM that training actually improves, and further still, how improvements to those aspects bring about improvements in other far transfer tasks. Further complicating matters, assessments of the effectiveness of WM training vary substantially across studies, with some showing massive near and far transfer effects after only several sessions whereas others only indicate improvements to the trained task, but no transfer, even after extensive training. This complication is compounded when one considers the bias toward publishing

statistically significant rather than null results, thereby increasing the visibility of training-related gains in the literature that may in actuality overestimate the true effectiveness of training.

A recent meta-analysis of 61 training experiments with older adults who received WM training (Karbach and Verhaeghen 2014) showed significant improvements to performance (i.e., pre- vs. post-test) on the trained tasks (effect size = 0.91), near transfer tasks (effect size = 0.47, corrected for publication bias), and far transfer tasks (effect size = 0.38). Moreover, these improvements were similar to those shown in younger adults and reliably larger than the improvements shown in the active and passive control groups, who generally showed statistically indistinguishable effects. Thus, although the improvements of training WM were largest for the trained tasks, there was still a modest improvement even in tasks representing other cognitive functions (e.g., fluid intelligence, episodic memory).

## Conclusions

Although the book is far from closed as to what underlies the age differences exhibited in WM capacity and the construct's importance for other age-related cognition, the field has made important strides toward this goal. A bird's-eye view of the literature taken through meta-analyses helps to identify sources of age-related variability that are correlated with WM capacity, most notably processing speed, and others that are uncorrelated with WM capacity (e.g., task switching). Moreover, age-related declines in inhibitory functions do not go beyond declines in general speed. Together, these findings rule out the task-switching/coordination hypothesis and the inhibition-deficit hypothesis of age-related declines of WM capacity. The speed hypothesis provides at best an incomplete explanation because age-related slowing accounts at best for a part of the age-related decline in WM capacity. A deficit in maintaining temporary bindings is likely to be one factor responsible for that decline. Neuroscience research has shown that older adults recruit WM-related neural networks less effectively

when WM is challenged by a high load; at the same time, older adults recruit a larger network at lower levels of load, perhaps to compensate for reduced neural efficiency. Reduced sensitivity to dopamine appears to be one factor responsible for the deterioration of neural efficiency in the WM system. Training studies have yielded promising results showing that performance in WM tests can be improved in old adults as much as in young adults, but it remains an open question how far these training gains transfer to performance in other tasks. These findings collectively demonstrate the importance of understanding age-related changes in WM capacity, especially as they relate to those of other areas in complex cognition.

## Cross-References

- ▶ [Age-Related Slowing in Response Times, Causes and Consequences](#)
- ▶ [Aging and Attention](#)
- ▶ [Aging and Inhibition](#)
- ▶ [Cognition](#)
- ▶ [Cognitive Control and Self-regulation](#)
- ▶ [History of Cognitive Aging Research](#)
- ▶ [History of Cognitive Slowing Theory and Research](#)
- ▶ [Individual Differences in Adult Cognition and Cognitive Development](#)
- ▶ [Memory, Episodic](#)
- ▶ [Process and Systems Views of Aging and Memory](#)

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## Workplace Creativity, Innovation, and Age

Eric F. Rietzschel<sup>1</sup> and Hannes Zacher<sup>2</sup>

<sup>1</sup>University of Groningen, Groningen, The Netherlands

<sup>2</sup>Department of Psychology, University of Groningen, Groningen, The Netherlands

### Synonyms

Adaptation; Change; Invention; Originality

### Definition

Creativity is the generation of ideas that are both novel and appropriate. Innovation is the subsequent intentional implementation of those ideas.

While work performance is a complex and multifaceted construct (Viswevaran 2001), one of the most coveted and elusive dimensions of work performance is creative and innovative performance. Organizations look for ways to stimulate (or at least not hinder) their employees' creative and innovative performance, because this will – it is believed – contribute to individual, team, and organizational success (Gilson 2008). Since the workforce is aging and will continue to do so over the next decades, organizations need to know what ramifications – if any – this demographic change will have for their

innovative potential. The goal of this entry, therefore, is to examine relationships between employee age and workplace creativity and innovation.

## Overview of This Entry

This entry consists of four main parts. First, the concepts of creativity and innovation are defined. Second, the entry briefly discusses the common belief that older employees are less creative and innovative, followed by a summary of the actual empirical state of affairs regarding direct, zero-order relationships between age and creativity and innovation. Third, our entry takes a closer look at two broad themes within the literature on creativity and innovation (motivation and group creativity) and describes some ways in which aging and age-related processes might fit within these perspectives. Finally, an important direction for future research is pointed out.

## Defining Creativity and Innovation

*Creativity* is commonly defined as the generation of ideas that are both novel (i.e., original or surprising) and appropriate (i.e., useful or feasible within a particular context) (Amabile 1996). Thus, employees show creative performance to the extent that they generate and contribute (e.g., to their team or organization) original and useful ideas. Then again, ideas by themselves are not enough; what organizations aim for, in the end, is *innovation*, which has been defined as “the intentional introduction and application within a job, work team or organization of ideas, processes, products or procedures which are new to that job, work team or organization and which are designed to benefit the job, the work team or the organization” (West and Farr 1990). In sum, creativity is about the generation and contribution of new and useful ideas, whereas innovation entails the actual implementation of those ideas. Creativity, then, is a necessary but insufficient condition for innovation to occur (West 2002).

## Are Older Employees Less Creative and Innovative?

There is a pervasive belief that older employees are less creative and innovative than their younger colleagues. Older employees are also often believed to be less flexible, less open to change, and less motivated (e.g., Ng and Feldman 2012; Sherrington 1992). The general picture that emerges does not bode well for older employees. Indeed, it cannot be disputed that aging does bring about changes in cognitive, affective, and physical functioning and motivation (e.g., Salthouse 2012) and that some of these changes might plausibly be related to lower creativity. For example, measures of fluid cognitive abilities, such as novel problem-solving, show a clear and substantial linear age-related decline (Salthouse 2012). Given that the ability to solve new problems is crucial for creativity, it may seem plausible that this would translate into lower creativity and innovation among older employees. Moreover, it could be argued that negative age-related stereotypes have a detrimental effect on older employees' creative and innovative performance because they undermine relevant self-efficacy beliefs. Interestingly, however, a generally negative relation between age and creative or innovative performance is not what emerges from the empirical literature.

Although empirical work on age and work has increased enormously in the past decade (e.g., Hertel and Zacher 2016), to date there have been relatively few studies that actually focus on age and creativity and innovative performance in work settings, despite calls for such studies (Sherrington 1992). Nevertheless, several studies have measured age as a predictor or, in most cases, as a covariate, and other studies on age in the work context have measured creativity or innovation as relevant aspects of work performance, which made meta-analytical work possible. A first meta-analysis on studies addressing the relationship of age to several dimensions of job performance, including creativity, found that age had zero relationships with self- and supervisor ratings of creativity (Ng and Feldman 2008). A second meta-analysis by the same authors examined bivariate relationships between age

and innovation-related behavior, such as idea generation (i.e., creativity), idea dissemination (the “selling” of ideas to stakeholders), and idea implementation (Ng and Feldman 2013). Results again showed that age was largely unrelated to innovation-related behaviors (neither linear nor nonlinear associations emerged).

These meta-analytical findings, which are mainly based on cross-sectional data, should not lead to the conclusion that employee age and aging are completely irrelevant to creativity and innovation. Although very few primary studies have actually *focused* on age and creativity, those that have suggest that the relationship between age and creativity/innovation is not a simple, zero-order relationship, but is moderated by other individual and contextual factors, such as individual differences in personality, job-related resources, and contextual characteristics. For instance, a study found that the relationship between employee age and creativity was positive when job autonomy was high (Binnewies et al. 2008).

Empirical studies such as those reviewed above are still relatively scarce, but it seems clear that an understanding of the relation between aging and creativity/innovation will require a more sophisticated approach than merely studying direct or zero-order relationships. One particularly fruitful strategy for aging research would be to focus on specific topics or domains within the creativity and innovation literatures, because these might suggest concrete moderating and mediating variables of the age-creativity/innovation relationships. The following section addresses two themes that seem particularly promising: motivation and group creativity.

## Motivation and Need Fulfillment

One of the most important and fruitful lines of (basic) research on creativity and innovation concerns the role of motivation. Broadly speaking, the consensus is that *intrinsic motivation*, or the motivation to engage in an activity for its own sake, because one enjoys it, is important and beneficial for creative performance (Amabile 1996).

In contrast, the role of *extrinsic motivation*, or the motivation to engage in an activity to attain or avoid a particular outcome (such as a reward or a punishment), is more complex: it can both stimulate and stifle creativity (Byron and Khazanchi 2012). Overall, the literature shows that contextual factors (such as rewards) that make employees feel *controlled* (i.e., less autonomous) are likely to stifle creativity through a decrease in intrinsic motivation.

In this line of research, work environments are thought to be conducive to intrinsic motivation (and hence creativity) to the extent that they contribute to (vs. thwart) the fulfillment of employees’ psychological needs (such as the need for autonomy or the need for competence). External motivators such as rewards can easily detract from intrinsic motivation, because they can cause employees to attribute their efforts primarily to the reward, rather than to their own task interest, and hence threaten need fulfillment regarding autonomy (Amabile 1996). Rewards are not necessarily controlling, however; when rewards are made contingent upon creative performance, they can actually stimulate creativity (Byron and Khazanchi 2012).

Such motivational issues probably are particularly important for older employees, because research suggests that older employees are not necessarily motivated by the same things as younger employees, due to, for instance, age-related changes in time horizons and experiences. For example, older employees tend to attach less weight to financial rewards and more to the sense of satisfaction they can derive from the work itself and to job characteristics such as autonomy (Kooij et al. 2011). In other words, the classic finding that creativity is stimulated by intrinsic motivation and likely to be hindered by controlling circumstances would appear to hold particularly strongly for older employees. Thus, organizations that wish to stimulate creativity among their older employees should pay even closer attention to job characteristics such as autonomy. Initial empirical support for this notion comes from a study reported in Binnewies et al. (2008), which found that the relationship between age and creativity at work was positive only when job autonomy was high.

Moreover, to the extent that extrinsic motivators such as financial incentives can motivate employees to perform creatively (Byron and Khazanchi 2012), this will probably be less effective for those employees who find such rewards relatively unimportant, such as older employees. Further, Kooij et al. (2011) found that age was negatively related to self-reported extrinsic motives (e.g., benefits and promotions) and work-related growth motives (e.g., training or learning opportunities). In contrast, age was positively related to work-related intrinsic motives (e.g., a sense of accomplishment and autonomy). All in all, it seems that older employees simply are not motivated or demotivated by the same factors as their younger colleagues. Thus, motivational effects on creativity and innovation are highly likely to depend on employee age – and, by extension, the same is likely to be true for the effects of contextual factors that influence employee motivation.

### Team Creativity and Age Diversity

Another line of research has looked into the benefits and risks of team or group collaboration in creative efforts and the factors determining the success or failure of such collective endeavors (see Paulus and Nijstad 2003 for a collection of overviews). One reason why group collaboration is thought to enhance creativity and innovation is because of the potential for cognitive stimulation: group or team members have different knowledge, experiences, and opinions, and this could – in theory – stimulate divergent processing and creative decision-making.

In fact, research on group creativity and group decision-making shows that groups tend to perform below their potential and often fail to make effective use of the divergent expertise and perspectives that are available (Paulus and Nijstad 2003). Demographic or surface diversity in particular seems to be problematic for groups; it has been found to relate to subgroup formation, within-group conflict, superficial information processing/exchange, and lower creative performance (Paulus and Nijstad 2003).

Other researchers, however, point to the possible advantages that come along with having a team comprised of members from diverse age groups. For example, when team members differ from each other in age and age-related characteristics, they are likely to also have different networks of communication outside the team (Joshi and Jackson 2003), which in turn could stimulate team innovation. Further, in addition to their unique expertise and experience, older team members may have more time to help and mentor their younger colleagues (Wegge et al. 2008). Moreover, when a workgroup consists of employees of the same age, these may in effect be competing for the same resources (such as promotion opportunities). The presence of older team members who are not (or no longer) competing for these scarce resources may contribute to a more positive atmosphere and enhanced creativity within the team (Choi 2007).

Thus, like other forms of team diversity, age diversity is a double-edged sword, presenting both opportunities and threats for team creativity and innovation. Further, it seems that, overall, these opportunities and threats may cancel each other out: in a meta-analysis of research on demographic diversity and team performance, Bell et al. (2011) found no relation between age diversity and team performance (although no specific results were reported on the relation between age diversity and creativity or innovation). Thus, the question once again does not seem to be whether age diversity is a good thing or not, but rather *under which circumstances* it contributes to team creativity and innovation or not. In other words, what might be relevant moderators of the relations between age diversity and team creativity/innovation? A particularly important moderator seems to lie in the way age/aging and age diversity themselves are viewed within the team, something we already alluded to above. In the following, this issue is addressed in some more detail.

### Age Stereotypes and Diversity Beliefs

Research on age stereotypes suggests that employees have specific expectations of their older colleagues. As discussed above, older

employees are commonly seen as less creative and innovative. Such stereotypes are potentially problematic, because they can become self-fulfilling prophecies and threats to the self-concept that impact on employees' actual performance. This could take place through mechanisms on the individual level and the team level.

**Individual Level: Stereotype Threat.** At the individual level, older employees may experience so-called *stereotype threats* which could undermine their creative and innovative behavior in the workplace (Walton et al. 2015). Stereotype threat has been defined as the concern of confirming or being reduced to a negative stereotype about one's social group (Steele and Aronson 1995). It is particularly likely to occur on difficult and nonroutine tasks and has been found to cause people to underperform on a variety of tasks and tests, including organization-relevant behaviors such as learning, feedback seeking, interpersonal behavior, and task performance (Walton et al. 2015).

Several subtle or not-so-subtle cues in the work environment could give rise to stereotype threat, for example, when ideas expressed by older employees are responded to differently, when older employees are underrepresented in organizations or in project teams working on innovation projects, or when the organization implicitly equates "innovative" with "young" or "a new generation." Sometimes such cues are not easy to remedy immediately; for example, if an organization has neglected to hire an age-diverse workforce, older employees will for some time be confronted with the cue that age diversity is not valued, even if the organization aims to remedy this by changing its hiring policies (Walton et al. 2015). In such situations, what might be important is for the organization or team to emphasize the value it places on age diversity, in other words, by stressing certain *diversity beliefs*.

**Team Level: Diversity Beliefs.** At the group or team level, negative age stereotypes are incompatible with the positive diversity beliefs that are necessary to make effective use of diversity (e.g., Homan et al. 2010). Thus, workgroups and teams where people hold the stereotypical belief that older employees have little to offer in the way of

creativity and innovation will be less likely to consider age diversity an asset and hence will be less likely to reap any potential associated benefits. For example, such groups might be less likely to seriously consider ideas put forward by older employees or even to discourage these employees from participating in the creative process. Given that the potential for cognitive stimulation stemming from a diverse knowledge base is one of the reasons for using teams and workgroups in the first place, it should be clear that this is something to avoid. As discussed above, one of the main stumbling blocks in group's effective use of diversity lies in social categorization and the formation of subgroups (Paulus and Nijstad 2003; Homan et al. 2010). Groups that hold positive diversity beliefs, however, appear to view diversity not so much in terms of subgroups, but rather in terms of individual differences – implying that the group is composed of unique individuals who may each have something worthwhile to offer (Homan et al. 2010), which in turn is likely to enhance group creativity.

## Future Research

As noted above, as well as by other researchers, more research on age and creativity/innovation is needed. The two sections above illustrate how a more fine-grained approach, focusing on specific creativity/innovation-relevant phenomena or processes, may yield more informative empirical results (or more fine-grained hypotheses) and may help link the budding field of age and creativity/innovation to existing theories from social and organizational psychology. One topic that has already been alluded to above, and that has been neglected for a long time, is the relation between creativity, or the generation of ideas, and innovation, or the implementation of these ideas.

**Idea Implementation.** Although creativity is, of course, a necessary condition for innovation, research shows that it is by no means sufficient and that reaping the benefits of creative ideas is a unique challenge in itself (West and Farr 1990; Anderson et al. 2014). Little empirical research thus far has addressed the factors that contribute to

successful idea implementation, although individual characteristics, such as networking abilities, and team process characteristics, such as team climate, have been found to play a role. One question that is sometimes raised is whether the more extensive experience and domain knowledge of older employees might not put them in a better position when it comes to successfully “selling” and implementing their ideas. Again, there is very little data on this, but an important exception can be found in *historiometric* creativity research, which has led Simonton (1997) to formulate the *equal odds rule*.

Basically, according to this rule, the relation between the total number of works produced in a given period (e.g., a career) and the number of “hits” (i.e., highly successful products, which would include successful innovation attempts) tends to be linear and stable. One implication of this (empirically derived) rule is that individuals do not seem to necessarily get better at realizing implementation or adoption of their creative ideas; instead, what seems to matter (over time) is total productivity. Although historiometric research suggests that productivity shows an inverted U-shaped pattern across careers or life spans, the meta-analytical results described above suggest that it is far from clear that such a pattern will always hold (although most of the research included in those meta-analyses is cross-sectional and/or limited in age range). All in all, only very little is known about the relation between creativity and innovation, let alone the possible moderating role of age.

## Conclusion

In this entry, the relationship between employee age and creative and innovative performance at work was discussed. While meta-analytical work suggests that, overall, younger and older employees do not differ with regard to creativity and innovation, primary empirical studies suggest that the relationships are more complex and influenced by various individual and contextual moderators. It was argued that individual motivation (i.e., intrinsic needs) and team-level

characteristics (e.g., climate for aging at work) may play a particularly important role in shaping the creative and innovative performance of older employees or teams with older employees. This does not mean that there are no other relevant factors or processes, rather the opposite. This review has inevitably been limited and selective. What is clear, however, is that the role of age in creativity and innovation at work has, thus far, received far too little attention. This is also witnessed by the fact that primary studies do not routinely report even zero-order correlations between age and creative or innovative behavior (which makes meta-analytical work unnecessarily difficult and limited). Given the existence of negative age stereotypes, the strong evidence that such stereotypes may have devastating effects on employee well-being and (creative) performance, and the fact that meta-analytical and primary empirical work fails to yield strong support for these stereotypes (if not the opposite), it is high time to remedy this.

## Cross-References

- ▶ [Age Stereotypes in the Workplace](#)
- ▶ [Age-Related Changes in Abilities](#)
- ▶ [Entrepreneurship and Aging](#)
- ▶ [Job Crafting in Aging Employees](#)
- ▶ [Technology and Older Workers](#)
- ▶ [Training at Work and Aging](#)

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## Workplace Mentoring, Role of Age

Friederike Doerwald, Susanne Scheibe and  
Nico W. Van Yperen  
Department of Psychology, University of  
Groningen, Groningen, The Netherlands

### Synonyms

Developmental relationships in the workplace;  
Intergenerational contact; Learning and social  
support at work

### Definition

Workplace mentoring occurs when a member of an organization with advanced experience and knowledge (the mentor), either as part of a formal mentoring program or informally, supports the psychosocial and career development of a less experienced member (the protégé).

## Background

As the number of older workers is rising in industrialized countries and a great proportion of experienced workers is approaching retirement, two issues become increasingly important for organizational success: (1) to recognize and utilize older workers' potentials and (2) to retain older workers while keeping them engaged (Calo 2005). One effective organizational practice that can capitalize on older workers' knowledge and keep them motivated is workplace mentoring. Workplace mentoring occurs when a member of an organization with advanced experience and knowledge (the mentor), either as part of a formal mentoring program or informally, supports the psychosocial and career development of a less experienced member (the protégé; Kram 1985). Usually, this means that an older employee serves the role of a mentor for a younger employee (Finkelstein et al. 2003), but the reverse age constellation is also possible in cases where a younger employee is more experienced in a certain work domain than an older employee (Murphy 2012).

In general, mentors provide two types of support, namely, career and psychosocial support (Kram 1985). Career support focuses on the protégé's career advancement and involves behaviors such as enhancing the protégé's visibility, sponsorship, and providing assignments that are challenging for the protégé. Psychosocial support focuses on the personal development of the protégé including a higher sense of competence and self-esteem and involves behaviors such as counseling or role modeling. Another important distinction in mentoring is between informal and formal mentoring relationships. While informal mentoring relationships evolve naturally in organizations, formal relationships are initiated by the organization such that the organization matches mentor and protégé.

## Benefits of Mentoring

Mentoring, and informal mentoring in particular, has been associated with numerous benefits for mentors, protégés, and organizations (Tong and

Kram 2013). The somewhat smaller benefits derived from formal relative to informal mentoring have been attributed to the stronger focus on career-related support than psychosocial support in formal mentoring programs and the potential lack of mutual identification as these relationships do not develop naturally (Ragins et al. 2000). Despite the difference in the magnitude of gains depending on type of mentoring, a considerable amount of research has documented benefits of both forms of mentoring.

Regarding *protégé benefits*, cross-sectional research has found positive relationships between receiving mentoring and protégé's job performance, salary, and promotion for both formal and informal mentoring (for a review, see Allen et al. 2004). Moreover, receiving mentoring has been associated with higher levels of job and career satisfaction (for a review, see Tong and Kram 2013). There is also some longitudinal evidence for the gains of mentoring for protégés. Specifically, receiving career-related support has been positively associated with affective well-being and organizational commitment at the end of a 7-month formal mentoring program, controlling for initial levels in both variables (Chun et al. 2012).

Regarding *mentor benefits*, a meta-analysis of cross-sectional studies on formal and informal mentoring indicates that providing mentoring can be beneficial for mentors' perceived career success, their organizational commitment, and job performance (Ghosh and Reio 2013). Moreover, cross-sectional research has found that proximal benefits of mentoring such as a sense of fulfillment for mentors predict more global work-related outcomes such as job satisfaction, organizational commitment, and the willingness to serve as a mentor in the future. Interestingly, proximal instrumental benefits for mentors such as increased recognition appear to be particularly important for mentor's job satisfaction, whereas relational benefits such as personal gratification might be more influential for intentions to become a mentor again (Eby et al. 2006). Noteworthy, proximal benefits for mentors appear to be unrelated to some more objective post-mentoring career outcomes such as salary and promotion

(for a review, see Tong and Kram 2013). A likely reason is that these career outcomes are influenced by many factors beyond mentoring, such as general job performance or position.

Regarding *organizational benefits*, cross-sectional research has shown that mentoring is associated with decreased turnover rates, increased performance, and organizational learning, though quantitative studies are scarce (Tong and Kram 2013). So far, there are no empirical studies that investigate the long-term benefits for organizations. However, since studies have generally shown that job satisfaction, affective well-being, and organizational commitment positively predict job performance, it is likely that organizations profit as well from the long-term benefits of mentoring.

### Negative Consequences of Mentoring

Despite the well-documented benefits of mentoring, mentoring relationships do not guarantee success and may even have harmful consequences (Tong and Kram 2013). Although the prevalence of negative mentoring experiences has been assumed to be rather low, they nevertheless occur according to researchers and practitioners and often have adverse effects (Eby and McManus 2004). A growing body of literature has therefore made an effort to identify common reasons why mentoring relationships may become dysfunctional. More specifically, studies have revealed that negative mentoring experiences are frequently due to the mentor's deficits in the required mentoring skills, the protégé's egocentrism or exploitative behavior, and, more generally, dysfunctional relationship dynamics between mentor and protégé (Tong and Kram 2013).

The consequences of these negative mentoring experiences compared to positive experiences for protégés include decreased job satisfaction and higher turnover intentions. While less is known about the negative effects for mentors, the available research has found that mentors who had dysfunctional relationships with their protégés had decreased intentions to become a mentor in the future (for a review, see Tong and Kram 2013).

Given the potential of mentoring to have negative effects on protégés and mentors, it is crucial to determine factors that predict who is suited to become an effective mentor. Moreover, it is important to identify characteristics of the protégé and the dyad that contribute to mentoring success, such as the protégé's personality or the fit between mentor and protégé regarding their personality. One important individual difference variable that is likely to affect mentoring effectiveness is *age*, as a characteristic of the mentor, the protégé, or in terms of the age composition of the dyad.

### The Role of Age in Mentoring

To date, research systematically examining the role of age in mentoring is limited and studies have yielded mixed results. In the following, dyads composed of an older mentor and a younger protégé and dyads composed of a younger mentor and an older protégé will be compared. Subsequently, zooming in on age of each party of the dyad, literature on the role of mentors' and protégés' absolute age for mentoring will be discussed.

#### Age Composition of the Mentoring Dyad

Traditionally, mentoring involves an older employee supporting a younger employee. However, this relationship can also reverse such that a younger employee with more experience in a certain work domain provides mentoring to an older employee with less experience in that domain (*reverse mentoring*; Finkelstein et al. 2003). Both traditional mentoring and reverse mentoring involve career support, encompassing, for example, knowledge sharing or networking, and psychosocial support, encompassing friendship or stimulating personal development. Noteworthy, it has been assumed that reverse mentoring is best initiated through formal mentoring programs, since informal mentoring relationships rarely develop between younger mentors and older protégés (Murphy 2012).

Traditional and reverse mentoring relationships are thought to be associated with unique benefits. Specifically, traditional mentoring has

the potential to fulfill *generativity motives* that become more salient with age (Parise and Forret 2008). The concept of generativity was first introduced by the developmental psychologist Erik Erikson (1963) and refers to establishing and guiding the next generation. Generativity motivation has predominantly been associated with middle age, falling into the second half of the working lifespan (i.e., 40–65 years; Erikson 1963). Organizational psychology research has demonstrated that age is associated with an increase in generative work motives across the working lifespan (for a meta-analysis, see Kooij et al. 2011). Scholars have suggested that mentoring represents an excellent way to express generativity at work (Parise and Forret 2008). Specifically, by mentoring co-workers, the mentor can meaningfully contribute to the protégé's development and thereby provide guidance to someone from the next generation.

Giving older workers mentoring opportunities, which allow fulfilling their generativity motives through mentoring, could also be an effective retention strategy as it addresses age-related changes in motivation. Specifically, work motivation tends to become more intrinsic with age and older workers' work motivation appears to be more strongly affected by a sense of meaningfulness and fulfillment gained from work than that of young workers (Kooij et al. 2011). Being a mentor may add meaning to older workers' work by addressing age-related increases in generativity motivation and thereby fostering older workers' motivation to continue working.

Reverse mentoring also likely has unique benefits although empirical research on reverse mentoring is absent to date. While reverse mentoring has initially been introduced to transfer technological knowledge from the younger generation to older workers (Murphy 2012), the benefits are thought to go beyond novel skill acquisition. Specifically, reverse mentoring may eliminate negative stereotypes that generations hold about each other (Murphy 2012) and enhance sensitivity for workplace diversity (Chaudhuri and Ghosh 2012). Furthermore, theoretical work suggests that younger mentors perceive the special opportunity to mentor senior

colleagues as a sign of recognition and organizational support, increasing their organizational commitment (Chaudhuri and Ghosh 2012). Older protégés, in turn, perceive the opportunity for learning and development, which they often lack, as a sign of organizational support, increasing their work engagement.

At the same time, reverse mentoring may also have unique threats. Specifically, reverse mentoring is in stark contrast to age norms in mentoring, in which an older worker offers mentoring to a younger co-worker (Chaudhuri and Ghosh 2012). Violating these norms might be perceived as threatening, impeding the mentoring process. However, it is yet unclear where the age cutoff lies, thus, when the age distance between a younger mentor and older protégé violates norms and has adverse consequence for mentoring effectiveness.

### **Absolute Age of the Mentor**

Regardless of whether traditional or reversed mentoring relationships are concerned, mentor's age likely affects mentoring outcomes. Among the mentor characteristics that have been associated with effective mentoring relationships are emotional abilities, which are subject to age-related increases. *Emotional abilities* refer to the capacity to handle one's own as well as others' emotions effectively. Specifically, research has identified three core emotional abilities: emotion regulation, emotion understanding, and emotion perception (Joseph and Newman 2010). *Emotion perception* pertains to the ability to correctly identify one's own and other people's emotions, while *emotion understanding* refers to insight into the development of emotions, the ability to differentiate between them and to identify appropriate emotions for a specific context. *Emotion regulation* encompasses cognitive or behavioral strategies used to influence the way emotions are experienced and expressed.

Together, these abilities are particularly important for mentors, as they help establish a trustful relationship with protégés (Chun et al. 2010) and represent important job skills that mentors can pass on to their protégés through role modeling (Cherniss 2007). Emotion perception might be

crucial for the mentor to identify the protégé's difficulties and react appropriately. Emotion understanding should be a critical skill for mentors to help the protégé gain insight and select effective coping strategies. Emotion regulation should help the mentor to establish a trustful relationship through authenticity, consistency, and reliability in emotional displays. Moreover, mentors may teach their protégés how to regulate their emotions effectively in critical work situations.

Interestingly, mounting evidence suggests age-related improvements in two of the three emotional abilities and maintenance in the other (for a review, see Walter and Scheibe 2013). These improvements are attributed to accumulating knowledge in dealing with affective events throughout life. Regarding emotion perception, evidence has been mixed but recently has pointed to minimal age differences. Older adults have further been found to have an enhanced emotional understanding relative to younger adults (Kafetsios 2004). They use adaptive emotion regulation strategies (e.g., reappraisal, deep acting) more often and maladaptive strategies (e.g., suppression, surface acting) less often and are also better at implementing many emotion regulation strategies (Scheibe and Carstensen 2010). These overall improvements in core emotional abilities may make older adults well suited for mentoring roles.

Another mentor characteristic, which is thought to be associated with effective mentoring relationships in traditional mentoring dyads (older mentor, younger protégé) and increases with age, is mentors' generativity motivation, as discussed above. Generativity motivation should facilitate mentoring effectiveness by leading mentors to invest their time and energy in mentoring relationships and at the same time increase protégé trust in the mentor. Though studies on generativity and mentoring are scarce, the available research has found that generativity is beneficial for mentoring such that generativity is positively associated with mentors' number of protégés and mentors' perceived effectiveness of mentoring training in a formal mentoring program (Parise and Forret 2008).

### **Absolute Age of the Protégé**

Cutting across both traditional and reverse mentoring relationships, some empirical research has examined relations of protégé's age to characteristics of the mentoring relationship and associated outcomes. For example, protégé age has been found to be negatively related to the duration of the mentoring relationship and positively to mentors' hierarchical level in the organization (Finkelstein et al. 2003). This suggests that older protégés in both formal and informal mentoring relationships have more short-lived mentoring relationships and are closer to the mentor's hierarchical level. Moreover, age of protégé is positively related with informal mentoring relationships, such that older protégés were more often part of informal mentoring relationships, whereas younger protégés were more often part of formal mentoring relationships (Finkelstein et al. 2003). Furthermore, while some studies have found that protégé age is unrelated to the type of mentoring support received, there is some evidence that older protégés, compared to younger protégés, receive less career-related mentoring, but experience higher levels of mutual learning and relationship quality in formal and informal mentoring relationships (Finkelstein et al. 2003).

One important characteristic of protégés are their emotional abilities, which tend to increase with age, as discussed above. Specifically, protégés' emotional abilities are predictive of trust in the mentor, which is an essential ingredient of a good mentoring relationship (Chun et al. 2010). Moreover, protégés' high emotional abilities can compensate for possible low emotional abilities of the mentor. As older adults overall tend to have higher emotional abilities compared to younger, this might be particularly relevant in the context of reverse mentoring. That is, older protégés' emotional abilities may buffer against low emotional abilities of the younger mentor.

### **Future Directions**

Evidence on the influence of age on mentoring processes and outcomes is only recently beginning to emerge. Future research should examine

additional age-related variables that may play a role in the mentoring process. In addition, the available research has some methodological limitations. In the following, a number of promising avenues for future research will be suggested.

### Considering Age-Related Variables

To date, previous research has only investigated linkages between age and mentoring, largely ignoring potential mediators. As discussed, emotional abilities and generativity might be two potentially important mediators to consider. A large body of research has demonstrated age-related improvements in emotional abilities (Walter and Scheibe 2013), and the relevance of these abilities of mentors for mentoring has been acknowledged (Chun et al. 2010). However, it remains to be tested whether emotional abilities mediate relationships between mentor's age and mentoring outcomes. Moreover, future studies should explore the dyadic composition of age, emotional abilities, and mentoring outcomes such as relationship quality, in more depth. Taken together, studies should combine research on age and emotional abilities with mentoring to gain a better understanding of the role of emotional abilities in the age-mentoring effectiveness link for both mentor and protégé. This might also shed light on the general mechanisms underlying effective mentoring processes.

Similarly, although scholars have highlighted that mentoring is an expression of generativity (Calo 2005), the generativity motivation of mentors as predictor of mentoring benefits has not yet received attention in the literature. Generativity may not only make older workers well suited for providing effective mentoring by leading them to invest their time and energy in mentoring relationships, it may also enhance their work motivation. More specifically, by fulfilling older workers' generativity motives through mentoring, they might become more motivated to continue working. In light of the demographic shift, the retention of older workers has become crucial for organizations to retain their accumulated knowledge and to prevent shortage of qualified workers.

Furthermore, a relatively small amount of research has investigated mentoring outcomes

for mentors, although it has been widely acknowledged that mentoring is beneficial for both mentors and protégés (Tong and Kram 2013). Future research should consider outcomes for mentors that gain importance with age, including fulfilling one's generativity motive, motivation to continue working, and affective well-being, which may subsequently positively affect desired organizational outcomes, including low absenteeism rates, commitment, and productivity. In addition, establishing mentoring programs with older workers serving the role of a mentor for a younger worker might contribute to an age-friendly organizational climate.

### Investigate Effects of Reverse Mentoring

Although reverse mentoring has been assumed to confer extensive benefits for all parties involved, there is no empirical evidence supporting this statement (Murphy 2012). Therefore, future research needs to carefully test the proposed benefits of reverse mentoring and the mentor, protégé, and dyad characteristics that support or hinder effective reverse mentoring. Another important task for future research would be to investigate the potential threats to mentoring success that may accompany reverse mentoring as it contradicts age norms in mentoring.

Relatedly, researchers could examine potential moderators that help to specify under which circumstances reverse mentoring is likely to be successful. For example, it would be important to test whether reverse mentoring is more successful when it is initiated formally as compared to informally (Murphy 2012). Moreover, it might well be that the effectiveness of reverse mentoring depends on organizational age norms such that reverse mentoring in organizations with strong age norms might be less effective than reverse mentoring in organizations with weak age norms (Chaudhuri and Ghosh 2012).

### Extending Methodology

With regard to methodology, research on age and mentoring has so far mainly relied on cross-sectional self-report data (Tong and Kram 2013). Therefore, longitudinal, multi-source studies are needed to uncover the mechanisms underlying the

relationship between age and mentoring and to evaluate long-term benefits of mentoring for younger and older workers. In addition, intervention studies might test whether high generativity in combination with emotional abilities training leads to better mentoring outcomes, or examine older workers' motivation to continue working when they receive the opportunity to mentor versus no opportunity to mentor, which might shed more light on the potential of mentoring as a valuable retention strategy. Finally, experience-sampling studies may focus on mentors' and protégés' changes in affect, cognitions, and behaviors during periods with versus without mentoring.

## Cross-References

- ▶ [Age and Blended Working](#)
- ▶ [Age Diversity at Work](#)
- ▶ [Affect and Emotion Regulation in Aging Workers](#)
- ▶ [Intergenerational Relationships](#)
- ▶ [Job Crafting in Aging Employees](#)
- ▶ [Organizational Strategies for Attracting, Utilizing, and Retaining Older Workers](#)
- ▶ [Work Motivation and Aging](#)

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## Worry in Later Life

Beyon Miloyan<sup>1</sup> and Adam Bulley<sup>2</sup>

<sup>1</sup>Department of Mental Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, USA

<sup>2</sup>School of Psychology, The University of Queensland, St Lucia, QLD, Australia

### Synonyms

Anxiety; Generalized anxiety; Older adults; Prospection

### Definition

Worry features chains of negatively valenced thoughts about potential future events and can be conceptualized as a future-oriented cognitive process aimed at minimizing the likelihood or impact of disadvantageous future outcomes in the face of uncertainty (Borkovec et al. 1983; Dugas et al. 1998; Miloyan et al. 2015a; Szabó and Lovibond 2002).

### Introduction

In its normal state, worry facilitates the detection and management of potential future threats and can also serve as a cognitive coping mechanism for the suppression of negative anxious affect (Borkovec et al. 1998; Eysenck 1992). In its extreme state, it represents the central feature of generalized anxiety disorder (GAD) and is a source of considerable distress and disability (Andrews et al. 2010; Ruscio et al. 2005). There are age-related differences in the manifestation of worry that may have an important bearing on efforts aimed at conceptualizing late-life anxiety and promoting the mental health of older adults.

## General Worry Processes

Worry features sequences of thoughts concerning potential negative future events (Borkovec et al. 1998). These thoughts are frequently associated with physiological arousal, thereby capturing present attention and alerting the individual to threats or potential problems with uncertain outcomes (Dugas et al. 1997; Hallion et al. 2014; Ruscio and Borkovec 2004; Tallis and Eysenck 1994; York et al. 1987). Those who engage in excessive worry orient to potential problems more readily than those with more moderate worry (Davey 1994; Dugas et al. 1995; Ladouceur et al. 1998). As a result, extreme worry is usually associated with a greater propensity to produce false alarms in the process of threat detection (Bateson et al. 2011; Nesse 2001, 2005).

Worry persists, most frequently in a verbal representational format, as the individual attempts to solve or resolve a perceived threat (Borkovec and Roemer 1995; Freeston et al. 1994; Hirsch and Mathews 2012; Leigh and Hirsch 2011; Williams et al. 2014). However, problem-solving ability does not differ significantly as a function of worry frequency (Davey 1994; Dugas et al. 1995; Ladouceur et al. 1998). Worry may also serve as a cognitive avoidance strategy for dealing with aversive anxiety about perceived threats, in part because verbal representations of imagined events may suppress emotional experience (D'Argembeau and Van Der Linden 2006) and because future-oriented thoughts can facilitate planning and preparation, leading to lower levels of arousal and stress based on subjective and physiological markers (Borkovec and Roemer 1995; Borkovec et al. 2004; Engert et al. 2014; Freeston et al. 1994; Laguna et al. 2004; Miloyan et al. 2015a; Ruby et al. 2013). Worry can also assist people to come to terms with inescapable problems. For example, individuals who worry prior to encountering a fearful stimulus have lower arousal when confronted with that stimulus relative to non-worriers (Borkovec and Hu 1990).

Worries tend to be generalized and abstract, likely due to the fact that the future is inherently

uncertain and harbors the potential for myriad threats (Stöber and Borkovec 2002; Miloyan et al. 2015a). In fact, uncertainty itself is a strong causal and maintaining factor of worry (Dugas et al. 1998). Worry-prone individuals often demonstrate a pessimism bias, characterized by heightened expectations of negative future outcomes (Mathews et al. 1997; Miloyan et al. 2014c). Repetitive thinking about future threats, a characteristic feature of worry (Watkins 2008), may lead to increased likelihood estimates for negative future outcomes (Szpunar and Schacter 2013). Importantly, even in its pathological form, worry is not associated with a reduction of positive future expectancies (MacLeod and Byrne 1996; Miloyan et al. 2014c; Miranda et al. 2008; Miranda and Mennin 2007). Alongside appraising a possible future threat, the worrying individual can also come to appraise the state of his/her own cognition about that threat, in a so-called “metacognitive” worry process (Wells 1995). This may manifest as beliefs about one’s own cognition, such as “my worries are uncontrollable” or “worrying helps me avoid negative outcomes,” and may result in individuals “worrying about their worrying” in a vicious cycle that may represent a key feature of pathological worrying (i.e., GAD) (e.g., Wells 1995).

### Age-Related Differences

We now turn our attention to age-related differences in the manifestation of worry, in terms of its *phenomenology* and constituent *processes*.

**Phenomenology.** There is a progressive age-related downward trend in worry frequency such that older adults report fewer worries than younger adults. Such a trend has been observed in cross-sectional studies, with nationally representative samples from the USA, the UK, and Australia, as well as in community studies conducted in Canada and the USA (Basevitz et al. 2008; Gonçalves and Byrne 2013; Gould and Edelstein 2010; Hunt et al. 2003; Lindsay et al. 2006; Miloyan and Pachana 2015; Powers et al. 1992). Similar downward trends have been observed for

anxiety symptoms more generally (Deer and Calamari 1998; Böttche et al. 2012; Frueh et al. 2004; Gretarsdottir et al. 2004; Miloyan et al. 2014a). However, older adults with higher levels of anxiety and depression worry comparatively more relative to age-matched controls, suggesting that there are important differences within the population of older adults (Conaghan and Davidson 2002; Gonçalves and Byrne 2013; Wetherell et al. 2003; Diefenbach et al. 2001).

Furthermore, there are age-related differences in worry content. For instance, older adults tend to worry about their own health as well as the health and welfare of loved ones, in contrast to younger adults who tend to worry about work, finances, and interpersonal relations (Gonçalves and Byrne 2013; Powers et al. 1992). Older adults also tend to worry *more* about particular topics than younger adults, including “family concerns” and world issues such as environmental degradation and economic downturn (Hunt et al. 2003). These “world issue” worries typically center outwardly on problems that could be faced by future generations, which may be of particular relevance during this developmental life stage (Hunt et al. 2003). In fact, late-life developmental transitions have been associated with other context-specific worries, such as about becoming a burden after transitioning out of a primary caregiver role and into retirement (Skarborn and Nicki, 2000; Wetherell 2006). Caregiving, too, can be a significant source of worry, anxiety, and distress in later life (Anthony-Bergstone et al. 1988; Lim et al. 2014; Razani et al. 2014). Additionally, older adults who endorse financial worries tend to be concerned about receiving care and about their own capacity to make decisions (Litwin and Meir 2013). However, despite the observation that older adults with GAD tend to endorse a greater variety of worries than matched non-GAD controls, there are fewer differences in worry phenomenology between older adults with and without GAD than there are between younger adults with and without GAD (Diefenbach et al. 2001; Miloyan et al. 2014b). In sum, the expression of worry may vary significantly as a function of the developmental stage of the

individual, with older adults endorsing worries commensurate with their changing life circumstances (Wolitzky-Taylor et al. 2010).

**Processes.** Memory systems play a critical role in anxiety-related future-oriented cognitive processes such as worry (for review, see Miloyan et al. 2014c). With a capacity for semantic memory, one can draw on conceptual information with which to construct mental representations of future scenarios; and with a capacity for episodic memory, one can integrate autobiographical information into conceptual schemas in a future-directed manner (Irish and Piguet 2013; Suddendorf and Corballis 2007; Szpunar et al. 2014). As individuals age, they report fewer semantic and episodic details when recalling past and generating future scenarios, and this reduction in details correlates with age-related neurological differences (for review, see Schacter et al. 2013). In other words, older adults tend to engage in highly generalized future thinking, such that these thoughts contain relatively few concrete details. Thus, general age-related reductions in worry frequency may be partly attributable to such neurocognitive changes, which lead to the construction of fewer and more generalized future-oriented thoughts, regardless of their emotional content.

However, observations of age-related reductions in worry frequency must also be assimilated with concomitant improvements in emotional well-being and the tendency of older adults to focus less on negative than positive stimuli (Bauer et al. 2013; Carstensen et al. 2011; Mather and Carstensen 2005). In fact, age-related reductions in worry frequency are also partly attributable to changes in emotional processes, considering that older adults experience more positive and fewer negative emotional states (Carstensen et al. 2011; Sutin et al. 2013). Additionally, negative emotional states are more transient for older versus younger adults, due in part to an improved capacity for emotion regulation (Carstensen 2006; Hay and Diehl 2011; Urry and Gross 2010). Thus, older adults come to experience fewer negative states and consequently worry less about the occurrence of negative future events, because one's current emotional state can have a profound impact on the content of future-oriented thoughts (Miloyan et al. 2014c).

Finally, age-related differences in meta-cognitive beliefs and attitudes about worry may also be invoked to explain age-related reductions in worry frequency. Compared to younger adults, older adults believe less in the functional value of worry and report being more tolerant of uncertainty (Basevitz et al. 2008). As a result, older adults may be less likely to worry in order to detect potential future threats and would also be less prone to worrying about the potential occurrence of negative future events that lie outside of their control. Despite these general age-related trends, there are important differences within the population of older adults, such that those who report comparatively higher levels of worry tend to harbor negative attitudes and beliefs about the future, as well as an external locus of control (i.e., that the future holds negative outcomes in store and that these potentialities lie largely outside of the individual's control) (Montorio et al. 2006; Powers et al. 1992). In sum, the manifestation of worry in later life is dependent upon cognitive, affective, and motivational processes. The way in which these processes change with age has practical implications for clinical approaches to worry in older adults – to which we now turn.

## Clinical Implications

Despite worry potentially providing short-term avoidance of unpleasant anxiety (Borkovec 1994), its role as a coping mechanism may be maladaptive in the long term (Borkovec et al. 2004). In its pathological state, worry is the central feature of generalized anxiety disorder (GAD) and is frequently associated with severe distress and functional disability (Lee et al. 2010). Uncontrollable worry, a key feature of GAD, is particularly associated with distress, disability, and poor clinical outcomes (Hallion and Ruscio 2013). Older adults with GAD report higher levels of disability, lower levels of well-being, poorer health-related quality of life, and increased use of healthcare relative to asymptomatic older adults and younger adults with GAD (Brenes et al. 2008; de Beurs et al. 1999; Porensky et al. 2009; Wetherell et al. 2004). Older adults

with GAD also have poorer cognitive functioning, which can improve with treatment, and even healthy older adults with mild worry symptoms show greater declines in learning and memory at two-year follow-up relative to asymptomatic controls (Butters et al. 2011; Pietrzak et al. 2012).

Worry may be associated with poorer cardiovascular health, as well as other somatic complaints and conditions (Brosschot et al. 2006, 2007; Brosschot and van der Doef 2006; Pieper et al. 2007). In older adults, GAD has a higher prevalence among individuals with cardiovascular health problems, and higher levels of worry may be associated with a higher risk for incident coronary heart disease (Grenier et al. 2011a; Kubzansky et al. 1997). Late-life GAD may also be associated with a higher risk of incident gastrointestinal disease (El-Gabalawy et al. 2014).

Worry, in its normal or pathological form, may also be preceded by some medical conditions; for instance, arthritis is associated with increased risk for incident GAD among older adults (El-Gabalawy et al. 2014). There are less pronounced differences in worry frequency and health characteristics between older – as compared to younger – adults reporting high and moderate worry, indicating that the relationship between worry, health, and functional outcomes also varies with age (de Beurs et al. 1999; Grenier et al. 2011b; Miloyan et al. 2014b, 2015b). Finally, GAD is highly prevalent among older adults in the context of primary care (Ansseau et al. 2008; Kroenke et al. 2007).

The impact of age on the presentation of worry occurs in a number of different ways, with implications for diagnosis and treatment of GAD. First, due in large part to age-related cognitive and emotional changes, older adults report fewer and less concrete worries (Basevitz et al. 2008; Hunt et al. 2003; Gonçalves and Byrne 2013; Gould and Edelstein 2010; Miloyan and Pachana 2015). Second, older adults with cognitive impairment may have particular difficulty reporting or identifying their worries in concrete terms (Beaudreau and O'Hara 2008; Wolitzky-Taylor et al. 2010). For example, in the context of neurocognitive impairment, it is possible for stressors to evoke bouts of negative affect without leaving strong

mnemonic traces as to their origins (Feinstein et al. 2010; Guzman-Vélez et al. 2014). This could be particularly problematic given that informant report is ineffective for identifying unobservable symptoms such as worry among cognitively impaired older adults (McDade-Montez et al. 2008). Finally, among older adults, physical symptoms exacerbate the emotional and functional impact of worry (Miloyan and Pachana 2015). The need for age-appropriate assessment strategies is being increasingly recognized on the basis of such findings (Wolitzky-Taylor et al. 2010). Existing CBT and psychosocial interventions for late-life GAD are at best moderately efficacious, suggesting the need for improved interventions for excessive worry in older adults (Gonçalves and Byrne 2012; Thorp et al. 2009). However, it is also important to note that some degree of worry could be advantageous. For instance, lower levels of anxiety may be associated with excess mortality; and specifically, those who endorse greater worries about particular health problems may be more likely to seek medical care and take preventative or corrective action (Chapman and Coups 2006; Edward Ransford 1986; Hay et al. 2006; Lee et al. 2006; Mykletun et al. 2009; but see Consedine et al. 2004; Dijkstra and Brosschot 2003).

## Conclusion

Worry consists of sequences of thoughts about negative future events and is aimed at minimizing the likelihood and impact of negative outcomes. Worry fundamentally relies on an individual's present emotional state, characterized by negatively valenced affect, and a capacity for future-oriented cognition. Thus, relative to asymptomatic individuals, worriers fixate more on threat-related stimuli, mentally generate a greater number of negative future events, and harbor increased expectations for the occurrence of future threat-related events. Older adults worry less than younger adults, due to reductions in the frequency of imagined future events, the experience of more positively valenced and fewer negatively valenced emotional states, and differences

in attitudes and beliefs about worry. There are also important differences in the content of worry across the lifespan, with developmental transitions in later life presenting new challenges about which older adults may be particularly prone to worry.

In its pathological state, worry is associated with increased distress and disability. Among older adults, relatively fewer worry symptoms are associated with distress and disability, partly due to the increased prevalence of physical symptoms. Pathological worry has also been linked to a number of negative health effects, particularly with regard to self-rated health, cardiovascular health, and quality of life. However, despite the key role worry plays in psychopathology, it also acts as a functional mechanism that could serve to reduce the likelihood or impact of future harm and may thereby be strategically (though not necessarily volitionally) employed. Nonetheless, chronic and uncontrollable worry frequently leads to poor psychosocial outcomes over extended time frames, making it an important target for intervention in later life.

## Cross-References

- ▶ [Anxiety Disorders in Later Life](#)
- ▶ [Cognitive Control and Self-Regulation](#)
- ▶ [Mental Health and Aging](#)

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# Y

## Young-Onset Dementia, Diagnosis, Course, and Interventions

Raymond T. C. M. Koopmans<sup>1,4,5</sup>,  
Christian Bakker<sup>1,3,4</sup>, Debby L. Gerritsen<sup>1,4</sup>,  
Joany K. Millenaar<sup>2</sup>, Frans R. J. Verhey<sup>2</sup> and  
Marjolein E. de Vugt<sup>2</sup>

<sup>1</sup>Department of Primary and Community Care:  
Center for Family Medicine, Geriatric Care and  
Public Health, Radboud University Medical  
Center, Nijmegen, The Netherlands

<sup>2</sup>School for Mental Health and Neuroscience,  
Alzheimer Center Limburg, Maastricht  
University Medical Center, Maastricht, The  
Netherlands

<sup>3</sup>Florence, Mariahoeve, Center for Specialized  
Care in Young-Onset Dementia, Den Haag, The  
Netherlands

<sup>4</sup>Radboud Alzheimer Center Nijmegen, Radboud  
University Medical Center, Nijmegen, The  
Netherlands

<sup>5</sup>Joachim en Anna, Center for specialized geriatric  
care, Nijmegen, The Netherlands

### Introduction

Young-onset dementia (YOD) refers to the onset of dementia before the age of 65. However, agreeing upon the nomenclature and definition of dementia with an onset before the age of 65 years is a matter of debate in the literature (Kelley et al. 2008;

Koopmans and Rosness 2014). In a recent editorial of *International Psychogeriatrics*, Koopmans and Rosness elaborated on this discussion (Koopmans and Rosness 2014). Two main points are indispensable concerning younger persons with dementia. First, it is difficult to distinguish between forms of dementia solely by age of onset since older adults with dementia differ in more aspects from younger people than simply in age. The second point is how to answer the question: when in fact should a person with dementia be considered young? A 64-year-old person with dementia is not viewed as young compared to a 44-year-old with dementia, even though they both have been diagnosed with the same label of YOD. Two terms are commonly used in literature: *early-onset dementia (EOD)* and *young-onset dementia (YOD)*. However, some still use presenile dementia (Vieira et al. 2013). In Australia, they prefer using *younger-onset dementia*, to express that these individuals are younger than those in general with dementia. Maybe people with YOD should be divided in a group of those with the first symptoms before the age of 45 and those with the first symptoms before 65 and after 45 years of age. Those with symptom onset before the age of 45 probably have more distinct etiologies than people with a later onset of dementia. In a study of 235 cases of dementia before age 45 years, the causes varied, with neurodegenerative etiologies accounting for 31.1% of the cohort. Alzheimer disease was uncommon, and autoimmune or inflammatory causes accounted for 21.3% (Kelley et al. 2008).

Figures on the prevalence of YOD are scarce. In 2003 Harvey and colleagues published an often-cited study on the prevalence of dementia in people under the age of 65 of a large catchment area in the UK covering 567,500 people (Harvey et al. 2003). The prevalence in those aged 30–64 was 54.0 per 100,000; for those aged 45–64 years, it was 98.1–118.00 per 100,000. From the age of 35 onwards, the prevalence of dementia approximately doubled with each 5-year increase of age. A Japanese study investigated the prevalence of YOD by sending a questionnaire to a variety of medical institutions (Ikejima et al. 2009). In a second step, they asked some additional information about the type of dementia. They found an estimated prevalence of 42.3 cases per 100,000. The most frequently diagnosed type of dementia was vascular dementia (42.5%) followed by Alzheimer dementia (25.6%), dementia caused by head trauma (7.1%), dementia with Lewy bodies/Parkinson dementia (6.2%), frontotemporal dementia (FTD, 2.6%), and other causes (16%). However, a recent study from Australia found that the primary clinical subtypes were alcohol-related dementia (18.4%), Alzheimer disease (17.7%), vascular dementia (12.8%), and frontotemporal dementia (11.3%) (Withall et al. 2014). The overall prevalence was 68.2 per 100,000 population at risk for the 30–64-year age group (95% confidence interval (CI), 54.9–83.4), 11.6 per 100,000 for the 30–44-year age group (95% CI, 5.3–21.7), and 132.9 per 100,000 for the 45–64 age group (95% CI, 105.8–164.2).

## Diagnosis

A timely diagnosis of dementia is a prerequisite for adapting to the changes that occur, access to support and care, planning for the future, and coping with the prognosis (Salloway and Correia 2009). Especially in YOD a timely diagnosis is a challenge because of its lower prevalence and larger variety of etiologies (Mendez 2006). YOD often presents differently from late-onset dementia (LOD), with more marked neuropsychiatric symptoms (NPSs) than cognitive symptoms

(Kelley et al. 2009). The Dutch Needs in Young-onset Dementia (NeedYD) study investigated the time between the first symptoms of dementia and diagnosis using a large sample of both YOD and LOD patients (van Vliet et al. 2013). The results showed that the duration of the pre-diagnostic period in the YOD group took an average time of 4.4 years, which is 1.6 years longer than in the LOD group. Especially in FTD the time to diagnosis was long with 6.4 years. This can be explained by the typical clinical characteristics of FTD including neuropsychiatric symptoms (NPS), personality changes, and lack of insight that can delay help seeking (van Vliet et al. 2011).

A recent Australian study, the INSPIRED study, found similar results (Draper et al. 2016). They included 88 people with YOD (PwYOD) due to Alzheimer dementia (AD), FTD, and other causes. They divided the period before the first symptoms and a final diagnosis of dementia in three phases: time between symptom onset and the first consultation (2.3 years), dementia diagnosis (3.2 years), and final diagnosis to the type of dementia (4.7 years) (Draper and Rigoni 2016). Patients with younger age at onset, minimal cognitive impairment, depression, and dementia other than AD or FTD had longer time to dementia diagnosis. The overall time to diagnosis of 4.7 years was comparable with the findings of the NeedYD study. However, in the NeedYD study, those with FTD had the largest delay in establishing a diagnosis, while in the INSPIRED study, people with other causes had the longest period. These differences are difficult to explain and may be caused by different methods used and the fact that the INSPIRED study took place in a specific Australian area (New South Wales), while the NeedYD study was a national study with many memory clinics involved.

In a qualitative part of the NeedYD study, insight was gained in the experiences of the caregiver in this pre-diagnostic period (van Vliet et al. 2011). Caregivers reacted differently to the first changes that they noticed ranging from feelings of uneasiness to a clear suspicion that something was wrong. Apart from cognitive changes, caregivers frequently reported behavioral changes, mostly apathy and lack of reciprocity.

These changes were difficult to understand and to deal with without a clear understanding of the cause. It disrupted the daily routines in family life and caused conflicts and tension in relationships. Some caregivers were even on the verge of leaving their spouse. In retrospect, once the diagnosis of dementia was established, they felt guilty about their negative feelings, and they were better able to understand the changes in cognition, behavior, and/or daily functioning.

Besides relational problems caregivers reported also problems at work and financial consequences. They were often not aware of work-related conflicts or mistakes until the person with dementia got fired before the diagnosis was established. An important factor that delayed help seeking was denial of the person with dementia and refusal to seek medical advice. Mostly caregivers rather than the person with dementia were the one to seek help. This was facilitated when friends or family members confirmed their suspicion. If a doctor was consulted, they were not always referred, or they received an erroneous diagnosis, such as depression or burnout, prior to the dementia diagnosis.

These problems seem specifically related to diagnosing dementia at a young age. The difficulties that were experienced in the period pre-diagnosis underline the importance for younger people to receive a timely diagnosis. Understanding the cause of the changes in the person with dementia offers caregivers and patients the opportunity to cope with their situation; it may prevent loss of their jobs, divorce, or disrupted relationships with children.

It is highly important to raise clinicians' alertness to the possibility of dementia at a young age, to increase responsiveness to caregiver reports, and to do regular follow-ups of people presenting with cognitive and/or behavioral changes. But even then establishing a dementia diagnosis at a young age will remain a challenge for clinicians until unique differentiating markers are found.

## Course

Next to the diagnostic difficulties, the person with YOD and other family members experience

problems that are specifically related to their phase of life. Therefore, it is important that they receive tailored support and counseling. For instance, at the time first symptoms occur, people are still working, raising children, and managing the household and often engaged in an active social life. For YOD caregivers this often results in a double burden because they have to combine the care for the person with dementia with these other roles and responsibilities (Bakker et al. 2013a; van Vliet et al. 2010). In addition, because of the dementia occurs at a relatively young age, both the person with YOD and their caregivers have to adjust their future plans. YOD families also often face financial difficulties, due to the loss of work and the fact that sometimes they are not eligible for receiving benefits (Sperlinger and Furst 1994).

The clinical characteristics in YOD also differ from LOD. Younger people with AD have a different cognitive profile with a higher prevalence of atypical symptoms (Smits et al. 2012). Whether they decline more rapidly than people with late-onset AD remains inconclusive. Some studies show that it may be more rapid, while others say they progress at the same rate (Stanley and Walker 2014; Grønning et al. 2012). It is important to note that the characteristics of young-onset AD are not generally applicable to all young-onset dementias. Not much is known about the rate of cognitive decline in YOD in other forms such as vascular dementia or FTD, and future research is needed. However, we do know that younger persons are less likely to suffer from coexisting diseases and are more physically fit (Gerritsen et al. 2016).

People with YOD experience cognitive and functional impairments and changes in personality, hindering them in their ability to work and engage in (social) relationships, hobbies, and other aspects of daily life, resulting in a loss of autonomy and identity. This adversely affects their well-being (Harris and Keady 2009). Specifically in younger people with dementia, behavioral changes are more pronounced, due to the high prevalence of FTD (Mendez 2006). The caregiver and other family members have to learn to cope with these changes, which can be difficult to deal with on top of the other challenges

they are facing. Unfortunately, they often have to deal with these difficulties with little support (Bakker et al. 2012). Furthermore, YOD caregivers often postpone institutionalization until the person with YOD shows advanced dementia and high levels of care dependency (Bakker et al. 2013b). Within this context the high levels of depressive symptoms and burden in YOD caregivers might be explained (van Vliet et al. 2010). YOD also affects relationships within the family structure in general (Millenaar et al. 2013; Svanberg et al. 2011; Werner et al. 2009). The reciprocity between spouses diminishes, and the caregivers gradually lose the relationship that existed prior to the dementia diagnosis and become a caregiver instead (Ducharme et al. 2013). Children often take on caregiving responsibilities as well, as they feel responsible for the well-being of their parent (Millenaar et al. 2013; Allen et al. 2009).

Mainstream dementia services are often specifically designed for the elderly and might have difficulties in addressing the needs of younger individuals (Chemali et al. 2011; Bakker et al. 2010). When people with YOD were asked about their needs, they reported that social company, intimate relationship mobility, and information about the dementia and care options were important (Bakker et al. 2013c). They would like to remain useful and have a sense of purpose in daily life (Roach et al. 2008). Furthermore, persons with YOD are more likely to be physically fitter than elder individuals and therefore require different care approaches (Delany and Rosenvinge 1995).

## Interventions

In several countries in the world, there have been initiatives to develop specific services for YOD families. These services include memory clinics with specific expertise on diagnosis and support in YOD (caregiver), support groups, community care, day care centers, and respite services as well as long-term care facilities offering care attuned to the needs of these younger individuals. However, there are large differences between

countries in the extent to which these services are offered and whether or not people have access to these specialized services.

Research on interventions specifically targeted at the needs of people with YOD is still in its infancy. A recent literature search on, for instance, the management of NPS in PwYOD in long-term care setting or living in the community, revealed only 1 and 26 hits, respectively. However, a closer look at the papers revealed no papers with a multicomponent and multidisciplinary approach to NPS.

A recent European study on the needs of people with YOD and their experiences with service provision as well as access to services revealed that PwYOD and their caregivers encounter a wide range of difficulties during the disease process and that there still is a lot to be gained in their care ([www.rhapsody-project.eu/home](http://www.rhapsody-project.eu/home)). This has resulted in a specific web-based support program for YOD caregivers, offering interactive modules to learn more about relevant topics in YOD such as basic knowledge on causes, diagnosis and treatment, frequent problems and possible solutions, dealing with problem behavior, changes in family structures, and practical advice. Currently this intervention is being piloted in France, Germany, and the UK.

Furthermore, an empowerment plan was developed for people with YOD and their caregivers in the Netherlands, with a specific aim to put people with YOD in the lead. It aims at improving sense of competence, participation in society, and social contacts. Its content is based on focus groups with people with YOD and their caregivers and regards daytime activities with social contacts, having fun, being physically active, and being useful. Its (cost-)effectiveness is currently being studied in a cluster-randomized controlled trial.

As challenging behavior provides a major challenge for both informal and professional caregivers in YOD, also interventions aimed at the improvement of the management of these behaviors are being developed. For instance, in the Behavior and Evolution in Young-onset Dementia (BEYOND-II) study, a care program is developed for long-term care facilities that have specific

special care units (SCUs) for people with YO-D. The care program is a multicomponent intervention aimed at educating the SCU staff about the context and management of challenging behavior in YOD as well as improving the actual management of these behaviors in daily practice. The latter is achieved by providing SCU teams with a web-based care program in which tools are integrated for the detection of challenging behavior, the detection of unmet care needs in the resident, the analysis of challenging behavior, the construction of a care and treatment plan, and the systematic evaluation of the effect of the plan. Also a tool for the self-evaluation of the appropriateness of psychotropic drug prescription is integrated in the intervention, to facilitate the SCU's physician. Although this intervention is currently being piloted in Dutch nursing homes, this intervention looks promising as the effect of the care program has already been positively evaluated in a previous study in LOD (Zwijssen et al. 2014).

## Conclusion

PwYOD have specific healthcare needs that differ from those of people with LOD. However, research on these needs and interventions to effectively address these needs are still in his infancy. Also, there is no international consensus on the nomenclature and operational definition of YOD. More research and agreement on the definition are urgently needed in order to formulate recommendations for service provision specifically tailored to the needs of this specific group of people with dementia.

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